Contribution to the development of the Bronze Age plant economy in the surrounding of the Alps: an archaeobotanical case study of two Early and Middle Bronze Age sites in northern Italy (Lake Garda region)

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Summary

During the Bronze Age human communities became more and more complex in their social organization and subsistence economy. A crucial role was played by the production of metal objects, which intensified exchange of goods and established new trade routes, but farming and animal husbandry were still the stronghold of Bronze Age economy. They underwent some innovations such as the introduction of new cultivars (e.g. spelt and millet), the intensification of pulse cultivation and the diffusion of rotation systems. The present research contributed to the reconstruction of the development of plant economy during the Bronze Age, within and in the surroundings of the Alps. A comprehensive archaeobotanical study has been carried out on two of the currently-excavated Bronze Age (Early and Middle Bronze Age phases) lake-dwelling sites (Lavagnone and Lucone D) in the Lake Garda area of northern Italy. The investigation in these sites south of the Alps is crucial to understand the spread of Bronze Age plant economy in the Po Plain, into the Alpine valleys and finally to the regions North of the Alps.

The standard methods of archaeobotany concerning sample strategy and quantitative analysis have been applied. This has formed the basis for a reliable comparison of lake dwelling cultures and husbandry between the northern and southern sides of the Alps. Plant macrofossil analysis focused on crop and weed assemblages collected from all archaeological layers, as well as on macroremains representing the local flora, useful for a palaeoenvironmental reconstruction.

Important results have been obtained in both sites. A large variety of cereal crops have been detected in both age periods. Emmer, the 'new glume wheat' type (NGW), barley and einkorn resulted to be the most important cereals, while spelt and naked wheat (both, 4n and 6n) were secondary crops. The abundance of the NGW remains is particularly noteworthy. The spread of broomcorn millet cultivation and of pulses (mainly horsebean) have been detected in the MBA layers of Lavagnone. The rich weed spectra and several archaeological finds such as farming tools allowed reconstructing crop husbandry practices. The finds of a conspicuous amount of wild edible plants testifies the large contribution of gathered species in food supply. Thanks to excellent preservation of plant remains in both sites and comparison with pollen data, we reconstructed open land, the perilacustrine belt, the aquatic habitats and their dynamics. The importance of open environments, particularly fallow land and dry meadows, is documented by a high number of open habitat plant *taxa* and also detected by the analysis of ruminants (goats and sheep) coprolites recovered from sediment samples.

In addition some remarkable finds such as several complete ears of "new glume wheat" (*Triticum* nn, possibly *T. timopheevi*), a necklace made of *Staphylea pinnata* L. (bladder-nut) seeds and marble stones, *Carthamus tinctorius* (safflower) achenes, and *Orlaya grandiflora* fruits shed light on the history of these *taxa* and pathways from their native range. Thus, they corroborate the arguments about probable trade routes across the Alps.

PART 1

1. INTRODUCTION

1.1. Aims of the study

The aim of the present research is to expand our knowledge about the Bronze Age economy in the surroundings of the Alps. We present hereby a study of two lake dwelling sites from the southern Alpine foreland to fill a knowledge gap in the palaeoeconomy and palaeoecology of Bronze Age sites from this region. Indeed, so far there are only few Bronze Age deposits rich in plant remains and artefacts, extensively studied for plant economy south of the Alps. This work therefore is intended to provide the basis for future research in the perspective to address a reliable comparison between Bronze Age lake dwelling sites North and South of the Alps.
This research will also shed light on the emergence of a more diversified plant production during the Bronze Age, particularly with the introduction of regular cultivation of new cultivars and the appearance of new weeds. Moreover, we intend to trace the origin of these *taxa* and practises along major long-distance trade-routes. Finally, this work will add information for detecting the probable trade routes across the Alps. The investigation of key sites south of the Alps is crucial to understand the spread of Bronze Age plant economy into the Alpine valleys and finally to regions North of the Alps, as at the moment we have very few information from the South.

In detail, the present research intends:
- to provide a comprehensive knowledge about the economy and the internal patterning of two Early and Middle Bronze Age settlements with an appropriate and up-to-dated archaeological background: Lavagnone (Desenzano del Garda) and Lucone D (Polpenazze del Garda);
- to apply the standard methods in archaeobotany concerning sample strategy and quantitative analysis (Hosch & Jacomet 2004; Jacomet & Brombacher 2005; Tolar *et al.* 2009) to the record of these two selected sites in northern Italy, thus allowing consistent comparison of lake dwelling cultures and husbandry between the northern and southern sides of the Alps. Plant macrofossil analysis will focus on crop and weed assemblages collected from all archaeological layers, as well as on macroremains representing the local flora, useful for a palaeo-environmental reconstruction (Chap. 3, 4, 5, 6 and 8).
- to analyse the pollen and macroremains content of a suitable number of goat/sheep coprolites in both sites in order to investigate animal husbandry in southern alpine foreland (Chap. 7 and Chap. 8.5).
- to reconstruct natural vegetation and face it with human activities by integrating the plant macroremains analysis with pollen data in order to obtain a more detailed reconstruction of the environment and of the natural resources during all the settlement phases. By means of this data integration, we also aim to unravel the climatic factors responsible for periodical shiftings of the settlement from a marshy damp zone within the lake to a shore area placed on a higher and therefore drier level at the Lavagnone site. The research aims to understand the relationships between the settlement dynamics, the changes in the surrounding landscape and the triggering climate factors (Chap. 4).

The present research has been carried out within the framework of two SNF projects. The first project (105312-110406/1 and K-13K0-117897/1) was limited to the analysis of plant remains from the dung of small ruminants. The second project (a 2 years Dissertations scholarship of SNF, project no. CR13I1-129918 / 1) allowed working on most of the samples taken during the archaeological excavations that took place until year 2011. The overall evaluation of the collected data has been partly carried out thanks to the FAG - Freiwillige Akademische Gesellschaft funding.

1.2. The environmental setting of the Garda region

1.2.1. The geologic and geomorphologic traits of the Garda region with details about the basins of Lavagnone and Lucone di Polpenazze

Lake Garda (65 m a.s.l.) is the major lake at the southern margin of the Alps[1] (Fig. 1.2.1, Fig. 1.2.2 and Fig. 1.2.3). It is hosted in a deep basin (maximum lake depth 346 m, i.e. almost 300 m under the modern sea level), oriented NNE-SSW and cut through the sedimentary cover of the Southern Alps. The area surrounding the lake, traditionally called 'Garda region', is framed southward by a wide hilly landscape originated by a composite end moraine, deposited by the biggest glacial system in Italy. More than fifty lakes were formed in this region during lateglacial times due to morainic dams and the hummocky topography of the proglacial forefield (Fig. 1.2.4). After the deglaciation was completed, most basins evolved as closed lakes (i.e. without an outlet). As the prevailing lithology of glacial deposits is carbonate pebble and sands, detritus of carbonate rocks and/or dissolved carbonate ions are abundant in the water lake inlets and thus in the sediments. Fine carbonate clastic components prevailed in the early lateglacial, turning to a chemical-biogenic limnic sedimentation in the last 17,000 cal years BP (Vallé 2010; Ravazzi *et al.* 2012; Ravazzi *et al.* 2014). Limnic organic mud (mostly gyttja) commonly characterized the early-middle Holocene deposition of many lake fillings including Lavagnone and Lucone, while the accumulation of terrestrial peat is recorded in the littoral belt [2]. Close to the innermost ridge of the end moraine, the Rocca di Manerba hill [3] represents a large bedrock area close to the sites of Lavagnone and Lucone D. It forms a limestone bedrock platform cut by a coastal cliff hanging on Lake Garda (see Fig. 1.2.2 and Fig. 1.2.3).

The age of these morainic arcs, also responsible fot the origin and development of the Lucone and Lavagnone basins, has been intensively debated (Penck & Brückner 1909; Habbe 1969; Venzo 1965; Cremaschi 1987; Bini & Zuccoli 2004). The outermost moraine ridges was deposited during the Last Glaciation and, more precisely, during the Last Glacial Maximum (LGM, 30-18 kyr BP) (Solferino Stage in Cremaschi 1987), and is continuous along almost the whole end-moraine, thus representing a correlation *criterium* used by different authors to date the moraines.

The Lucone di Polpenazze basin is framed between an outermost moraine ridge (Monte Brassena) and an inner one, delimiting the basin on the east side (Church of San Pietro) (see Fig. 1.6.1.1). According to Venzo (1965) the Monte Brassena moraine is pre-Würmian in age. More recently, Cremaschi (1987) and Ravazzi *et al*. (2014) assigned both these moraines to the Solferino Stage, i.e. to the Last Glaciation.

The Lavagnone basin was cut into fluvioglacial deposits and dammed by a morainic ridge on its eastern side (Fig. 1.2.4). According to Venzo (1965) the fluvioglacial plain is of pre-würmian age while the morainic ridge was deposited during the LGM. On the other hand, Cremaschi (1987) and recent studies (Ravazzi *et al.*, 2014) assigned these deposits to the last advances of the Last Glaciation.

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[1] The lake has a maximal width (17.5 km) between Peschiera del Garda and Desenzano del Garda, while it is much narrower (minimum 2.4 km) in the northern part, faced by significant reliefs developed in pre-Quaternary bedrock.

[2] Peaty layers have been recognized in the Lavagnone sequence (Chap. 1.6.2.2), while they are lacking in the Lucone sequence (Chap. 1.6.1.1). See chapter 8.6.3 for a discussion on this difference between the two basins.

[3] About 6 km far from Lucone and 15 km from Lavagnone.

1.2.2. Soil types and land capability [4] in Lucone and Lavagnone areas

The soil cartography produced by ERSAL (Minelli 1997) on the western side of the Garda region provides an excellent base for evaluating the soil properties, arguing their modern capability. However, as the land use across the last four millennia had a significant impact over soil properties, arguing land uses and limitations in the Bronze Age requires consideration of main intervening alteration factors, such as (a) erosional processes, (b) wetland reclamation, and (c) alteration of terrain morphology for agricultural purposes.
The ERSAL project of soil cartography adopted the Soil Taxonomy approach. For greater convenience, in the following treatment, the soil types defined according to the Soil Taxonomy system will be accompanied by their FAO system equivalents.
In the present work, we will concentrate on the soil properties of the most 'relevant area' for agricultural practises strictly pertinent to the villages, that we considered to be limited to 1-1.5 km radius area around the site. The properties of the most important soil types occurring in the "relevant area" will be summarized. Surfaces are estimated over 1-1.5 km radius from the lake margin, but, in both cases, the overall proportions between main pedological types may be extended further to roughly represent a radius of 5 km around the studied sites.
The Appendix 1 present the most important *land qualities* for each of these soil types.

Land use capability and arability
For each of the recognized soil types, the relevant land use class and limitations for arability will be assessed. Soil Taxonomy adopts a subdivision with VIII-classes. Classes I to IV are arable, with increasing limitations from I to IV; soils falling in classes V to VII are not arable and are used for pastures and forest.

Soil types in the area pertinent to the Lavagnone and Lucone sites
The classification and land qualities (ERSAL, Minelli 1997 see App. 1) have been supplemented thanks to trenches excavated in the relevant areas and examination of sections exposed during the archaeological excavations (2001-2013, see Chap. 1.2.2.3).
Four main soil types occupy the "relevant area" around the two pile dwellings under investigation (see also Fig. 1.2.5 and Fig. 1.2.6):

- **class Mollisols**. Soils provided with a mollic epipedon, rich in humus, base-satured, persistently water-satured (aquic regime).
- **class Entisols**. Poorly evolved soils, missing a diagnostic horizon (enti-), due to disruption of the thin original profile by ploughing. *Udarents*, however, preserve properties recalling the diagnostic horizons from where they derive. In the area they are considered to originate from a disruption of thin alfisols. *Udorthents* do not preserve clear properties recalling diagnostic horizons from where they may derive. This is the case of slope soils deeply degraded by erosion after forest clearing, intensive and persistent pasture. The original illuvial horizons have been completely removed. In current woodlands, the recent pedogenesis allows the development of rendzina-type soils.
- **class Inceptisols**.

[4] Land capability (sometimes also referred to as 'land suitability') is defined as the inherent capacity of land to be productive under sustained use and specific management methods. Land capability systems can identify both the capacity of an area of land for different uses and also the optimal use from a biophysical, as opposed to socio-economic, perspective (Brown *et al.* 2008).

- **class Alfisols**. Soils provided with a subsurface argillic horizon, well-drained and rubified (5 YR). Most of the current *hapludalf's* in the surrounding of the Lavagnone site result from erosion of earlier argillic horizons along slopes, thus leading to significant carbonate recharge and increase of the skeletal component. On the other hand, in the Lucone area also type 35 occurs, which is a less skeletal and not calcareous *hapludalf*.

For an estimation of the surfaces occupied by each soil type, see Appendix 1.

1.2.2.1. A synthesis of modern soils distribution and their exploitation in the Lucone area (Fig. 1.2.6)

<u>a. Area pertinent to the lake basin</u>

The lowermost Lake Lucone basin supports undrained soils, persistently water-saturated (endoaquolls – **eAq**). The mollisol belt extends no more than 50 m outward from the pile dwelling Lucone D. This was part of the lake in the Bronze Age. The north-eastern side of the lake basin includes a wide plain area formed by thin lake sediments characterized by low drainage, but seasonally dry (**aqInc**), which could be ploughed and cultivated even before the reclaiming carried out in 1458 AD. This area extends from 50 to 600 m northward to the pile dwelling Lucone D.

<u>b. Area outside the limit of the poorly drained basin</u>

Most of morainic hills supports alfisols (acronym **Alf**, i.e. luvisols according to FAO classification), i.e. soils provided with a distinct argillic horizon. pH reaction is variable according to the depth of the argillic horizon and slope rate due to carbonate recharge processes. This conforms to the today distribution of neutro-acidophilous *Quercus cerris* woodlands, which occupy only small surfaces at the slope base, being mostly deforested. Indeed, the gentle sloping surfaces supporting alfisols are suitable for crop cultivation, so that all the drained, gentle sloping surfaces have been intensively ploughed and their argillic horizon has been disrupted, although still recognizable from their pedologic profile (acronym **uEnt(alf)**). The main limiting factor for crop growing is water availability in summer. According to pollen analysis and the pedological setting, it may be argued that before their cultivation the plains supported a full argillic horizon with a mixed *Quercus cerris – Carpinus betulus – Fagus sylvatica* woodlands (see Furlanetto *et al.*, in prep.).

Steep morainic hills are often completely denudated, as they support only poorly evolved entisols (acronym **uEnt(calc)**, i.e. calcaric regosols). These calcareous and dry soils occur widely on the hills closely south of the Lucone D settlement. Grapes are currently grown here, but in the 19th - 20th century their main land use was dry pasture.

1.2.2.2. A synthesis of modern soils and their exploitation in the Lavagnone area (Fig. 1.2.5)

<u>a. Area pertinent to the lake basin</u>

The lowermost Lake Lavagnone basin supports undrained soils, persistently water-saturated (endoaquolls – **eAq**). This was part of the lake in the Bronze Age and until reclamation in 1911 AD, but undertook phases of drying in the advanced phases of Bronze Age, whose soils are not preserved due to 20th century ploughing. The external basin fringe is marked by a belt of organic epipedon (i.e. mollisols), mostly eroded or buried under ploughed colluvium (see Chap. 1.2.2.3 and App. 1, table mollisols for details).

<u>b. Area outside the limit of the poorly drained basin</u>

Most of the gravely plain surrounding the Lavagnone basin supports thin alfisols (acronym **Alf**, i.e. luvisols according to FAO classification) or entisols derived from alfisol disruption, due to the limited depth of the argillic horizon, which was severely affected by deep ploughs in modern time. It is presumed to have been a

highly fertile area at the onset of Bronze Age agricultural practices, due to favourable water availability in summer, although coarse pebbling may have limited suitability to early ploughing techniques.
A steep morainic hill, 100 m distance East of the pile dwelling, is completely denudated, and supports poorly evolved entisols (acronym **uEnt(calc)**, i.e. calcaric regosols). In the 20th century these calcareous and dry soils were used as dry pastures.

1.2.2.3. Evidence of Bronze Age buried mollisols at Lavagnone

The distribution and features of modern soils hardly reflect the Bronze Age pedological setting of the Garda area, given disruption and erosion caused by intensive ploughing and forest clearance since then. Hence, buried soils of pertinent age may provide a valuable source of information, not envisaged from the map of modern soils.
During the excavation of the Lavagnone pile dwelling, Sector B, a succession of inhabitation layers was found to cover a natural soil with no evidence of erosion (see profile picture in App. 1). This buried soil includes a thick organic horizon – i.e. a mollic epipedon, rich in humus, base-satured – resting over the weathered gravelly parent material (see App. 1, table mollisols). This soil type is estimated to have covered a 30 to 80 m wide belt bordering the Lavagnone basin (Fig. 1.2.5), facing outward the pile dwelling settlement, and was available at the early settlement phases for ploughing, gardening, livestock lodging. During the earliest settlement phase (21st century BC) the surface mollisol got a track-way connecting the pile dwelling with the drained land (see Chap. 1.6.2.4).

1.2.3. The climate

Due to its wide surface and low altitude (Chap. 1.2.1.), the Lake Garda basin creates a thermic island within a few kilometres of its surrounding hills, thus allowing for a Mediterranean influence to the mesoclimate (Larcher 1979). Indeed, the Garda end-moraine experiences milder winters compared with the alpine foothills. This thermal effect is also observed at other south-alpine lakes in the southern Pre-Alps (Brunetti *et al.* 2014), which however experience a wetter sub-atlantic climate due to their major altitude and influence of southern air masses rainout (Giuliacci 1985). The nearest meteorological station to the Lavagnone Lake recorded a mean annual temperature of 13.4 °C and mean annual rainfall of 860 mm during the period 1921-1971. The mean annual temperature (MAT) of the area rose further in the last two decades due to ongoing global warming. The MAT is currently placed at the limit between temperate and subtropical climates (Köppen 1936).
A milding climate effect may also be related to the limited water inflow and a slight outflow of Lake Garda, allowing for a reduced turbulence and therefore a high clearness of the water. Solar radiation penetrates more deeply and warms the water more intensely than in the water column of the other lakes at the fringe of the Italian Alps (Brullo & Guarino 1998). The large surface of the southern part of the lake emphasizes the water warming, thus reducing the relative humidity in the surrounding area. Moreover, the mountains on the northern side of the basin create a barrier to the cold continental winds and their steep slopes into the lake prevent a fast warmth dispersal.
The four climate-diagrams of figure 1.2.7, originating from climatic stations close to the Lucone and Lavagnone sites (localities of Puegnago, Lonato, Calvagese and Sirmione), highlight an average annual temperature of about 14.4 °C (decade 2002-2011) – with January as the coldest month and July as the warmest one – and two rainfall peaks in spring and autumn. The average annual rainfall is higher in the

northern climatic stations (Puegnago and Calvagese, much closer to the Lucone site). All the examined localities fail to show a drought period (precipitation line below the temperature line). A short semi-drought period is observed only in southern sites close to the Po Plain, i.e. Lonato. In Puegnago (inner Valtenesi, close to Lucone di Polpenazze), there is no semi-drought period, given higher rainfall in June-July.

1.2.4. The modern vegetation [5]

The present vegetation in the surroundings of the Lavagnone and Lucone basins is composed by crop fields, and a few olive stands. The residual wood and bush composition reflects the sub-mediterranean macroclimate and arid pedoclimates, as the forest is dominated by *Quercus cerris*, *Q. petraea, Q. pubescens* (with the controversial taxon *Q. virgiliana*, Brullo & Guarino 1998), *Ostrya carpinifolia, Fraxinus ornus, Prunus mahaleb, Cotinus coggygria*. A common physiognomy is a *Fraxinus ornus – Ostrya carpinifolia* coppice with evergreen understory of *Hedera helix* and *Ruscus aculeatus* (Fig. 1.2.8, upper photo). Xero-thermophilous seminatural grasslands occur on sunny slopes of morainic hills, which were intensively grazed in the recent past (Fig. 1.2.9). They are formed by *Carex humilis, Bromus erectus, Chrysopogon grillus, Koeleria splendens, Stipa pinnata*, chamaephytes (*Helianthemum nummularium* and *H. canum, Artemisia alba*) and include a rich eurimediterranean component (Giacomini & Arietti 1943). *Fraxinus ornus* and *Carpinus betulus* occur in the lowlands. A few intermorainic ponds preserve wetland vegetation including *Alnus glutinosa*-woods and patches of *Carex riparia*-fens. Among the several Mediterranean-Balkanian plants growing in a radius of a few km around Lavagnone and Lucone, we observed *Erica arborea* stands on "Terra Rossa" decarbonated soils, while a scrub similar to the Karstic Sibliak with *Prunus mahaleb, Cotinus coggygria, Celtis australis, Paliurus spina-christi* develops on abandoned rocky fields and stone walls, and *Orlaya grandiflora* stands occur in open woodlands. Mediterranean sclerophyll tree and shrubs nowadays occur in the Garda region (*Quercus ilex, Rhamnus alaternus, Phyllirea latifolia, Pistacia terebinthus, Cistus salvifolius, C. albidus, Rosmarinus officinalis, Buxus sempervirens*), but they are limited to sunny and petrophytic habitats such as cliffs and crevices on limestone bedrock facing the lake. These habitats do not occur in the current vegetation surrounding the Lavagnone and Lucone basins. The closest site hosting a Mediterranean sclerophyll scrub is located along the limestone cliff hanging over the Rocca di Manerba in a distance of about 6 km from Lucone and 15 km from Lavagnone (Fig. 1.2.2). Here, the eastern Mediterranean tree *Cercis siliquastrum* is present too.

A list of the modern flora recorded at Lucone and Lavagnone basins is given in Appendix 2.

1.3. Cultural chronology of the Bronze Age in Northern Italy

In the history of human society in Europe, the so-called Bronze Age corresponds to the period of time between 2500 ca. and 800 cal BC (Harding 2000). Social groups more complexly organized in comparison with the last Neolithic farmers characterized this period. At the transition from the Neolithic to the Bronze Age local-level, small farming pastoral groups evolved into a sort of quasi-political groupings on a large scale, where the expression of status and power was extremely important (Harding 2000). The use of metal, rather rare at the beginning, became common and metal tools and weapons were produced in large quantities (e.g. Strahm 1994; Harding 2000, p. 197; Tylecote, 1987).

[5] Scientific plant names cited in this chapter follow Pignatti (1982).

The relative chronology traditionally divides the Bronze Age into three parts: Early, Middle and Late (see Fig. 1.3.1). This chronological scheme was largely replaced in some areas of Europe by a series of phase labels based on representative typological finds. In Italy, the traditional scheme is still in use, and the periodization includes a further age. Therefore, the chronological subdivision is as follows: *Bronzo Antico* (Early, EBA), *Bronzo Medio* (Middle, MBA), *Bronzo Recente* (Late or Recent, LBA) and *Bronzo Finale* (Final, FBA) (Fig. 1.3.1 after de Marinis 2002). The ages are then subdivided in 'periods' (e.g. EBA I, EBA II, MBA I, MBA II) and the periods in 'phases' (e.g. EBA I A, EBA I B; see Fig. 1.3.2).
The main reference site for the chronological periodization of the Bronze Age in northern Italy is the pile dwelling sequence of Lavagnone (Perini 1988; de Marinis 2000, 2002). The Lavagnone site was settled during most parts of the Bronze Age from 2100 until 1200 cal BC (Early, Middle and part of the Late Bronze Age) and preserved a continuous cultural sequence where subsequent archaeological phases are recorded in high detail (see Chap. 1.6.2.4 for a detailed description of Lavagnone cultural sequence).
The beginning of the Bronze Age in northern Italy corresponds to the spreading of the Polada Culture[6] characterized by particular pottery and original bronze types. The oldest dendrodate of all 'Polada' settlements that are dendrochronologically dated is 2077 ± 10 BC. In most of other European regions the beginning of the BA is placed by radiocarbon datings at around 2200 cal BC; and this is also the time when the Bell Beaker Culture ends in northern Italy. Thus, the gap of ca. 100 years between 2200 and 2077 cal BC is likely due to dendrodates scarcity. These circumstances, together with the correlation with cultural groups of north of the Alps, suggest placing the beginning of the BA at 2200 BC in northern Italy, too (de Marinis 2002).

The Early Bronze Age (EBA)

The EBA is subdivided into two periods: EBA I (Polada culture *s.s.*) and EBA II (characterized by ceramic decoration in the style of Barche di Solferino[7]) (respectively fig. 2-4 and fig 9 in de Marinis 2002 for pottery typology; for a chronological scheme of EBA see Fig. 1.3.2 this work). The period EBA I persisted for about 300 years (2100-1800 cal BC) and was characterized in the Garda region by the distribution of settlements mainly in the morainic amphitheatre or along the Garda lakeshores (Fig. 1.2.4 and Fig. 1.5.2). Only at the end of this period people widely scattered and a progressive colonization of the Po plain took place (de Marinis 2000, 2009).
Thanks to the archaeological stratigraphy of the Lavagnone pile dwellings, three phases were distinguished in the EBA I: EBA I A, I B, I C. The first two phases are well documented, whereas the EBA I C phase, spanning from 1900 to 1800 BC, is still poorly known.
Correlations with transalpine cultures have been established for the EBA I A phase as metal artefacts dated to this phase are produced from copper reduced from Fahlerz ores. The transition from the use of Fahlerz ores to bronze for metal object production is barely documented as bronze objects in correct stratigraphic position dated to EBA I B and I C are very scanty. Only the composition of a dagger blade found in Lavagnone EBA I B phase revealed a small tin percentage (de Marinis 2002).
There are indications that in the late EBA I phases connections between the central Po plain populations and other cultural groups were established, particularly with the Únětice culture (area from Moravia to Saxony and the Oder-Neisse basin) and the Wieselburg-Gata culture (cultural group settled between the Danube

[6] Polada is a pile dwelling site located in the Lake Garda region, a few km northward from the Lavagnone site (see Fig. 1.2.2). It was discovered by G. Rambotti in 1872 (Munro 1890; Montelius 1895; Barich 1971; de Marinis 2000).
[7] The pile dwelling of Barche di Solferino is situated 10 km southward of the Lavagnone site, in the municipality of Solferino (province of Mantua).

river, the Wienerwald and the Neusiedl lake – Lower Austria and western Hungary) (de Marinis 2000, 2002). The EBA II (1800-1600 cal BC) is characterized by a pottery typology similar to the Polada one, but with peculiar decoration (Barche di Solferino style, fig. 9 in de Marinis 2002): cross-shape patterns, plaited ribbons, wavy or zigzag lines design. EBA II was contemporary with the Transalpine BzA2b (de Marinis 2002). Apart from Lavagnone (Lavagnone 4), pottery of this type was also found in Fiavé (area 2, foundation of the pile dwelling) and Canàr (phase II). During this phase, the perilacustrine settlements along the Garda lakeshores and in the small basins of the morainic amphitheatre strongly increased and flourished. But a new phenomenon happens: the systematic colonization of the plain south of Lake Garda in the area between the moraines and the Po River took place. These settlements are mainly hosted in low land, in damp locations, along the main rivers and consist of small pile dwelling structures (de Marinis 2009).

<u>The Middle Bronze Age (MBA)</u>
The MBA in northern Italy (1600-1300 cal BC) can be subdivided in two periods on the base of pottery typology (MBA I and MBA II). The MBA I is characterized «... by carinated cups (*capeduncole*) with handles ending in an 'axe' or a 'T' shaped raising appendage. The MBA II is marked by the presence of carinated cups with handles ending in a truncated horned raising appendage in an earlier phase and with lateral conical projections in a later phase, while the earliest mouse-ear shaped handles and the vertical raising horned handles appear towards the end of the period. » (de Marinis 2002). Pottery typology of MBA I is illustrated in figures 12-14 in de Marinis 2002, for MBA II see figures 20-24 there. For a chronological scheme of MBA in northern Italy, see fig. 44 in de Marinis 2002.
The MBA I is a relatively short period, lasting about 100 years (1600-1500 cal BC). No subsequent phases are recognized within this time period. In contrast, MBA II, lasting almost 200 years (1500-1300 cal BC), is subdivided in three different phases: MBA II A, II B, II C, although the distinction between MBA II B and II C is quite uncertain because of an observed continuity in pottery typology.
The MBA II A is characterized by the decline and following disappearance of the axe-handles and by the predominance of truncated horned handles. Therefore, some pottery typology of MBA I still persisted in this phase. Handles with lateral conical projections dominate the MBA II B, while the truncated horns are decreasing. Grooved decorations with sun-shaped motif on the internal side of pottery are frequent.
Most of the settlements known from the EBA II, are still persisting during the MBA I, both in the Garda region and in the Po plain. Moreover, during this period, a cultural homogeneity is observed in the area from Fiavè and Ledro, inside the alpine highlands, to southward, through the moraines ridge, until the plain reaching the Po river.
On the contrary, a settlement discontinuity happened at the transition from the MBA I to MBA II. Settlement shifting is recorded at Fiavè (from area 2 to the little island area, the so-called area 1) and in some pile dwellings of the Garda region where the settlements moved from the centre of the basins to areas with drier conditions on the banks, e.g. in Lavagnone. In the Garda region, many sites remained still occupied during the MBA II (A and B). In the plain, however, most of the numerous, small settlements came to an end, and were replaced by scanty but larger villages (de Marinis 2002, 2009).
Nevertheless, the settlement density in the central and southern Po plain became very high during the MBA and persisted along the whole LBA. A new type of village, the so-called *terramara*, appeared in the MBA II B. It consisted in a settlement enclosed by a bank and a large ditch. Such settlement types are widespread almost exclusively in the area south of the Po River. In the area south of the Po River the evolution of the pottery typology is more dynamic and articulated than in the Garda region, thus a clearer separation between pottery assemblages of MBA II B and II C is possible. Some authors defined the former phase (MBA II C) as a

distinctive period of the MBA, called the MBA III (Bernabò Brea *et al.* 1992; Bernabò Brea & Cardarelli 1997).

The Late and Final Bronze Age

The Late Bronze Age (LBA, *Bronzo Recente*) is subdivided in two periods: LBA I and LBA II and covers the time span between 1300 BC – 1175 cal BC ca. The LBA I is characterized by a high frequency of vertical raising handles types with lateral and vertical projections. In the subsequent LBA II period, a strong change in the pottery typology took place. Handles with ribbon and handles with rod became the dominant types.

In the Garda region, perilacustrine settlements are still widespread, especially along the eastern shores of Lake Garda. For instance, the pile dwelling of Peschiera is flourishing during this period, as testified by the large amount of metal objects finds (de Marinis 2000).

The Po plain is still densely populated and the *terramare* villages reached their largest size, pointing out a strong population growth.

At the end of the LBA, this settlement system involving the Garda region, as well as the area north and south of the Po River, suddenly collapsed. Large areas became depopulated; *terramare* villages and perilacustrine settlements were abandoned. This dramatic event characterized the whole Final BA until the beginning of the Iron Age at around 900 cal BC. Causes of this phenomenon were largely discussed and possible explanations suggest climatic and environmental deterioration, resource mismanagement, overexploitation of natural resources, and social instability; more likely a combination of all these factors is to be considered (de Marinis 1997; Cremaschi 1992; for a synthesis see de Marinis 2009).

1.4. Dendrochronology of the Bronze Age in the Garda region

Fasani & Martinelli (1996) carried out a first valuable synthesis on the tree-ring Bronze Age chronology in northern Italy. An updated outline is presented in Martinelli 2005a and 2005b.

The state of the art of Bronze Age dendrochronology in the Garda region counted so far 13 pile dwellings where dendrodates have been obtained from oak wood elements (mostly vertical posts). The single curves extend back to the time span from the 21st-16th century BC, but did not yield so far a single continuous plurimillenarian oak standard curve for the whole Bronze Age of northern Italy. Only regional or local dendrochronological curves dated by radiocarbon wiggle-matching are available. Teleconnections with the Central Europe chronologies have not been successful so far (Fasani & Martinelli 1996).

At the moment, there are two available regional curves. The most important and well known is the so-called GARDA 1 (335 years in length) which is subdivided in two parts: the first covers the time span 2171-1959 cal BC and was produced by data series from the pile dwellings of Lavagnone (BS), Lucone di Polpenazze (BS), Bande di Cavriana (MN), Barche di Solferino (MN) and Ca' Nova di Cavaion (VR). This part of the curve was recently amalgamated with data obtained in the site of Dossetto di Nogara (2128-1928 cal BC)[8] extending not only the chronological interval but also the reference geographical region of the GARDA 1 curve (Martinelli 2005a). The second part of the GARDA 1 curve covers the time span 2061-1837 cal BC and was produced by series data from sites of Cisano (VR) and Lazise-La Quercia (VR).

Martinelli (2005a) elaborated another regional curve, known as GARDA 3 (220 years length); it is based on the series from the settlements of Frassino (VR) and Bosca di Pacengo (VR). It covers the time span 1830-1677 cal BC.

[8] The site of Dossetto di Nogara (VR) is located along a paleochannel in the center of the Verona Plain, 50 km South-East of the Garda lakeshores, 10 km west of the Valli Grandi Veronesi.

On the base of the dendrochronological investigation an evolution of the Bronze Age settlements of the Garda region can be outlined. The oldest dendrodate comes from the site of Lavagnone, from a wood element of the track way that ran across Sector B[9]; it yielded a date back to 2077+/- 10 BC (Griggs *et al.* 2002 (printed in 2007)). Most of the oldest dendrodates are recorded around the mid-21st century cal BC. During this time significant felling dates are documented in the pile dwellings of the morainic amphitheatre (Lavagnone, Lucone D and Barche di Solferino), as well as in those along the south shore of Lake Garda (Peschiera and Ronchi del Garda). Therefore, most of the oldest pile dwellings date back to a short time after the beginning of the EBA, although older sites are known in the area (Poggiani *et al.* 2005 mentioned a Late Neolithic pile dwelling, submerged in Lake Garda near the touristic harbour of Padenghe sul Garda, 'palafitta 3A'). These early BA pile dwellings lasted a short time (50-60 years) and persisted until the 20th century cal BC. They are characterized by simple post constructions i.e. without any wooden base. During the 20th century BC, these sites were characterized by new phases and new settlements were founded, both lasting for 40-70 years. All these settlements marked an extraordinary population density in the area during the 20th-19th centuries cal BC compared to previous times.
No dendrodates are available for the 18th century cal BC. This gap is more likely due to a missing record than to a real non-existence of settlements in the area. Actually, in this period in some sites a shift of the settlements on drier ground is documented (e.g. the 'bonifica' layers of the Lavagnone site – see note 18, Balista & Leonardi 1996). The drier conditions are less favourable to the preservation of organic material.
17th century cal BC dendrodates have been obtained only from a few sites located along the shore of Lake Garda, nowadays totally underwater. From this time onwards dendrodates become more and more rare.

1.5. An overview of the archaeobotanical research about the Bronze Age cultures in the surroundings and inside the Alps. State of the art.

1.5.1. Archaeobotany of the Bronze Age pile-dwelling groups in the northern Alpine Foreland

Lake-dwelling sites are widespread in the northern Alpine region, from the western French Jura to the Austrian Alps in the East. Most of them are Neolithic, only a smaller number are dated to the Bronze Age (see compilations by Jacomet *et al.* 1998; Jacomet 2004 and 2008; recent investigations by Zibulski 2001; Zibulski 2005; Brombacher *et al.* 2005). The latter ones are mainly located in central and eastern Switzerland. In western Switzerland only a very important pile-dwelling site dated to Late Bronze Age is known, Hauterive-Champréveyres (Jacquat 1989). Thanks to the good preservation of wood elements, all these sites are precisely dated by dendrochronology (e.g. Billamboz 2001; for a critical review see Conscience 2001).
Thanks to its high number of perilacustrine settlements, the northern Alpine region is considered one of the best-investigated areas in Europe regarding Bronze Age archaeobotany. Nevertheless, archaeobotanical data are still incomplete for three main reasons (Jacomet *et al.* 1998). Firstly, the investigated sites are not equally distributed in all Bronze Age phases. Secondly, not all the Bronze Age phases are documented by lake-dwelling sites (e.g. from earlier phases of the EBA or Middle Bronze Age (MBA) only dry sites yielding exclusively charred remains are preserved, and only very few of them were investigated). Finally, the third reason concerns the methodological aspects: the methods applied are very heterogeneous thus, not all data can be used quantitatively to calculate seed concentrations, or do statistical analyses. Despite the mentioned biases, these archaeobotanical investigations give us an outline of the plant economy during the Bronze Age

[9] For the location of Sector B in the Lavagnone archaeological area see Fig. 1.6.2.2 and Fig. 1.6.2.7 in Chap. 1.6.2.4.

and testify the progressive change of the environment due to human activities comparing to Neolithic times. The cultivated plants spectrum of the Bronze Age north of the Alps underlines the crucial role of cereals in the nutrition. Cereal remains are found in large quantities in all the investigated sites. Hulled six-rowed barley (*Hordeum vulgare*) [10] played the main role, particularly in Early Bronze Age, other important cereals were still einkorn (*Triticum monococcum*) and emmer (*T. dicoccum*). A new cereal, spelt (*Triticum spelta*), appears for the first time in large amounts; its introduction and provenance is still an open question (e.g. Blatter *et al.* 2002, 2004; Akeret 2005). Free-threshing wheats are frequently reported but they are not of great importance. Other two important cereals appear during the Late Bronze Age[11], originating in the Far East (northern China): millets (*Panicum miliaceum* and *Setaria italica*; for a recent survey of the finds see Hunt *et al.* 2008). Large amounts of pulses (pea, horse bean and lentils) are present only in Late Bronze Age Lake-dwelling sites; their importance substantially increased the nutritional value of cultivated plants (Jacomet & Karg 1996: 258). Their appearance reminds of the spectra of SE-Europe, especially Thessaly (for a recent compilation see Becker & Kroll 2008). In addition, during the Bronze Age the collected plants have had still a great importance as staple food and for providing vitamins and trace elements, such as hazelnut (*Corylus avellana*), acorns (*Quercus* sp.), wild apples (*Malus sylvestris*), strawberries (*Fragaria vesca*), blackberries (*Rubus* aggr. *fruticosus*), etc.

As far as agricultural activities are concerned, inferred by the ecology of weed flora and the cultivated plants, in the Bronze Age, we have a clearer separation between summer and winter crops with the appearance of spelt, a typical winter crop, and millets, which are instead typical summer crops. Spectra of weeds from the region of Basel (Jacomet & Brombacher 2009) show rather clearly that during the Bronze Age (well visible from the LBA onwards) a division of the cultivated land into garden plots, with special cultures like millets or pulses on the one hand, and extensive winter cereal growing on larger fields on the other hand has taken place[12]. The latter were obviously prepared with an ard. An evaluation of Middle Bronze Age weed-spectra from Cham-Oberwil Hof (Zibulski 2001) with FIBS (using functional attributes of weeds) by A. Bogaard pointed clearly to this fact (Bogaard 2002, 2011).

1.5.2. Archaeobotany of the Bronze Age cultures inside the Alps (from Ticino eastwards)

From the interior of the Alps by now a fairly large amount of settlements is investigated (see e.g. the compilation by Jacomet *et al.* 1999; Schmidl 2005), however, only in some cases in a representative way. All these sites are not waterlogged, therefore only carbonized plant material – mostly coming from burnt layers – is preserved.

In the eastern Swiss Alps (Canton of Grisons) plant material from four Bronze Age excavation sites (Lumbrein-Surin, Crestaulta; Chur-Karlihof; Maladers-Tummihügel and Savognin-Padnal) has been recently investigated and these results are summarized in Jacomet *et al.* (1999)[13]. The most important of these sites is Savognin-Padnal (1210 m a.s.l.), a crucial site involved in mining and trade, linking the north-south pass route over the Julier / Septimer passes. Here, a long stratigraphic sequence, from Early to Late Bronze Age, is recorded. A

[10] The nomenclature of cultivar follows Zohary *et al.* 2012.

[11] Maybe these appear already in the MBA, however, there are so few investigations, and the available data are so unsecure, that we cannot be sure about this.

[12] In Jacomet & Brombacher (2009) also data from lake dwellings were considered

[13] Unfortunately, these sites were excavated partly long times ago, thus, only judgment samples, collected from burnt layers, were available and the sieving method was not construable. The overview presented in Jacomet *et al.* (1989) was based only on the available material.

preliminary report on the plant remains from northern Ticino (site Airolo-Madrano) has also recently appeared (Jacquat in Della Casa *et al.* 2009, Jacquat *et al.* 2011).

In sites from the Grisons, but also the new site from Ticino, the most important cultivated plants were cereals, mostly represented by *Hordeum vulgare* (hulled six-rowed barley). Wheat is present only in smaller amounts including grains and chaff remains of *Triticum spelta* (spelt), *T. dicoccum* (emmer) and *T. monococcum* (einkorn). Besides cereals, large amounts of pulses were found, such as *Pisum sativum* (pea) and *Vicia faba* (broad bean). The latter one refers to the oldest known stock (dated to Middle Bronze Age) in Central Europe. In the northern Alpine foreland, stocks of pulses are known only from the Late Bronze Age onwards. In addition, we have also evidence for the cultivation of flax (*Linum usitatissimum*) in the Alpine valleys[14].

In addition, there are some investigations from a „Brandopferplatz“ (a ritual site) in the Alpen-Rhine-Valley near Wartau (site Wartau-Ochsenberg, Heiss 2008). There, the spectrum of plants – beside charcoal – is extremely limited.

New data about Bronze Age agriculture practices, partly at higher altitude inside the Alps have been provided also by recent palaeoethnobotanical investigations in western Austria and South Tyrol (Oeggl 1992; Schmidl *et al.* 2005; Swidrak & Oeggl 1998; Heiss 2008). Particularly, the investigations of two hill-top settlements (Schmidl & Oeggl 2005) gave a significant contribution to the knowledge of subsistence strategy in the Alpine area during the Bronze Age. According to these studies, the most important cereal crop in the eastern Alps appeared to be hulled barley (*Hordeum vulgare*) as in other Bronze Age sites in the Alpine area; this might have its reason in the wide ecological range of this crop which can grow up to more than 2000 m a.sl. (pers. observ. Stefanie Jacomet, Findelen near Zermatt, Switzerland). Other common cereals were emmer (*Triticum dicoccum*), spelt (*T. spelta)* and broomcorn millet (*Panicum miliaceum*). Pulses, mostly pea (*Pisum sativum*) and broad bean (*Vicia faba*), were also regularly cultivated. Besides these crop species, a fairly high amount of edible wild plants was found testifying still a large contribution of gathered species in food supply. The weed flora spectra suggest winter and summer crops growing and denotes a crop rotation system during the Bronze Age in the eastern Alps.

The recent compilation of Stika & Heiss (2012, 2013) for the region 'Eastern Alps and Foreland' (including the eastern Alps as considered here and the foreland where Lucone and Lavagnone sites are placed) confirmed the dominance of barley during the EBA and MBA, whereas emmer and spelt were subdominant, as well as einkorn and free-threshing wheat. During the LBA, broomcorn millet remarkably increases while barley decreases, but still persisting as one of the main cereal crops together with emmer. For pulses, during EBA and MBA garden pea is dominant, while horse bean and lentil are recorded by only a few finds. In LBA, garden pea is still dominant, but the abundance of horse bean and lentil significantly increases.

1.5.3. Archaeobotany of the Bronze Age cultures in northern Italy

There are different Bronze Age settlement types in northern Italy, linked to the different geographical areas: pile dwellings are distributed along the southern border of the Alps, 'terramare' (terrestrial settlements elevated on stilts) in the Po plain south of the Po River, and terrestrial sites at higher altitudes of the Apennines and Alps, like e.g. Monti Lessini. In northern Italy therefore, there is a great potential for archaeobotany as settlement density is one of the highest in Europe during prehistoric times (Cremaschi *et*

[14] In the dry inner alpine valleys also millets played a big role, e.g. Late Bronze Age layers at Brig-Gamsen in the Valais (unpub. data by Karen Lundström Baudais).

al. 1991-92). In addition, there are many waterlogged sites (pile dwellings) which offer much more possibilities for good preservation of plant remains and, consequently, for detailed archaeobotanical studies. Archaeobotanical research, however, has not a long and ancient tradition in northern Italy. Only recently this discipline is becoming more and more appreciated, supplying information about palaeoeconomy and the palaeoenvironment (Castelletti 1983; Castelletti & Rottoli 1997; Follieri & Castelletti 1988).
Italian pile dwellings were already present in the Neolithic, with the earliest dating back to the sixth millennium cal BC. The relevant pile dwelling traditions of the Neolithic are those of the "Isolino di Varese" (Early Neolithic, 5200-4600 BC), and the culture of the "Vaso a Bocca Quadrata" VBQ (Early-Middle Neolithic, 5100-4000 BC), the latter widespread in all of northern Italy, from Ligury to Friuli. The VBQ also occurs at the Isolino di Varese, with a typical phase (VBQ type "Isolino").
Several lakeshores along the pre-Alpine foothills were settled during the Late Neolithic, belonging to the late VBQ culture and to the Chassey-Lagozza (4200-3300 BC), first described at the dwelling of Lagozza di Besnate (Fig. 1.5.1).
A first compilation of archaeological sites with plant material finds in Italy, including a first attempt to present a picture of the dominant crops in prehistoric times was performed by Hopf (1991) in her paper referring to South and Southwest Europe. She distinguished between Northern, Central and Southern Italy. Seven Bronze Age sites were at that time investigated for plant macroremains in northern Italy (included in the regions: Piedmont, Liguria, Lombardy, Trentino Alto Adige, Veneto, Friuli Venezia Giulia, and Emilia Romagna). A larger number of sites (43) was included in the synopsis on Bronze Age crops presented in Fiorentino *et al.* 2004. According to these data (ubiquity of species) during Bronze Age in northern Italy, barley is the dominant cereal, while emmer, einkorn and free-threshing wheat are a bit less frequent. Spelt is recorded since the EBA, but with only a few counts. Another important trait of this period is the appearance of broomcorn and foxtail millet. The former displays a remarkable increase towards the LBA, e.g. in the Custoza (southwest of Verona) site, where huge amount of broomcorn millet were found and interpreted as votive offerings (Nisbet 1997). Rye (*Secale cereale*) and oat (*Avena* sp.), most probably still non-domesticated, are documented by sporadic and a few finds.
Pulses are significantly less frequent than cereals. They are dominated by horse bean and garden pea, while lentil and *Lathyrus sativus/cicera* are recorded by only sporadic finds. Fresh fruits were still intensively gathered during the whole Bronze Age and among the most abundant *taxa* cornelian cherry (*Cornus mas*) is the most representative, it could be considered as a bio-chronological indicator of the Bronze Age.
Other gathered plants were acorns, hazelnuts, crab apples (*Malus* sp.), figs (*Ficus carica*), plums (*Prunus domestica* subsp. *insititia*, *Prunus spinosa* aggr.), pears (*Pyrus malus*), cherries (*Prunus avium/cerasus*), blackberries (*Rubus* aggr. *fruticosus*), strawberries (*Fragaria vesca*), raspberries (*Rubus idaeus*), alkekengi (*Physalis alkekengi*), elder (*Sambucus nigra/racemosa*).
Recently Stika & Heiss (2012, 2013) provided new up-to-dating regional overviews of crops in Bronze Age Europe. Their evaluation is given by a semi-quantitative approach, in contrast to frequency and coarse estimation of dominance in previous compilations; thus, only sites with raw data reported in publications were included in their study. North Italy is split in two of the regional overviews they considered: 'Eastern alps and Foreland' for the alpine area where 6 sites are included, and 'central and northern Italy (South of the Alps)' for the plain and "northern Apennines" (9 sites). The former overview was already commented in the previous chapter (see Chap. 1.5.2) as it refers also to the inner Alps. The latter displays a different assessment, as emmer is the dominant cereal during the whole BA, while barley is subdominant, together with free-threshing wheat and einkorn. During LBA einkorn decreases and free-threshing wheat is replaced by broomcorn millet. Spelt is documented by a few finds in the region. Pulses are normally recorded in low

amounts. The most well-represented species is horse bean, while garden pea is a secondary pulse. During LBA bitter vetch, lentil, grass pea and chickpea seeds are found, too.
In figure 1.5.2 and table 1.5.1 an overview of the all northern Italian sites, yielding archaeobotanical data (fruits and seeds) is given.

1.6. The investigated sites

1.6.1. LUCONE. State of the archaeological and archaeobiological research in the Lake Lucone area

Lake Lucone (249 m a.s.l., 45°33'N, 10°29'E, Polpenazze del Garda, Brescia, N-Italy) is a small inframorainic lacustrine basin located in the western part of the morainic amphitheatre of Lake Garda (Fig. 1.2.1 and Fig. 1.2.4). It is one of the best preserved lacustrine deposits of this region. As a matter of fact, it was not affected by peat quarrying activities, very common in the region during the period between the two world wars, which caused the destruction of the uppermost parts of the stratigraphy in most of the peat bog deposits of the Lake Garda area. Nevertheless, the small lake was partly drained in 1458 by the construction of a filling channel in order to reclaim new land for agriculture activities (Baioni *et al.*, 2005). As a consequence, the open water surface is nowadays strongly reduced (Fig. 1.6.1.1).
The archaeological area along the lakeshore is known since the end of the 19th century, Fossati (1891) mentioned the finding of abundant archaeological remains (flint artefacts, pottery and bones) along the lakeshore and inside the lake.
Only in the 1960ies, first archaeological excavations were officially carried out by the members of the Association 'Gruppo Grotte Gavardo' leading by the school teacher Piero Simoni under the supervision of the Soprintendenza [15]. From 1965 to 1971 the archaeological excavation affected the western area of the basin (later denominated Lucone A, see Fig. 1.6.1.1) (Guerreschi 1980; Baioni *et al*., 2005) and in 1986 a small sondage was carried out on the eastern side (later denominated Lucone D, see Fig. 1.6.1.1).
In addition to these excavations, the intensive archaeological survey of the area, mainly carried out by G. Bocchio, allowed defining five main archaeological areas, located along the shores of the Lucone lake (Lucone A, B, C, D and E, see Fig. 1.6.1.1). Only Lucone A and Lucone D have been excavated, as mentioned above, the others are known only by field survey. Apart of a limited Late Neolithic settlement (Lucone C), the basin was inhabited during the whole Early Bronze Age and the first part of Middle Bronze Age as suggested by cultural evidences and dendrochronology. The latter was carried out only at Lucone D.
The Early Bronze Age deposits of the Lucone D site are currently being investigated (2007-2017) by the Museo Archeologico della Valle Sabbia (Gavardo), under the supervision of Marco Baioni (director of the museum).

<u>The site Lucone A</u>
The Lucone A area is characterized by a sort of embankment strongly raised above the plain area of the basin and oriented towards the centre of the basin (Fig. 1.6.1.2). The archaeological excavation carried out in 1965-1971 consisted of a field survey and several small investigated areas, including a trench through the embankment (Baioni *et al*., 2005). During these excavations a unique wooden pirogue was found. At the end, all these campaigns got an estimation of how large the archaeological area was and defined the main residential complex in the central part of the embankment.

[15] The 'Soprintendenza per i Beni Archeologici della Lombardia' is the State Archaeological Service of the Lombardy Region.

The EBA I is documented by a very few counts of pottery finds; it is supposed that during this phase only a small pile dwelling settlement was present at the embankment place. On the contrary, lots of EBA II pottery finds have been recovered all over the archaeological area. During this phase the settlement was larger than in the previous phase and also the plain area around the embankment was partly occupied. Besides there are evidences of archaeological structures both raised on the water or based on the ground on 'bonifica' layers (see note 18).
The MBA I is also well documented by pottery finds, but archaeological structures are very rare because agricultural works damaged a part of this layer. Thus, any hypothesis on the settlement composition could not be drawn up. Finally, the record of an MBA II phase is extremely scarce and many of the finds are not in a clear context.

<u>The site Lucone D</u>
Lucone D excavations revealed two subsequent pile dwellings, rich in pottery and plant remains, which are separated by the evidence of a fire event in form of a burnt layer (Martinelli 1988; Poggiani-Keller *et al.* 2005; Bocchio 1988). The cultural layers are around 1 m thick and the excavated surface covers an area of almost 200 m^2 (Fig. 1.6.1.3 and Fig. 1.6.1.7).
Both phases are dated to EBA I (EBA I ranging from 2200 to 1800 cal BC) and they are not distinguishable on the base of pottery typology. Actually, the two phases yielded finds dating either to EBA IA and EBA IB. The lowermost layer (settlement phase 1) was deposited in a waterlogged environment and is rich in macrobotanical remains. This deposit is chronologically correlated to the early phase of the Lavagnone pile dwelling (Lavagnone 2 according to Perini 1980). Recent dendrochronological investigations, although in a preliminary state (Martinelli 2013), set the beginning of the first pile dwelling (phase 1) to 2035 cal BC. Fifteen dendro-groups, each related to a different felling episode, have been recognized. The felling episodes are grouped in three phases: installation (2035-2031 cal BC), renovation (2021-1998 cal BC) and development (1984-1969 cal BC).
The first phase ended with a fire event that led to a partial collapse of the structure most probably into the open water, as several observations during excavation revealed. Moreover, some constructional timbers found in the burnt layer are only partially and not completely charred or burnt. This, according to archaeologists, corroborates the hypothesis that the houses were erected over the open water and their constructional elements fell directly into the open water as a consequence of the fire event. This caused various above-ground parts to be preserved, including a beam forming part of the roof. The burnt layer thickness is not the same all over the excavation surface (higher thicknesses are recorded in the central and western part of the archaeological area (Fig. 2.3) where likely the fire originated) and it seems to disappear at the edge of the settlement towards the lake.
The second settlement phase (starting with the renovation phase of dendrochronological data, see below) is characterized by the presence of some huge heaps of discharged material ('cumuli'; Fig. 1.6.1.3 bottom) scattered all over the area (Fig. 2.3). They have a diameter larger than 2 m and are composed by alternated organic and minerogenic layers, i.e. detritus of plant material, ash layers, charcoal remains, waste of hearth remaking and daub fragments. The micromorphological analysis (Cristiano Nicosia, Université Libre de Bruxelles, unpubl. data) has pointed out that the deposition of these layers occurred in a water environment; this was highlighted by the absence of soil fauna bioturbation (except for the very uppermost part of the deposit), no trampling traces, and no signs of rainfall erosion, i.e. washing away of sediment in phases of intense precipitation. In the fine composition of the organic part, ash of wood, leaves, chaff remains, faecal remains (some of them burnt) both of ruminant and carnivore/omnivore were recognized.

The cultural deposits belonging to the second settlement phase are subject to drier conditions of preservation than the deposit of the first phase, which are constantly waterlogged. They are actually affected by seasonal water table oscillation of the basin, which is mainly linked to the rainfall regime and to the intensive maize crop cultivation in the surrounding fields (Fig. 1.6.1.2). Maize plants soak up huge amounts of water during the growing season producing an evident drawdown of the phreatic level.
So far, the last felling recorded by dendrochronology analysis was dated to 1969 BC (Martinelli 2013). As dendrochronological analyses are still in progress, this is a minimum dating (*terminus post quem*) for the end of the second settlement phase.
The houses of both settlement phases are supposed to have been elevated on stilts above the ground as there are no evidences of dried areas, trampling surfaces, or floor insulation.

1.6.1.1 The basin sequence offshore the Lucone pile dwelling

The sediments of the Lucone basin contain one of the richest Holocene archives in northern Italy. Peat quarrying or agricultural works only faintly damaged the Late Holocene stratigraphic sequence. It was investigated at the Laboratory of Palynology and Palaeoecology of CNR IDPA of Milano through 16 corings and two trenches carried out along a transect E-W crossing the archaeological area of Lucone D and near-site ponds offshore the village (Fig. 1.6.1.4).
The main units of the stratigraphic sequence can be summarized as follows (Fig. 1.6.1.5):

- 8 DT: The lowermost unit reached by coring is composed of grey and grey-bluish silt alternated to thin layers of fine sand (Early Late Glacial);
- 7 DT: fine organic, elastic laminated mud locally named ‘polmone’ classified as dy, lacking plant macroremains, about 1 m thick (Late Glacial and Early Holocene);
- 6 DT: alternances of brown carbonatic gyttja rich in mollusc and *Najas flexilis* seeds and lighter, yellowish carbonatic gyttja (Middle Holocene about 7000 to 4000 y cal BP);

The uppermost 2 m of the sequence are strongly affected by human impact, resulting in a spectacular dark to whitish banding:

- 5b DT: dark brown detritus gyttja rich in wood charcoal, and charred fruits and seeds, also including pottery fragments (EBA – pile dwelling phases Lucone D);
- 5a DT: dark brown fine gyttja lacking macroscopic organic detritus (BA post abandoning Lucone D)
- whitish carbonatic mud (from about 1000 BC to 100 BC)
- 4 DT: laminated alternances of brown gyttja and dark brown gyttja (100 BC to 500 AD)
- 3 DT yellowish carbonatic gyttja (500-800 AD about)
- 2b DT: very dark compressed gyttja (800-1300 AD)
- 2a DT: reclamation layers formed by clay prismatic aggregates fractured by mud-cracks (1400 AD)
- 1 DT: ploughed horizon.

The reconstructed transect W-E shows a general deepening offshore of the pile dwelling and normal faults dropping down the stratigraphic sequence (Fig. 1.6.1.5, trench 1). These faults are recent load structures related to the travelling of agricultural machineries along a farm road. Further soft sediment deformations were detected along a trench across the border of the pile dwelling to the offshore basin (excavation 2013). An early collapsing of the pile dwelling caused the latter. Two offshore sequences from the pond facing the pile dwelling village, but very close to the pond / settlement border, have been investigated for thin-resolution palaeoecology and geochemistry. Given their close position to the settlement, they received material discharged by human activities and thus they will be qualified hereafter as “near-site lake sequences”

1.6.1.2. Age depth model of the near-site Lucone D sequence and sedimentation rate

The age-depth model of the Lucone D near-site sequence[16] (Fig. 1.6.1.6) was supported by four radiocarbon AMS ages calibrated using CALIB software (v 7.0.1 Queen's University Belfast, using the IntCal13 calibration curve) and by correlating three main cultural events and four biostratigraphic regional scale events with the pollen record.
The first cultural event was the village foundation, detectable in the pollen-stratigraphy by a sudden NAP-rise (incl. cereals) caused by human activities on the site and nearby. Therefore, the dendrochronological age (2035 ± 10 yr cal BC) of this event was attributed to the relevant pollen layer. The second cultural event was the village abandoning at the dendrochronological age 1969 ± 10 yr cal BC, also detectable in the pollen record as a relatively sharp event. Finally, the third event was the land reclamation of the basin, which took place according to historical sources at 1458 AD. The biostratigraphic regional events were: i) first phase of beech and hornbeam spread (3010-3020 yr cal BC); ii) second phase of hornbeam spread (920-1260 yr cal BC); iii) chestnut spread (200-340 AD); iv) *Cannabis* and *Secale* spread (900-970 AD). Thus, a robust chronology, which allowed for a quasi-decennial resolution between the samples, was obtained.
The age-depth model (Fig. 1.6.1.6) highlights a very low sedimentation rate during the pre-settlement phase. A strong increase is observed when the village was founded and a high sedimentation rate persists during the two settlement phases (almost 1 m of compacted organic sediment in 50 years). This is explained by an intensive dump discharge in the pond during the settlement phases.

1.6.1.3. Stratigraphy of the Lucone D cultural layers

The stratigraphic sequence of the archaeological area of Lucone D was first described by Bocchio (1988) and this description referred to a sondage (3x3 m^2) carried out in the NE sector of the present excavation surface (see Fig. 2.3). This first description included 6 main stratigraphic units (US), among them only 3 were cultural layers (the two settlement phases described above and the burnt layer separating them). The excavation starting in 2007 enlarged the investigated surface thus extending the stratigraphic knowledge. The cultural layers turned out to be more articulated, especially those referring to the second settlement phase where heaps of discharged material formed by overlapping fine layers were found (see above the description of Lucone D site, "cumuli"). The burnt layer thickness appeared not uniform all over the investigated surface. The first settlement phase layers deepened offshore in the sector NW of the archaeological area. Nevertheless, the stratigraphic scheme proposed by Bocchio (1988) was confirmed for the whole surface.
The stratigraphic sequence is about 1 m thick and is composed as follows, from top to bottom (Bocchio 1988 and personal observation) (Fig. 1.6.1.7):
- ploughing horizon (US1, ca. 35 cm thick)
- whitish carbonatic mud rich in small molluscs sealing the cultural layers (US2, ca. 5-10 cm thick, increasing westward).
- dark brown gyttja. Organic cultural layer rich in ash, wood charcoal, daub mixture fragments and cultural remains (US3, ca. 20 cm thick). Locally, it is organized in thin alternated layers of prevailing organic or minerogenic components, forming heaps of discharged materials ("cumuli"). This cultural layer formed during the second settlement phase.
- very dark layer exclusively composed of abundant charcoal remains and pottery fragments, with lenses of

[16] The age-depth model of Lucone near-site sequence was elaborated by F. Badino, G. Furlanetto and C. Ravazzi (Laboratory of Palynology and Palaeoecology of CNR-IDPA Milan).

clay, sand and small gravels (US4, ca. 30 cm thick). This charcoal layer testified the fire event that destroyed the village of the first phase.
- dark brown detritus gyttja rich in wood charcoal, wood fragments, twigs, bark, and fruits, and including also abundant cultural finds e.g. pottery, wooden artefacts, bronze objects (US5, ca. 20 cm thick).
- alternances of brown carbonatic gyttja rich in mollusc and yellowish carbonatic gyttja (US6, from 1 m depth downward).

1.6.1.4. The palynostratigraphic investigation near-sites Lucone A and Lucone D

Valsecchi *et al*. (2006) carried out a preliminary pollen investigation near-site the Lucone A settlement basin. The investigated sequence was cored close to Lucone A (LUC1 in Fig. 1.6.1.1) and limited to few samples for the whole Bronze Age period. In 2009, the Laboratory of Palynology and Palaeoecology of CNR I.D.P.A. (Milano) undertook new pollen studies in order to provide a more detailed overview on the Holocene vegetation history of the Garda area (see Fig. 1.6.1.4 for corings and trenches location). Its goal was to create a palaeoenvironmental outline previous, contemporary and subsequent to the anthropic exploitation of the basin that occurred during the Bronze Age (Badino & Ravazzi 2011; Badino *et al.* 2011; Furlanetto 2013).
A palynostratigraphic investigation in the pond record offshore to the village of Lucone D has been carried out in the belt very close to the settlement limit, which still receive organic detritus discharged from the village and floated offshore (near-site Lucone D record). Two trenches have been dug respectively 7 m and 13 m from the limit of the stilt houses, the latter marked by waterlogged dump cumuli (Fig. 1.6.1.4), towards the centre of the basin. The investigated sequence was 220 cm thick and covered a time span from Copper Age (3400 cal BC) to Renaissance (1500 AD) (for details see Chap. 1.6.1.1). The vegetation history recorded in the lowermost part of the deposit can be subdivided in three main phases: i) pre-settlement phase (3400-2035 cal BC); ii) settlement phases of Lucone D; iii) post-settlement phase: after abandonment of the Lucone D BA-site. It can be briefly summed up as follows (Fig 1.6.1.8):
i) Before the settlement, the area was covered by dense thermophilous broad-leafed forests (*Quercus, Carpinus betulus, Fagus, Ulmus*). The finding of isolated pollen grains of cereals and *Plantago lanceolata* in the Copper Age sediments suggests sporadic human clearings unrelated to lake shores (pollen zones LD1 and LD2 in Fig 1.6.1.8).
ii) The village foundation (about 2034 cal BC) is documented by a strong increase of microscopic charcoal and the synchronous spread of several anthropogenic indicators (*Cerealia, Plantago lanceolata, Rumex acetosa, Trifolium*). The settlement phase is palynologically two-folded, in agreement with archaeological and dendrochronological data (Bocchio 1988, Martinelli 1996). During the oldest settlement phase (pollen zone LD3), the pollen composition pattern suggests a strong human impact with high and stable extent of cereal fields, pastures and orchards. The beginning of the subsequent settlement phase (pollen zone LD4) is marked by pollen changes indicating reduction of the surface of cereal fields.
iii) The definitive settlement abandonment is shown by a sudden disappearance of cereal pollen and anthropogenic *taxa*. The forest regeneration was mainly led by *Quercus, Corylus, Fagus, Carpinus betulus*.
Signs of human activity are recorded also after the abandoning of Lucone D settlement, during the subsequent Early-Middle Bronze Age, Iron Age, Roman and Medieval ages until the drainage of the 15^{th} c. AD. The vegetation history from the Iron Age onwards is not described here (for details see Furlanetto 2013).

1.6.1.5. Archaeozoological data from Lucone D

Preliminary results of the archaeozoological investigation of the Lucone D site are presented in Bona (in press) (Fabio Bona, Università degli Studi di Milano). Both wild and domestic fauna have been recorded in the two settlement phases. Pigs, cattle, sheep, goats and dogs represent the domestic animals. Cattle remains are not particularly abundant. Their proportion (%), based on the number of identifiable specimens (NISP) of domestic animal remains, is 14.1% in the 1st settlement phase and 17.2% in the 2nd settlement phase. Nevertheless, cattle provided almost half of the meat obtained from domestic animals (respectively 42% in the 1st settlement phase and 49.3% in the 2nd phase, based on bone weight). The age estimation of these remains accounts for a high mortality rate among adult individuals. This strategy of cattle management is consistent with an agrarian society where labour (traction) was the main motivation for keeping cattle. So far, no traces (e.g. bones pathologies) of traction activity of the animals have been detected.

Pigs played a significant role in meat supply in both settlements phases (respectively 39.1% and 32.7% proportion in bone weight). Pig bones are extremely abundant (NISP 46.7% and 48.8%) and the age estimation suggests pigs were slaughtered within 12 months age, reinforcing the hypothesis they were bred for food.

On the other hand, the small ruminants (sheep and goats) were less important in terms of meat supply: altogether, they provide only the 18.9% and 18% of the amount of meat from domestic animals. Nevertheless, the number and importance of sheep and goats in the economy of the village was relevant. The age range of sheep and goats and the abundance of sheep females are interpreted by Bona (in press) as consistent with an exploitation of the herd for milk production, wool production has been excluded.

Dog remains are very scanty in the bones assemblages and the bones so far recovered did not bear any signs suggesting the consumption of their meat.

In both settlement phases wild animals are poorly represented, a total of 5.5% of the identifiable animal bones recovered in Lucone D were from game. The most important hunted species were red deer (*Cervus elaphus*), wild boar (*Sus scrofa*), and pond turtle (*Emys orbicularis*). In addition to these, six other game species have been sporadically found: brown bear (*Ursus arctos*), beaver (*Castor fiber*), wild cat (*Felis silvestris*), roe deer (*Capreolus capreolus*), pine marten or beech marten (*Martes* sp.), and red fox (*Vulpes vulpes*). Considering the low amount of these remains, it's likely that wild animals did not play an important role as regards nutrition, but nonetheless were of significant use for the supply of antler, fur, bones, sinew etc., even though other reasons could not be excluded such as protection of the crops and defence of the village and its inhabitants.

1.6.2. LAVAGNONE. State of the archaeological and archaeobiological research at the Lavagnone site

The former lake of Lavagnone (101 m a.s.l., 45°26'N, 10°32'E, located 3 km south of Desenzano del Garda, Brescia, N-Italy; see Fig. 1.2.1, Fig. 1.2.2 and Fig. 1.2.4) originated into fluvioglacial deposits as a proglacial lake dammed on its eastern side by a morainic ridge, during one of the most recent Quaternary glaciations (Venzo 1965). With an average diameter of 390 m it was shaped in a basin of ca. 600 m diameter (catchment area only 1.86 kmq), it has no outlet and is mainly fed by groundwater (Vallè 2010, Ravazzi *et al.* in prep.). The basin contains a late glacial to Holocene continuous lacustrine succession. Today it is occupied by a drained peat-bog (Fig. 1.6.2.1 and Fig. 1.6.2.2) and the area is partly cultivated. The lake was continuously settled for about 700 years, during the Early, Middle, and Late Bronze Age (EBA, MBA and LBA). Earlier industries from Late Mesolithic and Neolithic industries have been also found along the northern and eastern edges. Probably the basin has been settled in the Copper Age too, but the best-recorded phases are those of the Bronze Age.

1.6.2.1. A short history of the archaeological research

First archaeological remains from the Lavagnone area were found between 1880 and 1886 during quarrying activities of the peat bog layers. Evidences of the pile dwelling were discovered during the First World War, when quarrying activity increased, and the site was placed under surveillance by the Archaeological Heritage Agency of Lombardy. Real archaeological excavations took place at first between 1958 and 1962 by F. Fussi (Fussi 1962) and in 1971 by Barbara Barich (Barich 1980). Renato Perini carried out six archaeological campaigns between 1974 and 1979, he described the complete archaeological stratigraphy of the site, which turned out to be fundamental for the study of Bronze Age in northern Italy, and he also brought to light the well-known oak wooden plough and half of its yoke (Fig. 1.6.2.3) (Perini 1980, 1988). On the base of pottery typology, Perini subdivided the stratigraphic sequence in cultural and chronological horizons labelled 'Lavagnone 1' to 'Lavagnone 7' (Fig. 1.6.2.8).

Since 1989 the archaeological excavations have been carrying out by the University of Milano, under the supervision of Prof. R.C. de Marinis (1989-2011) and Marta Rapi (since 2012). They enlarged the original area excavated by Perini and investigated new areas (Sectors named A, B, C, D, and E; see Fig. 1.6.2.2). The BA chronological stratigraphy was refined, new data were added about the villages' structure, building technique and village shifting along the lakeshore during the BA period. Besides, Prof. de Marinis started a collaboration with Prof. Peter Kuniholm (Cornell University of New York) for dendrochronological analysis of suitable piles exposed during the archaeological excavations.

1.6.2.2. The stratigraphic sequence of the Lavagnone basin

The central part of the depression contains a ca. 6 m thick lacustrine-palustrine infilling succession, which lies over a deposit of fluvioglacial-ice contact origin, recorded until 27 m depth. The infilling is documented by 41 drillings, performed at the Laboratory of Palynology and Palaeoecology of the CNR IDPA (Milano, Italy) by means of modified russian corers (Arpenti *et al*. 2002; Vallé 2010; Fig. 1.6.2.4).

The stratigraphy of the infilling can be subdivided in four main stratigraphic units described as follows (Fig. 1.6.2.4):

I) the deepest facies is a fluvioglacial deposit mainly consisting of gravel embedded in a light-gray clay matrix, at the top of this facies lay bluish laminated silty clays of early lateglacial age;

II) above facies I follows a laminated olive/brown silty gyttja (including a 'dy' layer *sensu* Ravazzi *et al.* in press) dated to the Early Holocene;

III) the subsequent unit is composed by laminated carbonatic gyttja, with variable content of organic matter (lake marl) deposited during the Neolithic period;

IV) the record of lake marls is overlaid by organic deposits, 2 to 3.5 m thick (human-triggered deposits and archaeological layers). In the site of the mastercore LAV1, the lowermost organic succession consists of gyttja and detritus gyttja including seeds of aquatic plants and sporadic charred cereal grains (323-300 cm in LAV1), whereas most of the remaining deposit is formed by rubbish dump discharged from pile dwellings (300 - 70 cm).

The sediment above 50-55 cm was not taken into consideration as it is disturbed by ploughing activities.

The lithostratigraphic sequence of the mastercore LAV1 (Fig. 1.6.2.5) is described as follows in de Marinis *et al.* (2005):

- 0-50 cm ploughed layer
- 50-157 cm peat
- 157-331 cm detritus gyttja rich in charcoal fragments and terrestrial plant remains
- 331-477 cm carbonatic gyttja with lamination formed by high organic detritus gyttja with seeds of aquatic plants
- 477-570 cm olive gyttja and clay

- 570-602 cm olive clay
- 602-605cm light clay-embedded gravel

The foundation of the pile dwelling caused a strong change in the lake sedimentation. Due to the beginning of a sudden import of anthropo-zoogenic material discharged in the lake and the consequent water eutrophication, the organic component of the sediment increased. It corresponds in the stratigraphic sequence to the characteristic 'transitional band' from lake marls to organic deposits, visually inspected in most of the cores (BT 331-323 cm in LAV 1, Fig. 1.6.2.5).

1.6.2.3. Age-depth model of the stratigraphic sequence at Sector D, sedimentation rate and processes

The age-depth model sequence cored at Sector D has been obtained integrating chronological information from different sources. Apart from calibrated radiocarbon ages from terrestrial seed and charcoal, the chronological range of diagnostic pottery types found *in situ*, as well as the age of the pile dwelling foundation, correlated to the dendroages of the oldest felling phase, were included. The age-depth model shows a remarkable low and stable accumulation rates during the pre-anthropic phase, while it increases in two steps after the dwelling foundation (Fig. 1.6.2.6). The first step corresponds to a phase with still limnic features as dwelling structures were not *in situ* but nearby; the 2nd one starts with an increase in plant detritus, actually testifying a dump from an *in situ* dwelling.

1.6.2.4. Chronology and cultural layers of Lavagnone

At Lavagnone, the Bronze Age is recorded by different phases. The Early and Middle BA phases are documented by a large amount of finds (pottery, flint, bronze objects, plant and faunal remains) and systematic excavations. The LBA is known only by field survey. Actually, the topmost archaeological layers were destroyed by peat-quarrying in the first half of the last century. Since then, agricultural works have been affecting a large area of the basin.

The recent archaeological excavations carried out by the University of Milano (Prof. de Marinis) have so far concerned five different areas: Sectors A, B, C, D and E. These sectors are located along a transect stretching over 170 m from the north-eastern lakeshore to nearly the centre of the basin (Fig. 1.6.2.2, Fig. 1.6.2.7 and Fig. 2.5) [17]:

- Sector A (ca. 90 m^2): it is placed near the lowermost area of the basin; preservation of the cultural layers is waterlogged.
- Sector B (ca. 65 m^2): it corresponds to the ancient edge of the lake, 70 m eastward from Sector A. Cultural layers are preserved in a terrestrial peaty environment.
- Sector C (ca. 45 m^2): it is situated between Sectors A and B, as a link between these sectors. Cultural layers are preserved in a terrestrial peaty environment, mostly in dry conditions.
- Sector D (25 m^2): it is located near to the present residual swamp in the centre of the Lavagnone depression, i.e. the bottom of the ancient lacustrine basin. First archaeological excavations of this sector were carried out in 2007, after stratigraphic prospections by coring (master core at Sector D, see Fig. 1.6.2.5). So far, only the uppermost layers, dated to MBA III, were reached by archaeological excavations.
- Sector E. During last years (2011-2013) excavations involved also the area between Sectors C and A.

[17] The order of the letters that name the sectors doesn't reflect the order of the sectors along the transect, but progressive steps of the excavations.

In the comparative scheme of Fig. 1.6.2.8 (after de Marinis *et al.* 2005) the development of the Lavagnone settlement activities during the Bronze Age is drawn and correlated with the cultural stratigraphy defined by Renato Perini during his 1970' excavations. It can be briefly described as follows:

In Sector A, two pile dwellings in stratigraphic continuity (EBA IA and EBA IB), were identified. The former pile-dwelling was dendrochronologically dated between 2048 and 1991 +/- 10 BC (EBA I A), while the dendrochronology of the latter yielded the following dendrodates: 1984, 1926, and 1916 +/- 10 BC (EBA I B) (Griggs *et al.* 2001). The two structures differ only by the building technique. The first pile-dwelling rested on simple posts, the second one on perforated wooden plates (plinths) (de Marinis *et al.* 2005). The superstructure and perimeter of the single houses were not detected, although some posts with plinths seem to form rectangles (Perini 1988). All the posts – mainly from oak wood – are strongly inclined (more than 45°, see Fig. 1.6.2.7 in the bottom picture on the right and Fig. 2.5) due to a collapse of the whole structure around 1750 cal BC (de Marinis 2000, p. 118). According to de Marinis, a strong lowering of the lake water table triggered a slipping of the anthropic deposits embedding the posts. This event was dated to EBA I / EBA II because subsequent posts are vertical or only lightly inclined. Basing on evidence of similar collapse events at the end of EBA I phase in other Garda pile dwellings, de Marinis suggested a climatic trigger to such a drawdown. Sediment accumulated among the posts of the EBA I A pile dwelling formed a huge waste heap (Stratigraphic Unit 338) composed by distinct subunits, called SU338a-d (see Fig. 1.6.2.7 in the bottom picture on the right and Fig. 2.5) (see App. 3 for a detailed description of the Stratigraphic Units from where analysed samples were collected). A fine organic layer of brown-yellowish colour (SU338d) marks the bottom of the heap stratigraphy. Horizontal wooden planks and poles have been found at the top of this layer. Then follows a thick coarse organic layer rich in pottery remains, including complete pottery in vertical position, bones, brushwood and wooden wreck (SU338c). At its upper surface burnt planks and horizontal poles were lying. A thin fine sand layer of light grey colour (SU338b) marked the transition to another thick organic layer rich in plant remains, wood, bones and cultural artefacts (SU338a). Burnt planks and poles can also be found here.

In Sector B, a timber track-way was unearthed. It was likely built in order to reach more easily the dwelling area. It was dated to 2077 +/- 10 BC (EBA I A), which corresponds to the oldest dendro-date obtained for the site of Lavagnone and for the Garda region (see Chap. 1.4). A fence, located in the Sector C, belongs to the same period. It probably delimited the eastern outer side of the village at the landside.

The EBA IC phase is recorded only in Sector B by waste dumps testifying settlement activities. Houses are not known yet, because they likely are out of the area investigated by excavations until today.

The subsequent EBA II phase is documented by waste dump layers in Sector B, and living floor levels in Sector C, whose dwelling structures are not yet defined. In Sector A, after a temporary abandonment during EBA IC, the EBA II phase is testified by houses built on infrastructures made of wooden planks on consolidated yellow silts (a 'bonifica' layer) [18].

The MBA is the best documented phase with a large amount of archaeological finds (de Marinis *et al.* 2005). It is represented in all excavated sectors (Sectors A, B, C, D and E) and is also known from field surveys on the north-eastern and south-eastern edges of the basin. On the edge, in Sector B, an MBA IIA house was unearthed, built directly on dry ground (de Marinis *et al.* 2002).

[18] A 'bonifica' layer is an archaeological structure carried out in order to keep the house, laying directly on wet ground, dry. Different kind of 'bonifica' have been described in the pile dwellings of northern Italy (Balista & Leonardi 1996: p. 220). Construction techniques to isolate the house floor differ, from creating a simple layer of trunks, wood bundles, leaves and stones along lakeshore (Fiavè EBA), to wooden houses built on a tabular spread out of sandy silt (Lavagnone in EBA II phase).

LBA layers are not preserved *in situ,* as they have been completely upset by agricultural works, nevertheless, sporadic artefacts from this phase occur in the ploughed fields near Sector B.
Sectors D and E are still in the early stages of excavation, however ceramic finds dated to MBA III (or MBA II C) were retrieved in waste dump layers. In Sector D layers are composed of strongly organic sediment with abundant macroscopic plant remains and pottery finds. Several posts were found scattered on the whole investigated surface, so far mainly embedded into in the SU4006 and immerging into the deposit with a W-E inclination of 45° ca (opposed direction of the Sector A posts). Layers in the western part of the sector are progressively inclined in the direction of the basin centre and a huge accumulation of plant debris material was found in this area (quadrants A-E/1-2). Taphonomic features of plant material of this sector are described in chapter 8.1. Descriptions of the stratigraphic units of which analysed samples have been collected are given in Appendix 3.

1.6.2.5. The pollen records in the Lavagnone basin

A detailed pollen record, covering the Middle-Late Holocene and including most of the Bronze Age, is available from the central part of the Lavagnone basin. The pollen analysis was carried out at the Laboratory of Palynology and Palaeoecology of CNR I.D.P.A (Milano), on the mastercore LAV1 located inside the archaeological Sector D about 200 m westwards from the present archaeological excavations of Sectors A-C (Fig. 1.6.2.2 and Fig. 1.6.2.5) (Arpenti *et al.* 2002; de Marinis *et al.* 2005, Banino 2005, Vallè 2010, Zanon 2010). The investigated sequence spans the time interval from the Neolithic to Middle Bronze Age (5350-1450 cal BC). The recorded vegetation history can be summed up as follows (Fig. 1.6.2.9).
1) Pre-settlement phase (pollen zones LVG16-LVG20).
The pollen assemblage of terrestrial plants is mainly composed by tree and shrub pollen (more than 90%) what points to a wooded landscape dominated by deciduous mixed oak forest (mainly oaks with hazel understory) and lakeside forest *(Alnus* and *Salix*). In pollen zone LVG19 *Ostrya carpinifolia* and *Carpinus betulus* appear and increase from now onwards. An ‘elm decline’ (sensu Smith & Pilcher 1973) is observed in pollen zone LVG18. Herbaceous plants are mainly represented by helophytes and hydrophytes from aquatic and lakeshore belts. Microcharcoal concentration is very low.
2) Foundation of the first pile dwelling (pollen zone LVG21)
The pollen assemblages clearly record an abrupt change, from natural, nearly undisturbed forest to an anthropogenic landscape with evidence of crops and grazed fields, meadows, abandoned-ruderal perilacustrine belts and reduced forest stands nearby the core site. In the phase recording the % drop of arboreal pollen and the coeval import of anthropogenic *taxa*, a sudden increase of micro-charcoal particles took place. A lithostratigraphic transition band can be detected in all corings at Sector D (levels 331 to 325 cm in core LAV1, Fig. 1.6.2.5). Six subsequent pollen samples taken from the transitional band display the progressive transition from natural to human-derived pollen assemblages, without significant unconformity or hiatuses.
The foundation of the pile dwelling caused a strong and sudden environmental change both in the surrounding landscape and in the aquatic ecosystem. Indeed, the overall change in sedimentation style in the lake centre from carbonatic marls to organic mud (gyttja) is triggered by anthropic eutrophication. According to the sedimentation rate obtained from the age-depth model, the change in pollen assemblages observed in the transition band took only a few decades.
3) Subsequent phases of village expansion (pollen zones LVG22-LVG31)
From now on aquatic and terrestrial ecosystems were under the continuous pressure of the human settlement. The archaeological record (see Chap. 1.6.2.4) documented expansion and shifting of the village.

The pollen diagram recorded changes alternating phases of weakly reduced human impact (LVG22-23, LVG25), denoted by a decrease of microcharcoal particles and cereal pollen, to more anthropic phases (LVG24, LVG26-30), characterized by a sudden increase of microcharcoal and high percentages of crop species, weeds, ruderals as well as meadows and pastures species. The interpretation of these fluctuating and abrupt upheavals as the subsequent restoring events and phases of village expansion requires further investigations because of the close proximity of the settlement to the coring site, to its displacements and to the complexity of pollen taphonomy in cultural layers.
From the pollen zone LVG27 onwards, a progressive increasing of upland herbs of dry habitats such as *Sanguisorba minor, Orlaya grandiflora* etc., and a coeval decreasing of aquatic and palustrine herbs sketch out a strong silting up of the Lavagnone basin.

1.6.2.6. Archaeozoological data

Several archaeozoological studies of animal bones on Lavagnone archaeological deposits have been carried out. They consist of analyses on:
i) Bone material from Sectors A and E, covering a chronological interval from the Early Bronze Age to late Middle Bronze Age (MB III), with a gap occurring in EBA I C (1916-1800 BC) by J. De Grossi Mazzorin and A.M. Solinas, University of Salento (Lecce) (De Grossi Mazzorin & Solinas 2013, De Grossi Mazzorin & Solinas in press);
ii) Bone material from EBA I layers of Sector B by A. Curci, University of Bologna (Curci 2013). Most of these remains are from EBA I C layers, thus filling the gap found by the above mentioned authors.
iii) Bird bones from Sector A by M. Gala, National Prehistoric Ethnographic Museum 'L. Pigorini' Rome (Gala 2013).
Bone remains of domestic animals from Sectors A, B and E belong to cattle, sheep, goats, pigs, horses and dogs.
Cattle was not particularly abundant in the EBA, whilst became widespread in MBA even if never exceeded a proportion of 35% of the remains of domestic animals. The age range testified that a high % of cattle were slaughtered when older than 42 months, which means they were used for labour (traction), mating and milk production. This is confirmed by predominance of females and castrated individuals as well as by the traces of pathologies (inflammatory processes) on phalanxes related to physical efforts (De Grossi Mazzorin & Solinas 2013).
Based on the number of identified specimens (NISP) and the minimum number of individuals (MNI), small ruminants (goats and sheep) exceeded those of the other domestic animals in the EBA, while in MBA pigs reached higher values of abundance. Herds were mainly composed by sheep (ratio goats/sheep is 1:4, a bit higher % of goat is observed only in EBA IA but never exceeding sheep, and an equivalent amount is recorded in EBA I C of Sector B, ratio 1:1.5). The mortality curve of undistinguished goats/sheep (based on dentition and teeth wear) points out most of the individuals were slaughtered between the second and the third year of life suggesting an exploitation mainly for meat. The absence of neonatal mortality could be interpreted as no interest in the milk production, which should be low when many lambs have to feed on their mother's milk. Wool production, indicated by animals kept alive beyond 3 years of age, seems to be of interest in the EBA IB and in the late phases of MBA.
Pig remains reached their highest values in the late phases of MBA (MB II B and MBA II/III) when they were slaughtered mainly at their full maturity (between the second and third year of life).
Of particular interest are the finds of horses, even if limited to a mandibular fragment in the EBA II and three bone remains in MBA I. Rare and scanty finds of horse remains are known in the Italian Peninsula since the

late phases of the Eneolithic period, but they became widespread only at the beginning of the MBA (De Grossi Mazzorin 1994, 1996). The finding of equine remains in the EBA II layers of Lavagnone anticipate a little the second domestic horse import in the Peninsula (De Grossi Mazzorin & Solinas 2013).
Dogs' remains are poor both in Early and in Middle BA. The consumption of dog meat is documented by slaughter traces on EBA II and MBA I remains. Dogs were probably used for hunting and sheep farming as well.
Wild fauna was represented by a high diversity of species, especially in phase EBA II. The proportions of game based on the number of remains are about 2-7% in the EBA phases and 2-4% in MBA phases. Large mammals were the favourite prey in hunting activities, so remains of red deer (*Cervus elaphus*) and roe deer (*Capreolus capreolus*) are quite abundant. Wild boars (*Sus scrofa ferus*) was also hunted but in a lesser extent. Small mammals such as fox (*Vulpes vulpes*), marten or beech marten (*Martes* sp.), wild cat (*Felis silvestris*), and hare (*Lepus europaeus*) were only occasionally hunted. Other wild mammals recorded were wolf (*Canis lupus*) and hedgehog (*Erinaceus europaeus*).
Fish remains are very scanty and are exclusively from EBA layers, thus fishing was a marginal activity in the subsistence economy of the village. Pond turtle was intensively caught during EBA, but drastically decreased at the beginning of the MBA, pointing maybe to an overexploitation. Bird bones are very rare as well, the only remains come from EBA layers. In all the other phases, birds seem not be included in the usual diet of the inhabitants of the Lavagnone settlement (Gala 2013).

2. MATERIAL AND METHODS

2.1. Sampling strategy and samples

The sampling strategy for macrofossil analysis followed the best possible way for waterlogged pile-dwelling sites, as described in Jacomet & Brombacher (2005).

Lavagnone

The samples included in the archaeobotanical investigation of the site Lavagnone originate from different contexts. They consist of:

i) 25 surface samples from EBA layers of Sector A (location of the Sector A see Fig. 1.6.2.2) with an average volume of 2.23 litres;

ii) 9 samples from column profiles taken from the southern section (section n. 98) of Sector A, covering EBA layers (location of the Sector A and details see Fig. 1.6.2.2 and Chap. 5.1; average volume of 325ml);

iii) 13 surface samples from MBA layers of Sector D (for location of the Sector D see Fig. 1.6.2.2) with an average volume of 4.33 litres;

iv) 88 samples along the whole stratigraphic sequence of the lacustrine deposit (core LAV 37, covering the EBA and MBA) (samples average volumes of 100ml). (For the location of the core and details, see Fig. 1.6.2.2 and Chap. 4.1).

In table 2.1 an overview of the studied samples and of used methodology is given, while in the Appendix 4 a complete list of the analysed samples is presented.

Details on samples stratigraphy and collecting strategy.

i) Surface samples of the EBA layers from Sector A were taken over the course of several archaeological excavations from 1996 to 2005, well before the archaeobotanical investigation started. Unfortunately, in 2005 the archaeological excavation in Sector A was interrupted in order to make safe the area because of the high water table level and the deep current surface of the excavated area in the waterlogged sector. Later the critical condition of Sector A did not allow continuing the excavation of this area. Therefore, no new samples could be collected from the surface of the waterlogged Sector A. The interruption of the excavation hindered a real systematic sampling of Sector A; the samples at our disposal were arbitrarily selected from places rich in plant material and in order to cover the surface as much of as possible (Fig. 2.1).

With one exception, all these samples come from the Stratigraphic Unit (SU) 338 (subunits 'a', 'c', and 'd'), which represents a stratified dump of discharged material, so a waste disposal area, under the pile dwelling ("cumulus"). This SU belongs to the archaeological phase EBA IA (2100-1990 BC) (corresponding to the Lavagnone 2 assemblage according to R. Perini, see de Marinis 2000 pp. 117-126). For details about this cultural layer see description in chapter 1.6.2.4. The sample LAVc258 was recorded as judgement sample as it was the infilling of the find rr643 (= a big wooden spoon with the bowl slightly deformed. The handle is aligned with the bowl – not at right angle – and square in section).

Only one sample is from the next younger Stratigraphic Unit SU472 (Fig. 2.1). It is a judgment sample recorded as the infilling of a basket (archaeological find n. rr625). It belongs to the subsequent phase EBA IB (Lavagnone 3 assemblage according to R. Perini) (1980-1900 BC).

ii) In addition to surface samples, column profiles were taken from the southern exposed section

(Sector A - section n. 98, see Fig. 2.5) using four metallic boxes (10x10x50 cm). They were distributed and placed in the section in order to cover the complete EBA archaeological sequence. They intercept the different layers of the Stratigraphic Unit SU338 (mentioned above) (EBA IA – Lavagnone 2) and the subsequent cultural layers: SU337, SU336, SUS335, SU370, SU329, SU328 covering the archaeological phase of EBA IB (Lavagnone 3) and SU204 attributed to archaeological phase EBA II (Lavagnone 4 assemblage of R. Perini, 1800-1600 BC). The archaeobotanical study of this sequence has been only partly carried out (only nine samples out of EBA layers could so far be analysed in the frame of the current study – see Tab. 2.1, Fig. 2.5, Fig. 2.6 and Fig. 2.7 – they were arbitrarily selected along the sequence starting from the bottom).

iii) The archaeological excavation in Sector D affected only MBA layers. This sector was opened in 2007 and subsequent archaeological excavations were carried out in 2011, 2012 and 2013. A systematic sampling strategy, collecting surface sediment samples of at least 4 litres for every second m^2, was here adopted (Fig. 2.2). The 13 selected samples for the archaeobotanical analysis are from four different Stratigraphic Units (SU4004, SU4006, SU4009, and SU4010) excavated in campaigns 2007 and 2011. All these Units correspond to the archaeological phase of MBA III (i.e. the former MBA IIC, de Marinis 2002) (pers. com., Candida Sidoli and Marta Rapi). The chronological attribution of these layers was possible thanks to some diagnostic finds (e.g. a bronze axe with rising median wings). The layers were rich in ceramic finds and wooden vertical elements (likely posts), but no evidence of archaeological structures has been detected so far. For details of this archaeological sector, see the description in chapter 1.6.2.4.

iv) A core (LAV37) was drilled in 2010 inside Sector D in order to obtain a complete stratigraphic record for plant macrofossils. The core reaches back to the middle Neolithic and extends up tp the end of the MBA. The core was sampled every 3-5 cm for a total amount of 88 samples, which all were analysed (Tab. 2.1). 41 samples referred to the Neolithic time interval (144.5 cm thick), 47 samples to the Early and Middle Bronze Age (241.5 cm thick). The core is located 2 m westward from the core LAV1 (pollen analysis mastercore). Both are close to the center of the lacustrine basin where the stratigraphic sequence is thicker.

<u>Lucone</u>

Considering the relatively large extent of the excavation area in the Lucone D site, and the presence of only two settlement phases (both dated to EBA), we adopted a systematic sampling strategy, collecting samples of at least 4 litres from each m^2. Samples were collected during five archaeological excavation campaigns from 2007 to 2011. Unfortunately, burglars who broke into the archaeological area have damaged most of samples collected in 2009 which thus were rejected for analysis.

Given the huge amount of collected material, a complete analysis was not feasible in the frame of the current study. Samples were selected to give a wide representation of different contexts related to the two settlement phases (Fig. 2.3). At the end 2011, the 1st settlement phase (i.e. the lowermost cultural layers) was excavated only on a surface of about 37 m^2, corresponding to the area where the first archaeological excavations were carried out (grey rectangular area in the middle in Fig. 2.3). The enlargement of this original area to the actual size (year 2014) started in 2009 and advanced not uniformly.

13 out of 38 analysed surface samples belong to the first settlement phase, 25 to the second one (Tab. 2.1). Samples from the first settlement phase were collected either from a burnt layer which "defines" the end of phase 1, and from an underlying layer, consisting mainly of subfossil waterlogged detritus. They correspond to two distinct archaeological Stratigraphic Units. Samples from the second settlement phases instead originate from a higher number of Stratigraphic Units. Actually, the stratigraphic setting of this second settlement phase is more complex, because it is formed by several dump structures (i.e. cumuli); in turn, each dump unit is formed by a complex set of cuneiform layers, each layer likely representing a distinct

discharge event. At least three different cumuli of discharged material were recognized in campaigns 2007 to 2011, interbedded with layers of continuous distribution over a large area across the excavation surfaces. For a detailed description of the two settlement phases and the respective cultural layers see chapter 1.6.1.3 and Appendix 3. During the excavations, judgment samples, (e.g. special accumulation of fruits, layers of cereals, sediment filling a pot, etc.) have been systematically collected, too. They were not deeply analysed in the present study. All in all, the sampling method allowed a fair choice of the best suited samples for a comprehensive archaeobotanical study.

2.2. Recovery techniques

To recover plant macroremains we adopted a wet-sieving technique (wash-over) with a set of sieves, well suited for waterlogged sediments (Kenward *et al.*, 1980; Hosch & Zibulski 2003, Tolar *et al.*, 2010). The same wash-over technique has been applied to samples gathered from burnt layers or drier conditions (e.g. the layers of the second settlement phase of the Lucone D site).
Samples were sieved by Renata Perego (RP) partly at the laboratory of IPNA (Basel University, Switzerland) with the help of Giovanni Di Stefano, and partly at the laboratory of CNR-I.D.P.A. (Dalmine and Milano, Italy). A discrete amount of the samples collected during recent excavations was sieved directly on the excavation (by RP and the student Andrea Tramelli) using the sieves-bearing structure planned by S. Jacomet, IPNA Basel) (Fig. 2.4), very convenient and practical for fieldwork.
The wet sieving system operated as follows: firstly, the sediment sample volume was measured (with a precision of 0.1 litres) in 10-litre buckets, secondly water was added to the sample and the sediment was gently disaggregated by hand. Then the sample was left to soak for a minimum of 2 hours prior to wet sieving. Then, the volume of the water saturated sample was also measured before sieving.
The sieving equipment used consists of three sieves (40 cm in diameter) with 4 mm, 2 mm, and 0.355 mm mesh apertures sizes. The last two are the standard ones used for waterlogged sediments (Tolar *et al.* 2010: 57); the coarse mesh (4 mm) was necessary to scan more readily the sample for goat and sheep coprolites. The minimum mesh size of 0.355 mm (or 0.250 mm according to Jacomet *et al.* 1989; Hosch & Jacomet 2001) allows recovering even extremely small items of wild plants (e.g. seeds of *Juncus, Verbascum,* some *Poaceae* grains and Oogonia of Characeae).
The "wash-over" tecnique (Kenward *et al.* 1980: 11) allows separating the organic fraction from inorganic matter during the sieving procedure. Through a moderate stream of water, the sediment is swirled in the tilted bucket and the supernatant, with its load of suspended organic particles, is decanted over the sieves set. The sample is processed until no visible organic particles are left in the bucket. This kind of procedure allows a proper recovery of also very fragile plant remains (see Hosch & Zibulski 2003).
The small fractions, in case of large volumes, were subsampled. The criteria for subsampling follow the method described in Van der Veen & Fieller (1982), adopted for waterlogged sediments (Hosch & Jacomet 2001).
The three fractions yielded per sample have been kept wet and in as cold as possible environment during the entire subsequent sample processing phases (subsampling, sorting, identification and storing).
Every plant remain picked out for identification were stored in alcohol-glycerin-demineralized water-thymol (5%) solution in plastic-stoppered tubes, enclosing a plastic label written in pencil (sample name and identification).

2.3. Analysis methods of surface samples

After sieving, the analysis of the surface sediment samples proceeded according to two different approaches: a) analysing as much as possible samples by rapid scanning (semi-quantitative analysis); b) carrying out full-quantitative analyses of a selected number of samples, chosen after performing step a).
a) Rapid Scanning (RS): As can be inferred from table 2.1, most of the sediment samples from cultural layers have been analysed by rapid scanning. The whole 4 mm organic fraction has been scanned, whereas the 2 mm organic fraction has been subsampled (subsample volume of 200 ml) only in case of large volume (i.e. >300 ml ca). The small organic fraction (0.355 mm) has been analysed by RS only in a restricted number of samples. The rapid scanning analysis was previously defined in medieval and roman plant assemblages, respectively by Kenward H. and Hall A. (Hall & Kenward 1990 and Kenward & Hall 1995) and later applied by Vandorpe & Jacomet (2011) for Roman sediments. They suggested this kind of analysis as a good alternative to full quantitative analysis to obtain an overview of the archaeobotanical content of a great amount of samples in a short time. It consists of scanning the organic fractions and recording the presence of plant remains on a five-point scale of abundance (1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items) (Vandorpe & Jacomet 2011). No specimens were extracted from the bulk organic fraction, except those requiring further examination or rare and single specimens kept for the archives.
b) Full Quantitative Analysis (FQA): FQA was performed for a selection of samples rich in plant remains, as attested by rapid screening, and distributed over the whole surface of the archaeological areas. The coarse fraction (4mm) was entirely analysed. The 2 mm and 0.355 mm fractions were subsampled. In order to provide a representative result of the plant assemblage, according to Van der Veen & Fieller (1982) and Hosch & Jacomet (2001), 384 identifiable remains have to be counted in each fraction; this allows to record the proportions of all *taxa* with an accuracy of the results of ±5%, at 95% confidence level. Therefore, the number of analysed subsamples should have been high enough to reach this amount of counted remains.
Plant macrofossil remains were identified using a stereo-microscope (Wild M3Z) with magnifications x6.5 to x40. Identification has been carried out with the support of the modern seed reference collections (at IPAS, University of Basel, and at C.N.R-IDPA of Milano, stored in Dalmine, BG). In addition, several seed atlas and specific archaeobotanical publications have been consulted (Beijerinck 1947; Berggren 1969, 1981; Anderberg 1994, Velichkevich & Zastawniak 2006; Katz *et al.* 1965; Cappers *et al.* 2006; Schoch et al. 1988; Jacquat 1988; Jacomet 2006).
The botanical nomenclature of wild plant was reported according to *Flora d'Italia* (Pignatti 1982) and *Flora Europaea* (Tutin *et al.* 1964-1993), the nomenclature of cultivar follows Zohary *et al*. (2012).

2.4. Analysis methods of goat/sheep faeces

Sediment samples from both Lucone D and Lavagnone layers yielded several goat and sheep faeces. A total of 113 coprolites (64 from 8 sediment samples of Lucone D and 49 from 17 sediment samples of Lavagnone) were analysed for their plant macro- and microfossil content (Tab. 2.2). Concerning pollen, 80 of these coprolites have been analysed by the palynologist Lucia Wick at IPAS/IPNA Basel (46 from Lavagnone, and 34 from Lucone). These analysis were carried out within the SNF project: "The role of Animal Fodder in Neolithic and Bronze Age Subsistence Economy and its Palaeoecological Implications / Nr. K-13K0-117897".
Goat and sheep coprolites were analysed according to the methods defined in Akeret *et al.* (1999) and Kühn *et al.* (2013). The surface of each dung pellet was first cleaned in demineralized water, removing the surrounding sediment attached on it. They were then measured, weighed and photographed in waterlogged

condition, taking a note on their preservation state (complete or fragmented pellet). Afterwards they were mechanically broken up in small pieces under the stereo-microscope (at magnification x10). All identifiable plant remains or remains larger than 0.5mm were picked out for a detailed identification. Identification was carried out using reference collections of fruits and plant epidermis stored at IPNA (Basel University) under a stereo-microscope (magnification 6.5x to 40x) and/or a transmission light microscope (magnification 400x). The abundance of seeds, fruits, epidermis, vegetative plant macrofossils, leaf fragments was full-quantitatively recorded; all other remains (e.g. small stones, charcoal, etc.) were recorded only in a semi-quantitative way as well as small plant remains not picked out (<0.5mm) (e.g. plant hair, small epidermis, leaf vein etc.). The adopted scale of abundance was as follows:

1, 2, 3 items; s (sporadic) >3; n (numerous) >10; vn (very numerous) >20.

All the remaining parts of the pellets were prepared for the pollen analysis carried out by Lucia Wick (IPNA, University of Basel). Pollen was extracted using standard methods with KOH, HCl and acetolysis (Moore *et al.* 1991). *Lycopodium* spore tablets were added in order to calculate pollen and microcharcoal concentrations (Stockmarr 1971). Beug (2004) and reference collections were used to determine pollen types.

Nomenclature of the plant fossils follows *Flora d'Italia* (Pignatti 1982) and *Flora Europaea* (Tutin *et al.* 1964-1993).

Plant macroremains were grouped in trees/shrubs, herbs, cultivated/gathered plants, ferns/mosses and unidentified remains.

The pollen diagrams show percentage values of pollen, spores, and stomata referring to the total sum of pollen and *Pteridophyta* spores. Tree pollen are arranged into deciduous trees, evergreen plants, catkin bearing trees/shrubs; shrubs and herbaceous plants are grouped into different habitats or ecological entities, respectively, based on modern analogues. Pollen and microcharcoal concentrations are given as grains or particles per mg wet material.

2.5. Analysis methods of samples from stratigraphic profiles

Stratigraphic profiles were studied from the Lavagnone deposits in two different contexts:

- along the archaeological sequence (section 98, on-site sequence) and
- the palustrine-lacustrine deposit (core LAV37, covering pre-settlement and settlement phases, from *off-site* to *on-site* sequence) (for location and other details see above).

Samples from column profiles of both stratigraphic context were processed as described for surface samples (see Chap. 2.3), using mesh aperture sizes of 1mm and 0.355mm. The plant macroremain analysis has been carried out adopting the full quantitative approach. Identification and counting of remains followed the same criteria adopted in surface samples analysis (see Chap. 2.6). Exceptions concerned the computation of *Quercus* sp. and *Corylus avellana* pericarp in core LAV37, whose fragments ≥ 5mm^2 were counted as 1 (no total surface evaluation was produced). Concerning cereal remains (spikelet fork, glume base, rachis fragments etc.), every single item was counted as 1. All *Triticum* species were grouped as *Triticum* spp. The counting of macroscopic charcoal remains included only fragments ≥ 0.5mm^2. Plant *taxa* were grouped according to their modern ecological habitat and ethnographical use as described below (see Chap. 2.8 and Tab. 2.4).

<u>The archaeological sequence of section 98 (Sector A)</u>

The complete archaeological sequence was sampled in 2004 along the section 98 of Sector A, using 4 metallic boxes (50 cm length each) (see Chap. 2.1 and Fig. 2.5 – 2.7). The four column profiles were then sliced in 3-5 cm thick samples. They cover the stratigraphic archaeological sequence of the deposit spanning from EBA IA to EBA II. The plant macroremains analysis concerned so far only 9 contiguous samples taken between 150 cm and 79 cm sediment depth (with 0 cm = bottom of the SU204 aligned with box1; the field surface was avoid because not well defined for trampling damages) (Fig. 2.5) (see Chap. 2.1 for sampling strategy and Chap. 2.5 for the processing methods of samples). The decision to interrupt the analyses was due to the rising opportunity to investigate the MBA layer from Sector D in 2007 when the excavation of this new sector started. The option and the interest of comparing EBA and MBA sediment samples prevailed over the complete investigation of the EBA sequence of Sector A within the limits of the present PhD research.

The Sector A of the Lavagnone site contains a ca. 2 m thick archaeological succession (de Marinis *et al.* 1996, de Marinis 2000). The stratigraphic sequence is described and resumed in chapter 1.6.2.2. The sediment accumulated between the posts of the pile dwelling during the EBA IA (Lavagnone 2, SU338) was mainly composed by material discharged from the settlement, and formed a sort of cumulus-shaped heap (a mound of rubbish). Although cultural finds from this sediment gave a homogenous and coherent outline, different subunits in the Stratigraphic Unit SU338 have been identified. The lowermost subunits is the SU338d, considered archaeologically barren. Follows the subunits SU338c and SU338a, formed by organic and cultural remains, rich in twigs, brushwood, wood fragments, charcoal, pottery, etc. and separated by a thin layer of grey sands (SU338b) (see Chap. 1.6.2.4 and the App. 3 for a detailed description). The nine analysed samples were collected from 2 out of the four boxes (box B1 and box B2) (see Fig. 2.5 for the position of the boxes, the analysed samples, and the Stratigraphic Units identified in the section 98).

The box B1 (40-90 cm; Fig. 2.6) intercepts the Stratigraphic Units 338a, 337 and 336. These Units are mainly composed by peaty sediment with no coarse plant remains or ceramic fragments visible to the naked eye apart from the two intervals 65-72 cm and 80-90 cm. In the interval 47-60 cm a compact lens of grey clayey silty sediment is described.

The box B2 (111-161 cm; Fig. 2.7) is entirely composed by the Stratigraphic Unit SU338c. Large plant remains (even larger than 10 cm in size), mostly wood fragments and charcoal, included in a peaty dark brown matrix, homogenously compose the sediment.

<u>The core LAV37</u>

The LAV 37 core was taken partly with a Russian corer (5 cm diameter) and partly with a gouge auger (6 cm diameter) and recorded a sequence of 490 cm (Fig. 2.8). It did not reach the deepest facies (the laminated silty clay and silty gyttja) dated to lateglacial age (for a detailed description of the stratigraphic sequence of the basin see Chap. 1.6.2.2 and Fig. 1.6.2.4). It covers the laminated carbonatic gyttja (490-299 cm), dated to early-middle Holocene, and the overlaying organic deposits (299-55 cm). The sediment above 55 cm was not considered as it was disturbed by recent ploughing activities. The characteristic transitional band from the lake marls to the organic deposits, clearly observed in most of the cores from the former lake centre, is placed at 299-294 cm in core LAV37. This band consists in a gentle transition from natural limnic gyttja to the first layers of predominant human-made debris accumulation (Chap. 1.6.2.2). The organic succession (294-55 cm) is composed by gyttja and detritus gyttja including seeds of aquatic plants, wild terrestrial species, useful plants (charred and waterlogged), wood fragments and charcoal testifying the presence of dump discharges produced by the nearby settlement.

The age depth model for the deposit of Lavagnone (described in the Chap. 1.6.2.3) was adopted for the macrofossil diagram thanks to the correlation between LAV1 (pollen analysis mastercore) and LAV37. The correlation has been obtained by sedimentological features of layers in the lowermost part of the sequence (which corresponds to natural sedimentation) and correlating micro- and macro- charcoal remains' trends for the uppermost part where the sedimentation is influenced by human activities. Thus, the analysed stratigraphic sequence resulted to span the interval between 5300-1400 cal BC.

The core LAV37 was sliced in samples every 5 cm ca. from 57.5 to 443.5 cm depth, for a total amount of 88 samples. The macrofossil data have been recorded and plotted quantitatively. The diagrams of the number of macrofossils per unit volume of sediment (100 ml) (concentration diagrams) were drawn using the program TILIA 1.7.16 (Grimm 2011). The most adequate representation for macrofossil in a stratigraphic sequence characterized by variable sedimentation rate is considered to be the influx diagram (Birks & Birks 1980), i.e. the number of macrofossil per cm^2 per year. Given that the age depth model does not allow a fine estimation of deposition rates, we skipped from elaborating influx figures. We limited the quantitative evaluation of our data to macrofossil concentration diagrams.

To avoid bias due to variability in production and dispersal of diaspores, the sum of diagnostic types assigned to each belt was also normalised to 1 in Fig. 4.2 and a threshold of 0.2 was chosen to highlight phases of major expansion and reduction of plant belts.

The dynamics of aquatic, littoral and wetland plant communities were reconstructed along the sequence on the base of the plant macrofossils composition of the aquatic, littoral and terrestrial waterlogged communities. We estimated changes in the plant belt's (distinguished in Tab. 2.4) expansions from the abundance of remains of the *taxa* belonging to each belt. We also considered the telmatic vegetation, marking the seasonally dried-up shores of closed lakes, mostly composed by short-lived annuals (group 6.3 in Tab. 2.4). At Lavagnone, the abundance of species that are specific for periodical flooded shores, apparently unrelated to human activities (e.g. *Rumex maritimus*), helps disentangling relationships between natural- and human-driven changes. Finds of Mollusca (shells and *opercula*) were also taken into account. The settlement phases, characterizing the uppermost sequence, were mainly distinguished on the base of the charcoal remains abundance.

2.6. Quantification

For the quantification of plant remains the following rule has been adopted: the whole diaspores of all *taxa*, the fragments including *hilum* (or other specified countable part), and single finds of one taxon in the sample (regardless of the size of the fragment) were counted as 1. Fragments with no countable part were counted but not included in the total number of individual seeds. Quantification main criteria and their exceptions are summarized in Table 2.3.

2.7. Evaluation methods

The plant *taxa* were grouped according to their ethnographical meaning and ecological habitat, based on actualistic criteria (for a detailed description of the groups see Tab. 2.4 and Chap. 2.8). Information for grouping was derived either from phytosociological assignments (Oberdorfer 1994), ecological attributes (Ellenberg 1988, 1991) and previous archaeobotanical studies (Brombacher & Jacomet 1997). The phytosociological approach has been employed as a tool to interpret the occurrence of 'character species' of certain *syntaxa* as indicators of habitat conditions (Bogaard 2004: p. 4) rather than to identify modern *syntaxa*. The application of a rigid classification system based on uniformitarianism as provided by synecological and syntaxonomical literature could be extremely dangerous in the interpretation of past plant

communities, especially when referred to weed communities characterized by strong instability through time (Holzner 1978, Behre & Jacomet 1991).
In table 2.4 the list of the plant groups is given. Two levels of grouping have been distinguished: a more detailed one (marked by numbers) and a larger one (marked by letters). The detailed grouping has been applied in the analysis of the Lavagnone stratigraphic sequence (core LAV37). The enlarged ecological groups have been considered in the evaluation and interpretation of similarities and differences of all the other contexts, both in Lavagnone and Lucone.
In order to interpret the plant spectrum we calculated the ubiquity of each taxon among the samples on the basis of presence/absence of data (frequency). Furthermore, concentrations of plant remains per liter (density) for each sample have been calculated. For density calculation, the volumes of samples saturated in water were used.
As all the analysed samples were waterlogged we did not separate plant remains according to type of preservation.
The total number of plant *taxa* has been obtained summing up:
i) identified species;
ii) items identified to 'family' and 'genus' level, only in the case that no other *taxa* belonging to these categories were found;
iii) cf. identifications, when no fully identified specimens occured;
iv) and finally multiple *taxa* identifications (as for example *Viola riviniana* / *V. reichenbachiana*) when not all the involved *taxa* were present as surely identified species.
The dataset of the identified and counted botanical remains are presented in different tables:
- synoptic tables for full-quantitative analysed samples (surface sediment samples: Tab. 3.2a, 3.3, 6.3a, 6.4a; stratigraphic samples of section 98 of Lavagnone: Tab 5.1). These tables listed the total amount useful for statistical analysis of each kind of remains for each samples. Other parameters are also included here (e.g. concentration of remains per litre, volumes of samples, etc.)
- tables of rapid scanning results (surface samples: Tab. 3.2b, 6.3b, 6.4b).

2.8. Definition of plant groups

In the following only plant groups whose members were found in the analysed samples are described (Tab. 2.4).

Cultivated plants (**C** - **1**)
The cultivated *taxa* include in the first place cereal *taxa*, secondly flax, then pulses and other potentially domesticated plants.

Weeds
Based on today's knowledge of weed associations one can distinguish winter crop weeds (*Secalietea*), summer crop weeds (including the annual ruderal species whose natural habitats are hardly discriminated) and perennial ruderal vegetation. Crop field species with an ubiquitarian distribution and broad ecological amplitude, which cannot be linked to a specific habitat were classified in the last group.

<u>Winter crop weeds on carbonate-rich soils</u> (**WW** - **2.1**)
Winter crop weeds include species adapted to the germination conditions and to the seasonal rhythm of

autumn-sown cereal crops (Ellenberg 1988, Holzner 1978). These are thermophilous and mostly calciphilous species assigned to the *Secalinetea* (or *Secalietea*) class of the classical phytosociological system (Oberdorfer 1994). This class can be split in two main groups: i) Order *Secalietalia*, Alliance *Caucalidion* and ii) Order *Aperetalia*. The former include weed species native in the Eastern Mediterranean region and occurring preferably on calcareous soils, i.e. essentially basic soils, the latter include plant species with a probable origin in south-western Europe and growing on acidic-neutral or lime-deficient soils.

Summer crop weeds / mostly annual ruderals (**SW** - **2.2**)

This group includes short-lived weeds occurring in ruderal sites as well as on cultivated land, primarily in the so-called root/row-crops, but also in all the crops sown in spring and harvested in autumn (e.g. broomcorn millet). Often such weeds today are characteristic for gardens (for definitions of "garden" and "field" see van der Veen 2005). Ruderal habitats hosting annual weeds in the vicinity or even inside the settlement are rubbish heaps, middens, and all kinds of disturbed land like e.g. areas along pathways, entrance areas, leaf or wood storage areas, etc. The frequent disturbing elements/activities typical of these habitats support the survival of mainly therophytic plants.

Summer crop weeds and annual ruderals are characterized by high temperature requirements for germination and fruit-ripening, by short life cycles and high nutrient requirements. According to the phytosociological system these plant communities are classified in the *Polygono-Chenopodietalia* Order (e.g. Holzner 1978).

Perennial ruderal vegetation: (i) Ruderal and crop fields ubiquitary species (**RU** - **2.3**) and (ii) Ruderal and nitrophilous communities, dry orchards (**RU** - **2.4**)

Perennial ruderal species are mainly widespread in disturbed areas in the near environments surrounding settlements or inside them, especially in the immediate vicinity of houses. Thus, the main habitats where we can find this type of ruderal vegetation are wasteland, disturbed grounds, alleyway areas, along paths, etc.

Some of the perennial ruderal species can also grow on crop fields, in gardens and/or orchards. Nevertheless ruderal sites offer more suitable habitats due to the presence of nutrient-rich soils and little competition comparing with the farmed land where cultivated plants are usually densely sown. Several ruderal plant species favor soils very rich in organic materials, which are rapidly decomposed releasing nitrogen and phosphorus, which are essential plant macronutrients. The organic material might be accumulated in natural ways (e.g. destruction of plants by forest fires) or might be man-made as a consequence of dumping organic waste of different origin.

Grasslands: meadows and pastures (**MP**)

The group of grasslands comprises all types of grass dominated formations, more or less influenced by human activities – mainly grazing of livestock. Grassland formations are discriminated mainly by the different degree of soil humidity.

Within the grassland vegetation, we can distinguish the following groups on the base of remains found in the analysed samples:

i) dry fallows on carbonate-rich and regolithic soils (MP - 3.1);
ii) dry pastures and meadows with summer water deficit, either on thin rocky soils or on well-developed soils (MP - 4.1);
iii) drained pastures and meadows with no summer water deficit, with or without manuring (MP - 4.2); and
iv) indistinct pastures and meadows (MP - 4.3).

i) Dry fallows on carbonate-rich, regolithic soils (**MP** - **3.1**)
The first group includes species growing in open land characterized by sunny and dry habitats on superficial soils. A part of them is ascribable to xero-thermophilous pioneer communities on rocky ground, shallow calcareous or base-rich soils with dominance of spring therophytes and succulents (Alliance: *Alysso - Sedion*). Similar communities may also develop in secondary habitats, sometimes very rich in nitrogen such as edges of paths and trails on dry ground. Moreover, we also grouped here species linked to more anthropogenic vegetation types, which develop under very similar ecological conditions (order *Onopordetalia*). They include thermophilous to moderately thermophilous species with a predominance of biennial and short-lived perennial plants. Soils are usually dry; they develop on hard base-rich bedrock, but also on anthropogenic substrates such as stone-rubble or waste places.

ii) Dry pastures and meadows with summer water deficit, either on thin rocky soils or on well-developed soils (**MP** - **4.1**)
The second group deals with vegetation representing dry and semi-dry grasslands (generally assigned to *Festuco-Brometea* phytosociological class). Such vegetation types occur in warm regions with low rainfall or dry pedoclimates, and characterized by free-draining soils poor in nutrients, usually on calcareous substrates. These species-rich plant communities are dominated by grasses and contain a high proportion of perennial herbs (hemicryptophytes and geophytes). In Central Europe such grasslands are considered as natural remnants of Late Pleistocene / early Holocene steppes; however, most of the dry grasslands are of secondary origin, replacing former forests (e.g. Zoller 1954a, b; Jacomet & Brombacher 2009). In former historical times they were traditionally grazed, and in some regions also mown (Knörzer 1975; Körber-Grohne 1990; Pott 1988; 1992; 1995; 1996; Speier 1996; Wilmanns 1997).

iii) Drained pastures and meadows with no summer water deficit, with or without manuring (**MP** - **4.2**)
The third grassland vegetation group includes meadows and moderately moist (mesic) pastures developing on soils rich in nutrients, with a high nitrogen content and a fairly good water retention capacity (*Molinio-Arrhenatheretea* class).

iv) Indistinct pastures and meadows (**MP** - **4.3**)
The last group encompasses plant species occurring in different grassland vegetation types. They can grow in dry, moderately dry or mesic pastures and/or meadows.

Woodlands, wood edges, clearings (**F** - **5.1**)
This group includes tree and shrubs species as well as herbs living in the undergrowth or at the woodland edges. Most of the recovered *taxa* belonging to this group are plants gathered for food consumption. They seldom reflect specific woodland-communities, as almost never dominant or character species of such communities occur.
For this reason, no specific ecological or phytosociological groups were further differentiated for the woodland vegetation.

Lakeshore vegetation / Wetlands
Lakeshore vegetation includes plant species growing in the lake marginal zone (eulittoral belt) and marking the open-water transition to permanently or seasonally submerged substrates (Rodwell 1995). The eulittoral zone consists of two main subzones:
- the ecosystems in shallow water, mainly dominated by helophytes (lower eulittoral belt) and,

- away from the water and progressively towards dry land, the ecosystems on land with a water table close to surface or saturated by water for a significant period of time (upper eulittoral belt) (Lang 1967, Jacomet 1985. p. 17 and fig. 9).

Within these two main groups of vegetation communities, a third specific habitat has to be mentioned. It deals with the area strictly influenced by lake water level fluctuations. This phenomenon could be particularly intense in small and closed, shallow lakes under particular and local climate conditions. Short-term water level fluctuations may play a structuring role in littoral and aquatic-terrestrial transition zones creating great habitat diversity (Coops *et al.* 2003). Desiccation- and inundation-tolerance determine the occurrence of particular plant species as well as the distribution of species along the littoral zone.

Furthermore, human activities in aquatic ecosystems and their surrounding environments can largely influence the trophic conditions of water and consequently the lakeside and aquatic vegetation. The more or less 'eutrophication' of the water can thus be inferred by e.g. a changing species composition.

The main groups of vegetation communities described above are represented in the three ecological groups concerning the lakeshore vegetation and recognized in the subfossil assemblages at the Lavagnone and Lucone sites (Tab. 2.4).

The groups are defined as follows:

<u>i) Wet terrestrial herb communities (meadows) (**LS** - **6.1**).</u>

They mainly consist of hemicryptophytes, including many tall-herbs, growing in the upper eulittoral zone, which is not often flooded. These grassland communities represent the farthest lying lakeshore herb communities from the open water, they develop beyond the reed beds on very moist soils and can be considered one of the intermediate stages in the succession from open water to Alder-Willow woodland. They are included in the phytosociological order of *Molinetalia*, alliance of *Filipendulion*.

The present-day distribution of this vegetation is the consequence of previous meadow management. In times before human activities in the littoral zones, according to Koch (1926) and Ellenberg (1988), these communities were naturally distributed, in small stands along riverbanks, in floodplains and at the edges of small streams.

<u>ii) Telmatic, seasonally dried-up belt (**LS** - **6.2**).</u>

It includes pioneering species on lakeshores, riverbanks, oxbows, mud of ponds and pools, which dry out in summer. There are summer-annual or biennial species completing their life cycle between two floods and surviving as dormant seeds. They favour nutrient-rich, wet and deep mud as living substrate. Some of these species can quickly spread on bare ground reaching a cover of even 100 % in few weeks and a height up to 1 m.

These communities are grouped in the phytosociological alliance of *Bidention tripartitae* (*Rumicetum palustri*s). It contains several associations of which the two commonest are: *Polygono-Bidentetum* and *Rumici maritimi-Ranunculetum scelerati.* Diagnostic and dominant species of the latter association are celery-leaved buttercup (*Ranunculus sceleratus*) and golden dock (*Rumex maritimus*).

<u>iii) Flooded or waterlogged littoral zone (0.5 – 1 m depth) (**LS** - **6.3**).</u>

The vegetation growing along this belt is mainly represented by reeds and tall-sedge swamps. They favour nutrient-rich and mud soils flooded for a long time, in still or only weakly flowing water. Such communities are included in the phytosociological class *Phragmitetea* (order *Phragmitetalia*) and are characterized by the dominance of one or two species forming thick beds, accompanied by a few other palustrine species.

The reed beds (All.: *Phragmition*) can extensively spread along the lakeside and even towards the open water.

Their broad spreading is favoured by highly eutrophic water.
Behind the reed beds, towards the dry land, tall-sedge swamps (All.: *Magnocaricion*) are diffused; in the absence of large reed-belts, tall-sedges may also occur directly at the lakeshore, especially in lesser eutrophic conditions.

Aquatic plants (depth > 0.8 m, optimum > 1 m) (**A** - **7.1**)
This group includes plant species growing in water and forming the vegetation of the sublittoral belt in waters deep up to 7 m (Oberdorfer 1977; Jacomet 1985: fig. 9). They can be rooted or free-floating, submerged or floating-leaved.
Apart from the Characeae (green algae) communities, forming pure stands, all the aquatic vegetation can be grouped in the phytosociological order *Potamogetonetalia.*

2.9 Interpretation bases

The interpretation of plant remains recorded in an archaeological site requires considering all factors that influence their entry and preservation into the deposit, both biological and archaeological ones (Jacomet 2013). In the archaeological contexts here examined, the terminology of 'ecofact' for plant material has to be rejected when it is exclusively used as result of human action (according to Wilkinson & Stevens 2003) since a certain component of the plant assemblage is also represented by the local vegetation e.g. aquatic vegetation. Most of the samples collected from Lavagnone and Lucone cultural layers represent assemblages both of plant remains brought to the site by human activities carried out in the surrounding of the site, and of plant remains linked to local vegetation (aquatic and perilacustrine *taxa* for instance). These plant assemblages should therefore be considered as 'mixed deposits' because the plant material accumulation originates from different sources (routes of entry into archaeological deposits). In most cases they consist of secondary refuse i.e. material discarded away from its location of use by humans (van der Veen 2007, Jacomet 2013).
The possible 'routes of entry' are various and not always clearly distinguishable and identifiable. As recently discussed in Jacomet 2013, the most important source of plant remains in a mixed assemblages could be: residues of crop processing (e.g. chaff remains) produced in the site or brought in for different purposes (fuel/tinder, bedding, fodder etc.), food preparation, table or kitchen waste, stored foods, leftovers of handicrafts, building materials, animal dung and droppings, as well as human fecal matter, etc. Seeds and fruits of plants growing in and around the settlement may be accidentally included in the refuse deposit as they were just deposited where they grew or they may have been blown into it.
The formation processes of carbonized plant assemblages also include remains of an unexpected destruction of the settlement by a fire event. The fire conflagration could involve large quantities of stored plant materials as well as foods. Such a type of carbonized plant assemblage could also preserve oil-rich seeds, herbs, and vegetables, which are usually underrepresented in charred daily refuse (as e.g. in Hornstaad Hörnle I, Maier 2001).

The modes of preservation of plant remains in archaeological sites, as well as the suitable sampling and the proper recovery technique of organic remains, are the main factors influencing the quality of archaeobotanical data and the accuracy of analysis and interpretation of such data (van der Veen 2007; Tolar *et al.* 2010).
The most common preservation states are carbonization, waterlogging, mineralization, and desiccation. They

resulted by different taphonomic processes and could be traced back to specific environmental and cultural contexts (Jacomet & Kreuz 1999). The formation processes can favour the preservation of some specific species, affecting the record of plant remains (Jacomet 2013). Therefore, a full understanding of the all involved processes is crucial to make accurate interpretations (van der Veen 2007).
Waterlogged deposits offer very favourable circumstances for the preservation of plant remains. The anaerobic conditions due to the permanent presence of groundwater avoid or slow down the decay of organic matter, allowing the preservation of plant remains in an almost unaltered state. Therefore, plant spectra of deposits located in waterlogged environments presents usually a high number of *taxa*.
Charring consists in the slow carbonization of plant remains in a low-oxygen environment, transforming its original organic composition in a pure carbon compound (Jacomet 2007; Jacomet & Kreuz 1999). With the exception of destructive events by fire, this process is strictly affected by human activity (hearth layers, discharge of fire waste, etc.). The composition of charred plant assemblages is therefore biased (Willerding 1991), it is generally restricted to a record of the major staples (especially cereals) and field weed flora (Jacomet 2013).

The following types of plant remains have been accounted for the present study: seeds, fruits, and some vegetative parts of plants.
The plant species record includes domesticated *taxa* as well as wild plants. Within the group of domesticates those species which could not have been attested as being surely domesticated, are also allocated (e.g. *Carthamus tinctorius*). In our grouping we choose to use the terminology of "cultivated" which requires some explanation. It is here proposed in the sense of domesticated *taxa*, which differ in terms of morphology and genetic constitution from wild plants. The cultivation involves sowing and/or transplantation of plants, and subsequent cares during their growth. In reality, all these actions are also possible for wild plants, and such manipulations as cultivation are important in the beginnings of agriculture (Fuller 2007, Fuller *et al.* 2010).
Plants obviously gathered for food consumption (based on ethnographic evidence) will be treated within the wild plants spectrum; however, it cannot be excluded if such *taxa* were e.g. tended in the surrounding of the settlement. As gathered plants (collected resources), we define those that are intentionally collected in the wild, normally in the vicinity of the settlement, and contribute to the daily diet. This definition is also based on the fact that stores may be found, and such *taxa* usually appear in large amounts and with high ubiquities.
As weeds, we define those herbs growing today in arable fields and contrasting food production, as well as those growing inside or around the domestic area. Weeds and all the other wild plants are discussed according to the actualistic grouping proposed in tab. 2.4.
Concerning cereal data, some remarks are needed for their interpretation. First of all, discriminating which cereal species was preferred by humans on the base of archaeobotanical remains is often tricky as different issues bias their representation: conditions of preservation, type of context, type of deposit (e.g. Willerding 1971, Vandorpe 2010: 48). The pure quantitative data should be therefore cautiously considered as evidence of the most widespread crop species.
Besides, waterlogged cereal *testa* fragments (so-called cereal 'bran') have been found, both in Lavagnone and Lucone D in the Early and Middle BA samples. The identification of these remains is quite tough, and based on their cell structures; detailed descriptions are mainly given in Körber-Grohne (1964) and Dickson (1987). Moreover, the size of these fragments is frequently too small to show the diagnostic features, which allow distinguishing the different cereal genera. Whenever the identification was possible, it conducted to *Triticum* sp. otherwise such remains were included in the 'Cerealia' group.

RESULTS 1: LAVAGNONE
3. Surface samples analysis: spectra of crops and wild *taxa*

In this chapter, the results of the sediment samples analysis from the Lavagnone site are presented. A detailed overview of number of identified *taxa*, ordered according to their preservation state and age contexts, is given in table 3.1. Tables 3.2 and 3.3 show the total number of remains. Some percentages graphs illustrate these results (Fig. 3.1, 3.2, and 3.3).

3.1 Preservation of plant remains in the EBA and MBA samples

The plant macro remains recorded in the site of Lavagnone have been preserved through waterlogging and charring (Tab. 3.1). From the EBA, 25 samples were included in the following statements, from the MBA 13 samples. 24 EBA samples were semiquantitatively analysed. A selection of 11 out of 25 EBA samples and the 13 MBA samples were fully quantitatively analysed.
The EBA samples collected in the archaeological layers of Sector A of the Lavagnone site and analysed in the current investigation originate from that part of the deposit, which was steadily under the present ground water table. These layers lie almost 2 m under the current surface. The investigated MBA layers (Sector D), even if closer to the nowadays swampy area of the basin, were more strongly affected by the seasonal oscillation of the ground water table due to their low depth in the stratigraphic sequence (they lie only around 50-80 cm under the current surface). During years with particularly low rainfall and intensive uptake for watering, the groundwater table can subside here more than 1 m (e.g. summers of 2003 and 2012), thus exposing the uppermost archaeological sequence to unsaturated conditions. Even in this unsaturated state, the water content of the deposit is still high.
As expected, the preservation of the plant remains in Lavagnone is very good. In total 223 *taxa* have been identified: 187 *taxa* in EBA samples and 135 *taxa* in MBA samples. Most of the seeds and fruits were found in a waterlogged state of preservation, a small amount in charred state and a few remains were only slightly charred (Tab. 3.1).
Charred plant remains, though not in large quantities, are preserved in both archaeological contexts; they include above all edible plants. A higher number of wild *taxa* in charred state is recorded in MBA layers.

3.2. General results: densities (concentrations) and number of *taxa*

The 11 fully quantitatively analysed EBA samples yielded 10’195 plant remains and the amount of 65’136 remains were extrapolated for the whole volume of the sieved sediment (22.84 litres). Greater quantities were obtained in the 13 fully quantitatively analysed MBA samples: 10’111 plant remains recovered and 162’501 remains calculated for the total volume of 56.3 litres of sediment.
The average concentration of plant remains per litre of sediment analysed is 2975.48 in EBA samples (min – max: 1095.47 – 6571.69) and 2838.21 in MBA samples (1182.5 – 7261.4). These values are slightly higher than those recorded in the organic layers of some northern alpine pile-dwelling sites of the Neolithic and Early Bronze Age (Jacomet *et al.* 1989: Zürich-Mozartstrasse, EBA and Late Neol.; Kleiner Hafner: Neol.; Schlichtherle 1985: Yverdon, Avenue des Sports, Neol.; Brombacher *et al.* 2005: Wädenswil-Vorder Au). They are not apparently biased by the preservation of great amounts of single species, such as poppy in Horgen

layers in Mozartstrasse, Pfyn layers in AKAD-Seehofstrasse or Egolzwil layers in Kleiner Hafner (Jacomet *et al.*, 1989).

As it regularly occurs in organic cultural layers of waterlogged sites, the concentration of plant remains per litre, both in the EBA and the MBA samples, strongly fluctuates from one sample to another. This is principally due to different intra-site patterns like presence of rubbish heaps, specific processing areas, etc. (see e.g. Maier & Harwath 2011). Consequently, the standard deviation values are very high: 1967 in the EBA samples and 1745 in the MBA samples.

Comparison between the concentrations of plant remains in the two different age contexts according to their state of preservation and the depth of the samples (Fig. 3.4) highlights significant differences in the abundance of charred and waterlogged remains. In the MBA samples, remains of the two types of preservation have roughly the same figures. A different outline is drawn for the EBA samples where a strong discrepancy in the amount of remains related to their preservation state is observed, even in the samples at lower depth. Charred remains are less abundant in almost all the samples; while waterlogged remains are a little more numerous compared to MBA samples. This could be hardly ascribed to different deterioration grades of fruits and seeds in the two archaeological contexts as the amount of uncharred remains is comparable; in addition, in both contexts a high diversity of species in subfossil state is present.

A comprehensive amount of 223 plant *taxa* has been determined (*taxa* occurring in both age contexts have been computed only once). 28 out of 33 charred *taxa* and 180 out of 208 waterlogged *taxa* have been identified to species level.

The plant spectrum is shown in tables 3.2 (a, b) and 3.3 and described in detail in the chapters below. The plant species record includes domesticated *taxa* as well as wild plants. Weeds and all the other wild plants were discussed according to the actualistic grouping proposed in table 2.4. The actualistic groups mentioned in the table are explained in the chapter 2.8. The interpretation bases are discussed in chapter 2.9.

The discussion is mainly based on the ubiquity of the species in all the analysed samples of each layer. In some cases, quantities are reported, too; for the EBA samples they exclusively refer to the fully quantitatively analysed samples. Diagrams of proportions of *taxa* and of numbers of remains were also drawn and are discussed for some specific groups.

3.3. The crop spectrum

Domesticates represent a large amount of the identified remains. More than 50% of the identified remains in the MBA samples and around 21% in the EBA samples (Fig. 3.2a and Fig. 3.3) belong to cultivars. They include in the first place cereal *taxa*, secondly flax, then pulses and finally other potentially cultivated plants.

3.3.1. Cereals

In the Early and Middle BA samples we have totally found 8 cereal *taxa* (Tab. 3.4). In addition to remains identified to species or genus level, there are several intermediate identifications. These determinations are due partly to the preservation state, but partly also to the existence of intermediate morphotypes.

The cereal remains were recovered in waterlogged and charred state of preservation (Tab. 3.5). As clearly shown in table 3.5, the majority of remains consisted of charred chaff fragments (spikelet forks, glume bases, and rachis fragments). All parts of the ear are represented: spikelets from the lower, middle, and the uppermost part of the ear, ear bases, rachises and culm fragments. However, no complete ear has been found. Charred grains are few compared to chaff remains (ratio 1:41.2 in the EBA samples and 1:50.08 in the MBA samples, calculated on the base of total items excluding Cerealia remains, see Tab. 3.5) and frequently fragmented, especially in the EBA samples.

As regards uncharred (subfossil, waterlogged) cereal remains (see App. 7 Plate 7 for illustrations), a certain amount of chaff remains has been recovered in both age contexts (Tab. 3.5). The identification of uncharred chaff remains is in most cases hard to pursue as they are often strongly compressed and flattened, due to the lack of dense or woody parts in their composition. In the MBA samples, several waterlogged chaff remains could have been identified to species level, as the 'flattening' of remains from these layers appears to be less marked. No waterlogged remains of barley (*Hordeum vulgare*) have been found both in the Early and Middle BA samples. As it was already observed in waterlogged sites (Maier & Harwath 2011: 351; Jacomet *et al.* 1989), uncharred *Hordeum* remains are rarely preserved in large amounts and their presence/absence could be used as indication of the intensity of decay processes occurring in the cultural layers.

The overall cereal *taxa* spectrum will be discussed primarily based on charred chaff remains. Main reason for doing this is that charred chaff fragments can often be much more easily identified to species level than subfossil chaff remains and cereal grains themselves. Nevertheless, the cereal spectrum based on cereal grains is commented in the following.

On the base of number of charred chaff remains the most abundant cereal *taxa* in the EBA samples are respectively emmer (*Triticum dicoccum*), the 'new glume wheat' (*Triticum* nn), and barley (*Hordeum vulgare*) (Tab. 3.5 and Fig. 3.2b). Einkorn (*T. monococcum*), spelt (*T. spelta*) and the naked wheats (both *T. durum/T. turgidum* and *T. aestivum*) are present in reduced amounts. The three most abundant cereal *taxa* are also the most frequent ones (they show high ubiquities and occur in respectively 95%, 83%, and 79% of the samples). Remains of einkorn and spelt - although not numerous - are distributed in a discrete number of samples (around 70% of the samples).

In the MBA samples not only the spectrum, but also the proportions of the cereal crops are quite different (Tab. 3.5 and Fig. 3.3b). First of all, they yielded the highest absolute number of remains. This is likely due to larger volumes of samples (average volume of 4.33 l in MBA samples vs 2.07 l in EBA samples) and taphonomic processes involved in the deposition of the cultural layers (discussed in Chap. 8.1). On the base of the numbers of chaff remains (Tab. 3.5), the most abundant cereal taxon comes out to be the 'new glume wheat', followed by einkorn and, with a stronger quantitative disparity, by emmer. In addition, barley is also recorded in lower quantity compared to the EBA layers. Spelt and naked wheat remains are very scanty. *Panicum miliaceum*, broomcorn millet, appears as a new cereal and has been found only in MBA layers.

As already mentioned above, the EBA cereal spectrum represented by charred grains is strongly biased by bad preservation of these remains. Most of the grains have been identified as *Cerealia* because of their high fragmentation. The spectrum of the 'better preserved' grains (Fig. 3.2c and Tab. 3.5) is dominated by *Triticum* species (totally more than 50%). Barley covers the remaining percentage. All the identified *Triticum* species have proportions of less than 10%; among them, grains of the possible new glume wheat are the most abundant (8%). In the MBA samples, a better preservation of charred grains allowed more precise identifications (Fig. 3.3c and Tab. 3.5). Charred grains of all of the *taxa* detected by chaff remains have been identified, too. The cereal grain spectrum is dominated by broomcorn millet (almost 48% of the cereal grains). This strongly contrasts with its low proportion in the chaff remains. Apart from broomcorn millet, the highest percentages are respectively represented by emmer, barley and einkorn. The 'new glume wheat' grains are recorded in moderate amounts, their proportion is less than 10%. Spelt and naked wheat grains appear only in rather negligible numbers.

In the following the main results concerning the cereals are summarized.

Emmer (*T. dicoccum*). It is the most commonly recorded glume wheat during the EBA; its charred spikelet forks are found in 91.6% of the samples (Tab. 3.2c). On the whole, emmer chaff remains are almost the double of any other cereal species remains. In the MBA samples, lower amounts of emmer finds are recorded; nevertheless, it still has a high frequency (100% of the samples). Several intermediate identifications, more frequent in the EBA samples, involved emmer with spelt, einkorn, the 'new glume wheat' (see App. 7 – catalogue of the main species), and naked wheat.
New glume wheat (*Triticum* nn). The proportion of 'new glume wheat', which already showed high ubiquity-values of 83.3% in the EBA samples, greatly increases during the MBA and becomes the main crop together with einkorn. Both were found in all the analysed MBA samples (100%). Morphotypes of the 'new glume wheat' can be easily identified; nevertheless some intermediate identifications, both of spikelet forks and glume bases with emmer (see App. 7 – catalogue of the main species) and einkorn can subsist.
Einkorn (*T. monococcum*). Concerning the einkorn finds it is remarkable to underline their strong increase in ubiquity from the Early to Middle BA layers, as well as its co-occurrence with the 'new glume wheat'.
Barley (*Hordeum vulgare*). Chaff remains of barley are less abundant than those of emmer and 'new glume wheat', in the MBA samples there are even less than einkorn ones. Despite the lower amounts, compared to other cereal species, barley remains occurred regularly in both age contexts. They were recovered in almost 80% of the EBA samples and 46.2% of the MBA samples. On the other hand, the recording of barley grains shows a frequency of 80% (same frequency as chaff remains) in the EBA samples and of 92% in MBA samples, so much more of what could be expected considering the record of chaff remains. On the base of chaff finds, barley remains belong to the six-row type (Jacomet 2006). It is probably hulled barley as several charred grains present glumes and no clear naked grains have been found.
Spelt (*T. spelta*) and naked wheats (both *T. aestivum* and *T. durum / T. turgidum*). They can be considered as secondary crop both in the Early and Middle BA samples as their finds are very rare. Spelt remains are mainly glume bases, while naked wheats are represented by rachis fragments, normally composed by two or more segments.
Broomcorn millet (*Panicum miliaceum*). The distribution of broomcorn millet is limited to the MBA samples: more than 90% of them yielded *Panicum* remains. These remains consisted of charred grains and glume fragments; the latter ones are preserved both, in charred and waterlogged state.
All in all, there is a remarkable diversity of cereals in both chronological contexts.

3.3.2. Oil seeds

Besides cereals, another domesticated plant, *Linum usitatissimum* (flax, linseed) was recorded. Remains of flax were found only in the EBA samples, they were mainly preserved in waterlogged state (96.5% of the all flax remains counted in the fully quantitatively analysed samples) (Tab. 3.2a). They consist of different parts of the plant: seeds, capsule segments, stem fragments (fibres) (see catalogue of remains in App. 7, for illustrations Plate 3). The remains are highly fragmented: only one complete capsule, in carbonized state, and a few whole seeds, both carbonized and waterlogged, have been found.
Charred remains of flax include only seeds and capsule fragments; no charred stem fragments have been recovered. Charred seeds appear in 16.7% of the analysed samples; charred capsule fragments have been recovered in 8.3% of the samples. In contrast, waterlogged remains of seeds and capsules are more abundant and occur in 70.8% of the samples. The stem fragments consist in shivers less than 1 cm long and pressed flat, they were rare in all of the analysed samples. The high fragmentation rate of seeds did not allow a detailed morphometric analysis in order to detect any flax variety (Herbig & Maier 2011).

3.3.3. Pulses

The role of pulses is hard to judge, as they are documented by only a very few finds. The only recovered remains are horsebean (*Vicia faba* var. *minor*) seeds (see App. 7, Plate 3). Only 7 charred seeds have been found in 4 different samples from the MBA layers (Tab. 3.3). The EBA context yielded no finds. What was argued by Jacomet (2006) about the preservation of pea remains in lake dwelling sites can be extended to all pulse species also in the Bronze Age sites. The preservation of pulse seeds in waterlogged sites is difficult most probably for taphonomic reasons (Jacomet, 1987 and 2006). Evidences of waterlogged pulse remains concern rare circumstances (Jacomet, 1987: uncarbonised parts of pea seeds, Maier 2001: uncarbonised pea pods). Pulse seeds' composition appears to be not favourable to waterlogged preservation despite their thick and leathery seed coat. Pod fragments are not easy to recognize and thus probably often overlooked (Jacomet 2006). Concerning carbonised pulses, they are usually found in lower amounts compared with cereals whose processing could require the use of fire and produce large amounts of by-product, which have obviously high chances to get charred. In contrast, the carbonisation of pulses during daily processing seems to be not very likely. In larger amounts, pulses therefore occur only in burnt layers.

3.3.4. Other potential domesticates

A few remains of *Carthamus tinctorius* (safflower) were found in samples of the EBA layers (Tab. 3.2a and Tab. 3.2b). They consist of four almost complete achenes and one fragment, retrieved in five different samples (two full-quantitatively analysed samples and three roughly scanned samples). The fragment was attributed to *C.* cf *tinctorius.* All safflower remains are preserved in waterlogged state.

Determinations of *Carthamus* remains beyond the genus level are in some case weakened by the dimorphism of the achene morphology of safflower as pointed out by previous authors (Van Zeist & Bakker-Heeres, 1988; Van Zeist & Warebolk-Van Rooijen, 1992; Kroll, 1990). Two morphotypes were described: a slender smoothed-surfaced type, clearly attributed to *C. tinctorius* (similar to the modern achenes of safflower), and a second type, bordered by a distinct rim or "collar" which resembles in some way to *C. lanatus* as suggested by Kroll (1990) who has provided a detailed description of the differences between the two species (see catalogue of remains in Appendix 7). On the base of these notes and of the examined reference material, we determined as *C.* cf *lanatus* 3 waterlogged achenes found in Lavagnone: 2 from two different EBA samples (Tab. 3.2a and Tab. 3.2b) and 1 from one MBA sample (Tab. 3.3).

Camelina sativa remains were found only in EBA samples (Tab. 3.2a). They consist of a few seeds retrieved in one sample and fruit fragments from three different samples.

3.4. The wild plant spectrum

3.4.1. Potentially collected resources

A huge number of obviously gathered plant species (edible nuts and wild fruits) has been found both in the Early and Middle BA samples. These remains are mostly preserved in waterlogged state. In the EBA samples, only one fragment of a hazelnut shell and one acorn were retrieved in carbonized state, all the other remains were preserved waterlogged. A higher quantity of carbonized remains was instead recovered in the MBA samples reflecting different taphonomic circumstances of this deposit (see Chap. 8.1). They consist of remains of hazelnut shells, acorns (pericarp and fragments of the cotyledons) and a few wild grape seeds.

Local concentrations of fruits/seeds in the cultural layers that might be interpreted as direct evidence of the intentional collecting of these plants were not found. Nevertheless, their general amount in the cultural layers and their palatability let suppose they were deliberately brought into the settlement.
Almost all of these *taxa* are included in the ecological group defined “Woodlands, wood edges, clearings” (Tab. 3.2a, 3.2b and 3.3) as they mainly consist of tree and shrub species. Such habitats may have been therefore of great importance for food supply of both, humans and domestic animals. All of the recorded *taxa* could have grown in the surroundings of the settlement.
Beside the more intensely discussed *taxa* of the above mentioned ecological group, there is a whole range of plants with starchy seeds or otherwise edible parts, belonging to different habitats. We only mention shortly these *taxa* in the final part of this chapter (see below).

<u>Results of the EBA samples</u>
Concerning the EBA samples the most common collected species were blackberry (*Rubus* aggr *fruticosus*) and oak (*Quercus* sp.). Oak remains (kernels and acorns) were found in all the samples (100%). Remains of acorns mainly include waterlogged pericarp fragments and fruit bases, the carbonized remains consist solely of one half kernel (= one cotyledo) in all of the EBA samples. The high fragmentation of the remains and the lack of cupule finds made an identification of species rather impossible as the form of the cupule and the shape of its scales are the main diagnostic features (Renfrew 1973). Blackberry was represented by a huge amount of remains, distributed in all the samples (100%).
Wild grape (*Vitis vinifera* subsp. *sylvestris*) was another wild fruit largely eaten. Numerous subfossil pips were recovered in almost all the samples, therefore reaching a ubiquity of more than 95%. A complete waterlogged fruit (*acinus*) was found in one of the EBA samples. The problem of distinguishing wild grape from cultivated forms is deeply discussed in chapter 8.3.1.
Hazel (*Corylus avellana* L.), the only other nut species apart from acorns, was recovered in more than 80% of the samples. Its finds consist solely of shell fragments, no whole nut has been found.
Complete or partially complete stones of cornelian cherry (*Cornus mas*) were found in almost 80% of the samples. The stony endocarps can easily survive in archaeological deposits thanks to their thick lignified wall.
Achenes of wild strawberry (*Fragaria vesca*), found in 70% of the samples, are the most numerous remains of wild fruits counted in the fully quantitatively analysed samples. The consumption of figs (*Ficus carica*), probably as fresh or chiefly dried fruits, was obviously also quite common, since it appeared in 62.5% of the samples. The habitat where this species could be gathered in the wild is discussed in chapter 8.3.
Pear (*Pyrus* sp., *Pyrus pyraster, Pyrus communis*) and crab apple (*Malus* sp., *Malus sylvestris*) seeds are rather poorly represented in the EBA samples. The most common remains are fragments of pericarps (Maloideae) found in more than 50% of the samples and pear stone cells (in 33% of the samples). No complete apples or pears, even no specimen cut into halves, have been found.
Almost 80% of EBA samples yielded seeds of bladder cherry or Chinese lantern (*Physalis alkekengi*). They were found in high amounts (more than 600 items) in the fully quantitative analysed samples (Tab. 3.2a).
Other wild fruits with much less frequent finds in the EBA samples (ubiquity of 8%), but probably anyway collected as food in the surroundings of the settlement were raspberry (*Rubus* cf *idaeus*), elder (*Sambucus nigra*), and blackthorn (*Prunus spinosa*). Hawthorn (*Crataegus monogyna*), and rose (*Rosa* sp.), distributed in respectively 33% and 25% of the scanned samples (Tab. 3.2b), were also gathered in the wild. Danewort (*Sambucus ebulus*) fruits might also be collected for food purposes, even if this plant could also be largely widespread close to the settlement as ruderal weed species (ubiquity of 25%).

<u>Results of the MBA samples</u>

The spectrum of gathered plants in the MBA samples is rather different in the *taxa* frequency. Cornelian cherry and blackberry are the most common fruit species, they were found in all of the samples (100%). The high frequency (100%) of blackberry, although characterized by fluctuating concentrations between the samples, confirms its large scale consumption, but also its easily preservation in archaeological sites. The absolute amount of cornelian cherry stones in the fully quantitative analysed samples is strongly higher than in the EBA samples, but this is above all related to two samples (Tab. 3.3).

Other collected species marked by a frequency increase compared with the EBA are danewort, fig, and hazelnut. Hazelnut and fig have been found almost everywhere in the settlement (in more than 80% of the samples). Danewort is characterized by a lower rise, it is actually restricted to a lower number of samples (ubiquity of 46%), but in some samples it shows a high concentration of pips (e.g. samples LAVc4069, LAVc4076) (Tab. 3.3).

Acorns are mainly represented by fruit bases (found in 61.5% of the samples), while pericarp fragments are less recurrent (46% of the samples).

Wild grape and strawberry are still important fruits during the Middle Bronze Age even if they are a bit less frequent in the analysed samples (62% respectively 85%). A greater decrease is observed in the ubiquity and abundance of crab apple, pear, and bladder cherry. Fragments of Maloideae pericarps (93 items) were found in only 7.7% of the samples, pear stone cells (25 remains) in 30%, and bladder cherry seeds in about 15% of the samples.

<u>Other minor collect resources</u>

Other species with starchy seeds were also found in large amount in both Early and Middle BA samples. About their probable collecting for food purposes, see chapter 8.3. We mention fat hen (*Chenopodium album*) and black bindweed (*Fallopia convolvulus,* syn*. Polygonum convolvulus*). Fruits of other *Polygonum* species (*P. lapathifolium, P. persicaria,* and *P. aviculare*) are quite abundant only in the EBA samples.

Seeds of fat hen (*C. album*) are frequently recovered in archaeological sites. In the Lavagnone settlements they reach ubiquities of 100% in the MBA layers (Tab. 3.3) and more than 70% in the EBA (Tab. 3.2b). Black bindweed (*F. convolvulus*) was more common in samples of the EBA (ubiquity of 75%) where a few carbonized nutlets were found.

Purslane (*Portulaca oleracea*) seeds show a remarkable accumulation in the MBA samples where they reach concentrations values of 1865 items per litre. This high amount of seeds suggests a use of purslane as food.

Valerianella dentata and *Daucus carota* were also possibly used considering they have been found in high amounts.

3.4.2. Potential weeds

Wild plants are represented by a fairly good number of plant species belonging to the ruderal and weed flora based on actualistic assumptions. We can list 51 plant *taxa* in the EBA samples (27.12% of the all *taxa*) and 42 in the MBA samples (31%) (Tab. 3.2b and Tab. 3.3).

3.4.2.1. Winter crop weeds (Secalinetea) (WW)

EBA

In the EBA samples 14 weeds *taxa* of winter cereals have been found, two were preserved through charring and 13 through waterlogging. Six weeds can be assigned to the Aperetalia Order and eight to the Caucalidion

Alliance (Tab. 3.2b). The commonest winter weeds were black-bindweed (*Fallopia convolvulus*) and narrow fruit corn salad (*Valerianella dentata*) both found in 75% of the samples. Another important weed was annual hedge nettle (*Stachys annua*) distributed in 41.6% of the samples. All the remaining species were found in less than 17% of the samples.

Stachys annua, field hedge parsley (*Torilis arvensis*), and broad-fruited cornsalad (*Valerianella rimosa*) are 'character species' of the Caucalidion Alliance. *Valerianella dentata*, although it does not grow exclusively as a weed, is included in this group too and is characterized by high ubiquity and numerous finds in the fully analysed samples (Tab. 3.2a).

The most frequent species belonging to the Aperetalia Order is *Fallopia convolvulus*. Other cereal weeds, distinctive for slightly acidic (or neutral), free of lime and well-drained soils are annual knawel (*Scleranthus annuus*), prickly poppy (*Papaver argemone*) and blindeye (*Papaver dubium*).

MBA

In the MBA samples, 12 different plant *taxa* of which eight are preserved in waterlogged and four in charred state represent the weeds of winter cereals. Four of these weeds could be ascribed to the Aperetalia Order and eight to the Caucalidion Alliance. Although less frequent, *Valerianella dentata*, *Stachys annua* and *Fallopia convolvulus* are still the commonest winter weeds. Their frequencies are respectively 61.5%, 53.8% and 46.1% (Tab. 3.3).

Some new *taxa* appear; of those, parsley-piert (*Aphanes arvensis*) belongs to the Aperetalia Order, and possible yellow vetchling (*Lathyrus* cf *aphaca*) is a 'character species' of the Caucalidion Alliance.

3.4.2.2. Summer crop weeds/mostly annual ruderals (SW)

EBA

Seeds/Fruits of 19 different plant *taxa*, all preserved in waterlogged state, belonging to this ecological group have been found in the EBA samples. The commonest species is fat-hen (*Chenopodium album*) which was found in more than 70% of the samples. Quantitatively it represents a large part of the summer crop weed remains, exceeding by far the amount of any other taxon belonging to this group. The second most frequently found taxon is purslane (*Portulaca oleracea*) distributed in 37.5% of the samples. Blue pimpernel (*Anagallis arvensis*) and possible little lovegrass (cf *Eragrostis minor*) are recorded in 25% of the samples; all the other *taxa* have a frequency of less than 17% (for details see Tab. 3.2b).

MBA

The MBA samples yielded 13 plant *taxa* belonging to summer crop weeds and annual ruderals, out of them only one was preserved through charring.

Portulaca oleracea and *Chenopodium album* were found in high amounts in all the samples. Particularly *Portulaca oleracea* reaches a very high concentration of 1865 seeds per litre (sample LAV c4072). All the other *taxa* occur at frequencies less than 46% (for details see Tab. 3.3).

3.4.2.3. Perennial ruderals and crop field ubiquitary species (RU)

EBA

In the EBA samples 18 plant *taxa* could be attributed to this group (two of them were identified only to genus level). The remains of all of them were preserved through waterlogging, only one was also found as charred fruit. The commonest species found in more than 50% of the samples are (in order of abundance): knotweed (*Polygonum aviculare*), vervain (*Verbena officinalis*), and redshank (*Polygonum persicaria*) (for details see

Tab. 3.2b). Another important taxon quite common was creeping cinquefoil (*Potentilla reptans*) recorded in 45.8% of the samples.
All the detected *taxa* are plant species favouring alkaline soils. A part of them are linked mostly to humid and nutrient-rich soils such as some buttercup species (*Ranunculus* spp.), *Potentilla reptans*, *Polygonum persicaria*, common nettle (*Urtica dioica*), and danewort (*Sambucus ebulus*). Another small group includes species typical of drier environments such as: yellow chamomile (*Anthemis tinctoria*), white campion (*Silene alba*), and knotgrass (*Polygonum aviculare*).

MBA
The MBA samples yielded 16 plant *taxa* representing perennial ruderal vegetation or crop ubiquitary species. The remains of the majority (15 *taxa*) were preserved through waterlogging; remains of only three *taxa* were also found in charred state. The most frequent and numerous fruits/seeds belong to *Potentilla reptans* (found in 84.6% of the samples), *Urtica dioica* (77%) and *Verbena officinalis* (69.2%). *Sambucus ebulus* and *Polygonum aviculare* respectively occur at a frequency of 46% and 38.4% (for details see Tab. 3.3).
During the Middle Bronze Age, we can observe an increase in the number of species linked to dry habitats. Examples are giant needleleaf or field Polycnemum *(Polycnemum majus / arvense*), drooping or barren brome (*Bromus tectorum / sterilis*), and lesser chickweed (*Stellaria pallida*). Greater plantain (*Plantago major*) can also grow on dry habitats, it is well adapted to disturbed soils, compacted by frequent trampling. Among the nitrophilous species the most commonly occurring species, which is also represented by large amounts (more than 3000 items) is *Potentilla reptans.* Besides, common nettle (*Urtica dioica*) is quite abundant; it is the second most abundant species for number of remains after *Potentilla reptans*. Both *taxa* show a strong increase in comparison with the EBA. They spread vigorously in areas where animal/human dejections are released enriching the soil with nitrogen compounds

3.4.3. Grasslands: meadows and pastures (MP)

Grasslands are represented by 39 *taxa* (20.74%) in the EBA samples (remains of 39 found in waterlogged state and 1 in charred state) and 19 *taxa* (14.2%) in the MBA samples (remains of 15 found in waterlogged state and 6 in charred state) (for details Tab. 3.2b and Tab. 3.3). Considering the variety of plant *taxa* it represents one of the largest ecological groups in both chronological contexts (see Fig. 3.1 and Fig. 3.3). Within the grassland vegetation, we distinguished different groups (for a description see Chap. 2.8).

i) *taxa* of dry fallows (MP 3.1)
In the EBA samples 13 *taxa* belonging to this group have been found. The commonest species are wild carrot (*Daucus carota*) and thymeleaf sandwort (*Arenaria serpyllifolia*) found in more than 50% of the samples (Tab. 3.2b). Catnip (*Nepeta cataria*) and childing pink (*Petrorhagia prolifera*) were also quite frequent with ubiquities of respectively 25% and 12.5%. Another important species included here and previously discussed (Chap. 3.3.4 and Chap. 8.4) is saffron thistle (*Carthamus lanatus*).
The MBA samples yielded 9 plant *taxa* that can be included in this group. *Arenaria serpyllifolia* is still the most frequent and abundant species together with yellow bugle (*Ajuga chamaepytis*), they both occur at a frequency of 69.2% (Tab. 3.3) [19]. They are followed by bur medick (*Medicago minima*), exclusively found as

[19] Yellow bugle may also be a character species of the weed groups e.g. Caucalidion Alliance (see Chap. 2.8), for a detailed discussion about its inclusion in the ecological group of dry fallow (3.1 MP) see Chap. 8.6.2.

pod remains, and wild carrot. Other two important and significant species, strong indicators for the vegetation discussed here, are: white lace flower (*Orlaya grandiflora*) and scotch thistle (*Onopordum acanthium*).

ii) *taxa* of dry pastures/meadows (MP 4.1)
The number of *taxa* assigned to this group amounts to 14 in the EBA samples and 4 in the MBA samples. The most commonly found species in EBA layers are: wall germander (*Teucrium chamaedrys*) recorded in 62.5% of the samples, Nottingham catchfly (*Silene nutans*) in 20.8% and bladder campion (*Silene vulgaris*) in 12.5%. The majority of dry-grassland species remains are limited to one or two samples.
In the MBA layers this vegetation type is represented only by a small number of *taxa*, distributed in only a few samples.

iii) *taxa* of drained pastures/meadows (MP 4.2)
This vegetation is not well documented in the Lavagnone fossil plant assemblage. The only species with ecological requirements linked to these habitats is narrowleaf plantain (*Plantago lanceolata*), recovered solely in the MBA samples. Nevertheless, despite this species is known as a classical 'pastoral indicator', it has a very large ecological amplitude thus it can be found in a wide range of habitats. It may also be indicative of fallow ground.

iv) indistinct pastures and meadows (MP 4.3)
The EBA samples yielded 12 different *taxa* belonging to this group. The most frequently found (recovered in 25% of the samples) are: sheeps sorrel (*Rumex acetosella*) and self heal (*Prunella vulgaris*), followed by *Knautia* sp. (likely field scabious, *Knautia arvensis*) in 20.8% of the samples and tunic flower (*Petrorhagia saxifraga*) in 12.5%. All the other *taxa* occur only in 1 or 2 samples.
In the MBA samples only 5 *taxa* of indistinct pastures have been found, all of them occur at low frequency (in 1 or 2 samples).

3.4.4. Woodlands, wood edges, clearings

Plant species representing the vegetation of woodlands, wood hedges, and clearings consist of 38 different *taxa* (4 charred, 37 waterlogged) and 20'071 remains in the EBA samples and 23 *taxa* (3 charred, 23 waterlogged) and 8136 remains in the MBA samples.
The archaeological plant assemblage did not provide evidences of a strong diversification in the forest typologies growing around the settlement. The main plant *taxa* grouped here refer to species gathered for food supply (Chap. 3.4.1). As a consequence, this carpological spectrum resulted from an aware selection of species in the surrounding woodlands. Species were chosen and collected on the base of their abundance, palatability, nutrition value, easy storing, etc.

3.4.5. Lake shore vegetation

Plant species of the lakeshore vegetation represent a large part of the subfossil plant assemblage in Lavagnone, especially in the MBA contexts. This group consists of 36 different *taxa* in the EBA samples, all the remains were preserved in waterlogged state. In the MBA samples, 25 *taxa* are represented (remains of 1 in charred state, 24 waterlogged).

The proportions of the three groups (6.1-6.3) described in chapter 2.8 are more or less similar.
Within the plants growing in wet meadows (group 6.1), hairy buttercup (*Ranunculus sardous*) is the commonest taxon in the EBA samples together with gypsywort (*Lycopus europaeus*), they have been found in more than 50% of the samples. All the other species, even those exclusively growing in such environments, e.g. purple-loosestrife (*Lythrum salicaria*), hemp-agrimony (*Eupatorium cannabinum*), hoary willowherb (*Epilobium parviflorum*), are less frequent. In the MBA samples the most commonly found *taxa* are ragged robin (*Lychnis flos-cuculi*), *Lycopus europaeus* and mint species (*Mentha spicata / M. suaveolens*). They are recorded in respectively 46%, 31% and 38% of the samples.

The 6.2 group (telmatic, seasonally dried-up belt) is represented by a lower number of species, but well distributed in all the samples in large amounts. In the EBA samples the most significant species found in more than 65% of the samples are, in order of frequency, golden dock (*Rumex maritimus*), pale persicaria (*Polygonum lapathifolium*), and celery-leaved buttercup (*Ranunculus sceleratus*). The distribution values of *Cyperus flavescens* and *Scirpus radicans* – respectively in 41.6% and 50% of the samples - are plausibly affected by the deficiency of the fine fraction analysis in all the samples. Actually they produce small seeds that can be retrieved only in fine sieves. Their abundance is confirmed in the full quantitatively analysed samples (Tab. 3.2a). In the MBA samples, apart from *Polygonum lapathifolium* recorded in 30% of the samples, all the other *taxa* mentioned above show high frequencies ranging from 77% to 100%. The character species of the plant community *Rumici maritimi-Ranunculetum scelerati*, *Rumex maritimus* and *Ranunculus sceleratus*, are well documented in both age contexts.

The last group (6.3) comprises reed and tall-sedge stands. Apart from *Carex riparia*, no other character species of the latter plant community has been found. In contrast, reed beds are documented by the record of several possible dominants which could be exclusive in the more or less extensive and continuous swamp vegetation, such as *Typha latifolia / T. angustifolia, Phalaris arundinacea, Sparganium erectum, Schoenoplectus lacustris*.
In the EBA samples the most frequent *taxa* are *Cyperus glomeratus*, common bulrush / Lesser bulrush (*Typha latifolia / T. angustifolia*), and possible bog bulrush (*Schoenoplectus* cf. *mucronatus*) respectively. All of them reveal eutrophic waters.
On the other hand during the MBA *Typha latifolia* and *Cyperus glomeratus* seem to be less prevalent and the most frequent *taxa* are common clubrush (*Schoenoplectus lacustris*), found in 46% of the samples, and bog bulrush (*Schoenoplectus* cf *mucronatus*) with a frequency of 30.7%.
In addition to *Cyperus glomeratus*, another rare taxon was found as single finds in both Early and Middle BA samples: Parnassus-leaved water-plantain (*Caldesia parnassifolia*).

3.4.6. Aquatic plants

All the recorded aquatic *taxa* remains have been found in cultural layers. In the EBA samples 10 aquatic *taxa* have been recorded, they represent 5.3% of the all identified *taxa*. The most frequent species were common hornwort *Ceratophyllum demersum* (found in 95.8% of the samples) and broad-leaved pondweed *Potamogeton natans* (50%).
Also *Characeae* were found in large amounts in 50% of the samples. Other significant species were Eurasian watermilfoil (*Myriophyllum spicatum*) and European white waterlily (*Nymphaea alba*). Common duckweed (*Lemna minor*) is well documented in the fine fraction of full quantitatively analysed samples (Tab. 3.2a).

In the MBA samples 8 aquatic plant *taxa* have been recovered (5.9% of the all identified *taxa*). The commonest finds are *Characeae* oogonias, they occur at a frequency of 92.3% and in huge amounts. *Ceratophyllum demersum* is recorded in 84.6% of the samples, but in modest quantity. Another frequent species is *Lemna minor* (almost 70%), while *Myriophyllum spicatum* is quite abundant but limited to only two samples.

4. The plant macroremains assemblages from mastercore LAV37 (Sector D), Lavagnone basin

The plant macroremains analysis of the Lavagnone depositional sequence carried out on the core LAV37 (for location of the core see Fig. 1.6.2.2, for description of the deposit and its sampling see Chap. 1.6.2) encompassed 88 contiguous samples (see Chap. 2.1 for sampling strategy and Chap. 2.5 for the processing methods of samples and methods applied to this analysis). These samples yielded 33'084 plant remains. 155 plant *taxa* were identified, mostly to species level (Tab. 4.1). The obtained macrofossil data are plotted in a concentration diagram of selected *taxa* and terrestrial ecological and ethnographical groups (Fig. 4.1). Groups linked to aquatic or wet habitat are plotted in a different diagram (Fig. 4.2). The complete diagram including all *taxa* is given in the Appendix 6a.

4.1 Description of the macrofossil zones recognized in the sequence LAV37

The concentration diagrams were subdivided into 9 'macrofossil zones' (MZ) based on changes in the plant macrofossil concentrations (Fig. 4.1 and Fig. 4.2).

As plant macrofossil remains reflect to a large degree the local vegetation (in contrast to pollen), they are unsuitable for reconstructing regional vegetation (Birks & Birks 1980). Even in archaeological contexts, macrofossil spectra change a lot horizontally within a very small area (Jacomet *et al.* 2004: p. 384). The biostratigraphic zones represent therefore macrofossil accumulations, yielded by both, the spontaneous local flora and vegetation, and *in situ* human activities. Therefore, they reflect specific palaeoenvironmental conditions.

The macrofossil zones of the Lavagnone sequence LAV37 are defined as follows (see App. 6 for details of single *taxa*).

LavMZ1 (443.5-353 cm) - *5260-3200 BC*

This macrofossil zone is characterized by the almost exclusively dominance of aquatic plants. It can be further subdivided in two subzones for a change in the abundance of *Najas* species. The first subzone LavMZ1a is charcterized by high concentrations of *Najas marina* seeds. *Najas flexilis* is also present but more discontinuously and in lower concentrations. The peaks of both *Najas* species are synchronous with the peak of *Ceratophyllum demersum,* although sporadically recorded in this zone. A few Characeae oogons and Mollusc fragments are discontinuously recorded.

The subsequent subzone LavMZ1b is defined by a sharp increase in the concentrations of *Potamogeton natans* remains. A few remains of *Nymphaea alba*, *Myriophyllum spicatum,* and *Trapa* are also present. A moderate peak marks the concentration of *Ceratophyllum demersum*. The trend of *Najas marina* is continuous along the whole subzone. Characeae oogons and Mollusc fragments show an increasing trend.

Wet terrestrial herbs such as *Cyperus flavescens* (continuously distributed), sporadic fruits of *Cyperus glomeratus*, *Lythrum* cf *salicaria, Polygonum lapathifolium,* and *Lycopus europaeus* appear in this subzone. The only tree species is *Betula* sp.

LavMZ2 (353-298 cm) - *3200-2180 BC*

The most significant aquatic species of this zone is *Potamogeton natans,* fairly abundant and continuously distributed along the whole interval, with two marked peaks in the concentrations. Another continuous

record is that of *Nymphaea alba*, although it is characterized by low quantities. *Najas marina* is sporadically present and disappears at the end of this zone, whereas *N. flexilis* has been found only in one sample. It is interesting to note the complete absence of *Cerathophyllum demersum*.
Remains of Characeae oogons and Molluscs are highly concentrated and present two peaks of abundance synchronous with those observed in the pondweeds.
Among terrestrial herbs, the below mentioned species are recorded. *Lycopus europaeus* and *Lythrum* cf *salicaria* are both characterized by low concentrations, but continuously and sporadically recorded. *Cyperus flavescens*, recorded along the whole sequence of LAV37, presents its highest concentrations in the central part of this zone; *Cyperus glomeratus* has a continuous record with high values in the second part of the zone. At the same time *Scirpus radicans, Typha* and *Alisma plantago-aquatica* show an increasing trend.
Betula sp. is still present at the beginning of this zone.

LavMZ3 (298-275 cm) - *2180-1940 BC*
The beginning of this zone is marked by the appearance and sudden increase of macrocharcoal fragments, coupled with first occurrences of cultivated and gathered plant *taxa*. Among the cultivated plants, great amount of cereals (charred and waterlogged) and flax remains were found. Barley and broomcorn millet are documented only by few remains, wheats are more abundant and from this zone upward they are continuously recorded. Other anthropogenic indicators particularly abundant are *Quercus* sp., *Fragaria vesca*, *Rubus* gr *fruticosus*, Maloidaeae pericarps.
The perilacustrine wetland vegetation is represented by a progressive expansion of *Cyperus glomeratus,* by a continuous record of *Typha latifolia / T. angustifolia*, although in low quantities, and by a decrease of *Scirpus radicans* and *Cyperus flavescens*. We detected here the first occurrence of *Rumex maritimus*, although with lower concentrations than it will reach later in the succession.
Among aquatic plants, the abundance of *Nymphaea* sp. and the sudden increase of *Ceratophyllum demersum* are of interest. *Potamogeton natans* and *Myriophyllum spicatum* are documented only by few remains. Molluscs and Characeae oogonia are strongly decreasing.

LavMZ4 (275-254 cm) - *1940-1800 BC*
This zone is defined by a strong decrease of the anthropogenic indicators (macrocharcoal, crops and gathered plant *taxa*). *Triticum* remains are still present but in very low concentrations. Among ruderals, it's worth to mention the occurrence of *Polygonum persicaria*, nevertheless, this species could be here more likely linked to wet habitats close to the lake. In the lakeshore vegetation, the following pioneer species are dominant: *Bidens cernua, Polygonum lapathifolium, Ranunculus sceleratus,* and *Rumex maritimus.* The most important helophytes are *Cyperus glomeratus* and *Typha latifolia / T. angustifolia*. They both show a peak of concentration. The aquatic habitat is still dominated by *Ceratophyllum demersum*, accompanied by an increasing trend of *Lemna minor*.

LavMZ5 (254-220 cm) - *1800-1688 BC*
This zone is characterized by a second increase of macrocharcoal and anthropogenic indicators. The anthropogenic indicators include cultivated and gathered plants (cereals, *Quercus* sp., *Fragaria vesca*, *Maloidaeae* pericarp, *Pyrus*, sporadic remains of *Corylus* and *Cornus mas*) as well as weeds and ruderal species, recorded in discrete amounts like e.g. *Chenopodium album, Valerianella dentata, Polygonum aviculare, Solanum nigrum, Portulaca oleracea, Verbena officinalis.* Although in low amounts and in a sporadic distribution, meadow- and pasture-species appear in this zone, too. They are mostly represented

by species of dry habitats such as *Arenaria serpyllifolia* and *Daucus carota,* other important species are *Prunella vulgaris* and *Rumex acetosella*.
Among the wetland vegetation species, telmatic habitat indicators such as *Bidens cernua*, *Polygonum lapathifolium, Ranunculus sceleratus, Rumex maritimus, R. palustris, Scirpus radicans* are dominant. The littoral belt vegetation is dominated by an increasing trend of *Cyperus glomeratus* and by a second abundance peak of *Typha*.
The most significant aquatic plants are *Lemna minor* and *Myriophyllum spicatum.* Concentration values of *Ceratophyllum demersum* remains are lower but still continuously recorded. *Potamogeton natans*, *Ranunculus* gr *batrachium* and Mollusc remains are few and only sporadically found.
The end of this zone is marked by a decreasing trend for most of the abundant *taxa*. The following short *hiatus,* due to sediment loss during coring works, emphasizes the decrease of concentration of the remains.

LavMZ6 (215-205 cm) - *1675-1660 BC*
A strong decrease of macrocharcoal and anthropogenic indicators have been detected in this zone. *Chenopodium album* presents the lowest concentration of its record. A few remains of other weeds are irregularly recorded. The eulittoral belt *taxa* are scarcely documented. *Lemna minor* and *Myriophyllum spicatum* are the only aquatic plants.

LavMZ7 (205-144 cm) - *1660-1635 BC*
This zone documented a strong increase of the concentration values of several *taxa*. Most of them present a bimodal trend: two distinctive abundance peaks are discernable, even if not exactly synchronous in all the *taxa*. This allows distinguishing two subzones in the diagram: **LavMZ7a** (205-161 cm) and **LavMZ7b** (161-144 cm), using charcoal remains and primary anthropogenic indicators (cultivated and gathered plants).
The records of crop weeds, openland terrestrial herbs are more or less continuous, but without reaching high values. It is worth to mention the extremely high amount of *Chenopodium album* fruits as to suggest a probable use of this species as food.
Taxa of the perilacustrine vegetation show a continuous distribution. Among the aquatic *taxa*, *Myriophyllum spicatum* has a peak of concentration in the subzone LavMz7b; *Ceratophyllum demersum, Lemna minor, Nymphaea* sp. are recorded along the whole interval.

LavMZ8 (144-128 cm) - *1635-1631 BC*
The main feature of this zone is the complete absence of macrocharcoal remains and most of the cultivated plant *taxa*. Weeds are barely documented. It is worth to mention the increasing trend of *Portulaca oleracea*, starting already in this zone, and the abundance peak of *Urtica dioica* at the end of the zone.
The zone is delimited by high concentrations of some *taxa* of the perilacustrine vegetation belt. First of all the remarkable high concentration values of *Rumex maritimus*, an annual or biennal taxon well adapted to flooding habitats or to lake-level oscillation belts has to be emphasized; other species linked to the same habitat and abundant too are *Scirpus radicans, Rumex palustris* and *Ranunculus sceleratus*. *Cyperus glomeratus* colonizing the waterlogged littoral zone is as much copious.
Aquatic habitats are documented by a moderate peak of *Ceratophyllum demersum*, and by the presence of *Myriopyllum spicatum, Potamogeton natans, Ranunculus* gr. *batrachium*, and molluscs, too.

LavMZ9 (128-50 cm) - *1631-1460 BC*

This last macrofossil zone is defined by a new increase of charcoal as well as cultivated and useful plants. Flax is the only exception as few finds have been found in this anthropic phase compare to the previous one. Three different subzones can be described. The first subzone LavMZ9a extends until 108 cm depth and is characterized by low concentrations of the anthropogenic *taxa* and charcoal remains. Species of telmatic and seasonally drying-up habitats (*Rumex maritimus, Ranunculus sceleratus, Scirpus radicans*) have been found in high concentration values but progressively decreasing upwards to the end of this subzone. Some aquatic *taxa* are also significantly recorded. The beginning of the subsequent subzone LavMZ9b (108-77.5 cm) corresponds to a sudden increase of *Panicum miliaceum* with a peak of concentration at 85 cm depth. The same trend is observed in *Triticum* remains and gathered plants (*Fragaria vesca, Quercus* sp.*, Rubus* gr. *fruticosus*). The same tendency can be seen looking at the following weed species: *Legousia, Fallopia convolvulus, Valerianella dentata, Anagallis arvensis, Stellaria media; Chenopodium album* and *Portulaca oleracea* appear in very high amounts. High values are recorded even for *Arenaria serpyllifolia*, a small plant of dry fallows on carbonatic soils. In the perilacustrine vegetation the quantity of *Cyperus flavescens* is significant.

Finally, the transition to the third subzone LavMZ9c (77.5-50 cm) is indicated by an abrupt decrease of several anthropogenic and dryland *taxa*, and simultaneously by a slight addition of aquatic *taxa* and wetland herbs. *Lemna minor* and *Myriophyllum spicatum* are recorded along the whole zone, whereas *Ranunculus aquatilis* and *R. gr batrachium* show a slight increase in this subzone like *R. sceleratus,* spreading again along the lakeshores.

5. The plant macroremain assemblages from Section 98 (Sector A) of the Lavagnone site. Comparison with pollen data and goat/sheep coprolites

5.1 The plant macroremains assemblages of section 98

The nine analysed samples picked up along the section 98 yielded 6778 remains (extrapolated on the base of 2777 sorted remains) from the coarse (≥2mm) fraction of the all samples and the fine fraction (0.35mm) of a part of them. Because not all the sieved fractions of these samples have been analysed, the results may be somehow biased. The fine fraction is missing, thus some ecological groups are apparently not represented (e.g. ruderal, weeds etc.) because of the small size of their diaspores. Nevertheless, 92 plant *taxa* were identified, mostly to species level (Tab. 5.1). The macrofossil data have been grouped and their proportions plotted in the two diagrams of Fig. 5.1a-b.
Concerning the proportion of *taxa* in the ecological and ethnographical groups (Fig. 5.1b) a homogenous outline is observed among the samples. Small variations are shown by the samples B2/09, B2/11 and B2/13. The highest number of *taxa* is recorded by the group of 'Woodlands, wood edges and clearings' (= F in the graphs) including most of the gathered plants, therefore the plant spectra of this group are extremely diversified. The plants representing this group often have larger seeds like apples, hazelnuts, cornelian cherry etc.; therefore, this group is particularly well represented. Another important group is that of the 'Lakeshore vegetation' (= LS) testifying a great contribution of the local vegetation to the sedimentation. Cultivated plants are represented by three *taxa*: *Hordeum vulgare*, *Triticum* sp. and *Linum usitatissimum*. (barley, wheat and flax). Among grassland *taxa*, those of indistinct pastures and meadows are dominant. *Taxa* of dry open habitats (pastures and fallow) are as well abundant.
The proportions based on the number of remains (Fig. 5.1a) point to a significant change in the macrofossil assemblages of the two uppermost samples (B1/02 and B1/04) which correspond to the transition of two different archaeological and Stratigraphic Units, SU338a and SU337. This change is marked by an increase in the abundance of lakeshore vegetation *taxa* remains and a relative decrease of the anthropogenic ones. The different macrofossil assemblages in the uppermost samples are consistent with a less intensive plant discharging under the pile dwelling and a prevalent natural sedimentation in the deposit. Actually, the two Stratigraphic Units are respectively interpreted as a probable collapse of the roof structure and its covering (SU338a) as a consequence of a fire event affecting the whole pile dwelling (according to C. Balista in de Marinis *et al.* 1996) and a subsequent interval of settlement displacement/interruption (SU337).

5.2. Results of the pollen analysis of the section 98 samples and the embedded goat/sheep coprolites

Pollen analyses of the section 98 samples

The pollen analysis was carried out on 6 samples (Fig. 2.5, blue dots) and results are presented in the simplified pollen diagram of Fig. 5.2. M. Zanon carried out this analysis at the Laboratory of Palynology and Palaeoecology of CNR IDPA of Milano (Italy) (Zanon 2007).
The vegetation changes observed along the sequence are not particularly significant; nevertheless, samples from the uppermost layers (box B1, SU338a and SU337) testified a bit more diversified landscape with a larger forest cover coexisting with dry open habitats. Lower % of arboreal pollen (AP) are actually recorded in the lowermost samples (B2/03, B2/07), whereas xerophytes increase in the uppermost samples reaching

the highest percentages in the sample B1/02. The most interesting *taxon* included in this category is *Helianthemum* showing high percentages (4-7%) especially in the samples from box B1. Gramineae (Poaceae) and Umbelliferae (Apiaceae) are the most frequent herbaceous *taxa* in the pollen spectra (>25%). Aquatics and wetland herbs are constantly recorded with percentages of 3-6.5%. Cereal pollen grains are recorded with percentages of 2-7%.

This pollen record allowed correlating the on-site samples from section 98 in Sector A (SU338, SU337) with the depth interval 305-313 cm of the pollen diagram carried out on the mastercore LAV1 from Sector D (pollen zone LV2 302-333 cm) (Fig. 5.3). The correlation was based on pollen % and specific *taxa*: low % of AP characterize and distinguish the LV2 pollen zone from the previous one (LV1); the absence of *Orlaya grandiflora* pollen grains allows excluding the LV3 and subsequent pollen zones as in these phases *Orlaya* pollen gets particularly abundant; other pollen types percentages show comparable values in the two contexts. This correlation is discussed in detail by Zanon (2007).

<u>Pollen analyses of goat/sheep coprolites retrieved from section 98</u>

13 goats/sheep coprolites were extracted from 4 out of the 6 cultural layer samples studied for pollen content (see above). 2 samples yielded no coprolites. The coprolites have been studied for macroremains and pollen (for the analysis methods, see Chap. 2.4).

The coprolites are somewhat poor in macroremains (Tab. 5.2). Actually, some of them contained very few identifiable plant remains. In addition to plant fragments, a few insect remains and small stones were found. The most frequently identified macroremains are prickles of *Rosa/Rubus* (more likely *Rubus*) and fragments of *Triticum* sp. (testa). Trees are represented only by *Quercus* remains (mostly leaf epidermis and pericarp fragments). Other woody and evergreen *taxa* are shrubs and climbing *taxa* such as: *Rosa/Rubus* prickles, *Rubus* fruits fragments and *Hedera helix* epidermis. Among herbs, mostly wetland species have been recorded (Cyperaceae, *Juncus* cf *compressus*, *Poa palustris*). Ferns and mosses are also frequently documented, usually preserved as very small fragments.

The pollen record from coprolites is presented in the pollen diagram of selected *taxa* in Fig. 5.4. This analysis was carried out by L. Wick at the IPNA laboratory (Basel University). The diversity of *taxa* is very high and the pollen spectra are quite different from one coprolite to another. The coprolites can be basically sorted in two groups: the first one is characterized by higher percentages of tree and shrubs pollen (mainly *Quercus* and *Corylus* pollen), the second one is dominated by herbs among which Apiaceae, Scrophulariaceae (mainly *Veronica* and *Odontites*), and Cichoriaceae show high percentages.

5.3. Comparison of macro and pollen data

Here we present a comparison of the pollen and macrofossil contents of those 6 samples of section 98-Sector A, from where both pollen and macroremains were investigated. Pollen and macrofossil *taxa* have been listed altogether in table 5.3 (including all the *taxa* found in pollen and macrofossil analysis). The quantitative data (percentages) of selected families are drawn in the figure 5.5.

The forest vegetation is quite well documented in the pollen record. Arboreal pollen is composed by 21 different *taxa*, whereas pollen types of shrubs and creeping species are only four. In the macrofossil record woody and shrubby vegetation are represented by fruits and seeds of only three tree species (oak, crab apple and pear) and six shrubs / creeping *taxa* (hazel, cornelian cherry, elder, wild grape, rose, and blackberry) (Tab. 5.3).

Concerning herbaceous *taxa*, they belong to many different families and habitats. Pollen of herbaceous *taxa* of 39 different families have been identified and among them 7 have been identified only to the family level. In the macroremain assemblages the number is lower (31), but for all the families it was possible to identify at least one genus or species.

Poaceae is one of the most important families with regards to the amount of remains both in pollen and macrofossils (Fig. 5.5). This is essentially due to cereals in the macroremains and to wild grasses in the pollen. The % of Poaceae pollen are high compared to the correlated off-site pollen sequence and even to the pollen content of the small ruminants coprolites (Fig. 5.3 and Fig. 5.4).

Cereals together with flax (*Linum usitatissimum*) are the main crop cultivars. They are well represented in both analyses, but which cereal crops were actually grown has been perceived only by macroremain analysis. These were *Triticum* (different species) and *Hordeum vulgare* (Fig. 5.5 and Tab. 5.3).

Other possible cultivars may be looked for in the Brassicaceae and Fabaceae families. *Camelina sativa* macrofossils have been found but in low amount, thus its cultivation remains doubtful. Identification of Brassicaceae pollen at genus level is not easy, thus no hints can be achieved by pollen content. Fabaceae are concerned only with genera not involved into cultivation, both in pollen and macroremains.

The Caryophyllaceae family is well documented only in the macroremains as only a few pollen types are identifiable. 10 different *taxa* could be identified as plant macroremains; most typical are *Arenaria serpyllifolia* and *Cerastium* sp. (Fig. 5.5 and Tab. 5.3).

A similar outline is yielded by the identification of the Lamiaceae family where 13 *taxa* resulted from the macroremain analysis, while only two pollen types at family identification level were got by pollen analysis. The identified Lamiaceae species belong to a very high diversity of habitats (lakeshore vegetation belt, forest, crop fields, meadows and pastures). Typical *taxa* are *Origanum vulgare* and *Lycopus europaeus* in the macrofossil record, and *Mentha* type in the pollen one, the latter including pollen both of *Origanum vulgare* and *Lycopus europaeus*.

Rosaceae diaspores are almost exclusively represented by gathered plants and among them tree and shrubby species are prevailing. Most of them are not identifiable in the pollen record. The most abundant pollen type is *Filipendula*, which is usually over-represented in the pollen record as it is often quite widespread in the wetland habitats, but not too much close to the settlements as no fruits were found in all analysed samples (Fig. 5.5 and Tab. 5.3).

The identification of fruits and seeds of the Cyperaceae family allow for detailed identification that are not feasible with pollen. Pollen identification at light microscope is normally limited to family level. In the macrofossil record, we identified *Cyperus* and *Schoenoplectus* species as well as *Carex* genus fruits.

The Polygonaceae family is well documented both in pollen and macroremains. The most common species *Polygonum persicaria* and *P. aviculare* are detected both as pollen and as fruits.

Apiaceae macroremains are mainly represented by diaspores having adhesive mechanisms (spines and hooks), probably dispersed in the site by man or animals (exozoochory), e.g. *Torilis* spp. and *Daucus carota*. The pollen % of Apiaceae is substantial, thus likely including several different *taxa*, but the pollen grains were not further identified (Fig. 5.5 and Tab. 5.3).

The Cistaceae and Plantaginaceae families are documented only by pollen record. The costant abundance of *Helianthemum* pollen does not correspond to any macroremains find. The same figure concerns Plantaginaceae, with several pollen types identified, but macroremains are completely missing.

A further opportunity to compare pollen and plant macroremains is given by the analysis of goats and sheep coprolites found in the same samples of section 98 and by the off-site pollen sequence (mastercore LAV1 in Sector D). In order to estimate the contribution of coprolites as the vehicle for pollen transport to the pile dwelling basin, the pollen content of synchronous sediments in the master core LAV 1 from the basin centre, in the cultural layers from the pile dwelling (samples from section 98), and in the coprolites extracted from these cultural layers (Fig. 5.6) have been compared.

The pollen % average and standard deviation of selected *taxa* have been plotted in the figure 5.6. The standard deviation in coprolites % is particularly high as the pollen content is strongly different from one coprolite to another (Fig. 5.4).

The most important results emerging from this comparison are as follows:

- arboreal pollen (*Carpinus, Quercus* and *Corylus*) shows the highest % in the master core LAV1. Hazel pollen % is apparently very high in coprolites, this is due to 2 single coprolites particularly rich in hazel pollen (actually the pollen % shows a very high standard deviation);
- there is a high pollen % of Apiaceae and Poaceae in the cultural layers of the pile dwelling of section 98 in Sector A and in coprolites found in the same layers. The Apiaceae species included in coprolites are mainly linked to meadows (e.g. *Daucus carota, Peucedanum, Seseli libanotis* type and *Torilis arvensis*) rather than to wetland habitats, as well as those identified in macroremains analysis of cultural layers samples (Fig. 5.5);
- the highest % values of Cichorioideae and Scrophulariaceae pollen are recorded in coprolites and in cultural layers (section 98, Sector A). The Scrophulariaceae pollen found in coprolites is particularly abundant and was mainly identified as *Veronica* and *Odontites* (pollen from the cultural layers was not deeply identified).

RESULTS 2: LUCONE D
6. Surface samples analysis: spectra of crops and wild *taxa*

In this chapter, the results of the surface samples analysis from the Lucone D site are presented. Table 6.1 summarizes the number of identified *taxa* according to their preservation and the archaeological context (settlement phase; for the archaeological background see Chap. 1.6.1). Tables 6.2a-c give the number of *taxa* for each ecological group. The total number of remains are given in tables 6.3 (a, b) and 6.4 (a, b). Statistical results are plotted in the figures 6.1, 6.2, 6.3 and 6.4.
A total amount of 38 samples from the cultural layers of the Lucone D have been analysed. From the 1st settlement phase, 13 samples were included in the following statements, from the 2nd phase 25 samples. All the 38 samples were semiquantitatively analysed, a selection of 8 samples from the 1st phase and of 14 samples from the 2nd phase were fully quantitatively analysed.
In total 146 *taxa* have been identified: 123 from the 1st phase samples and 95 from the 2nd phase samples (Tab. 6.2). Despite the lower number of samples analysed in the first settlement phase, a higher number of *taxa* was found.

6.1 Preservation of the plant remains

All samples collected in organic-type cultural layers of both settlement phases yielded plant macroremains preserved through waterlogging and charring (Tab. 6.1). Most of the remains are preserved in waterlogged, subfossil state; a reduced quantity is preserved as charred remains, and only a few are partly charred. In contrast to Lavagnone, the Lucone D site stratigraphy contains a burnt layer, due to a fire event ending the first settlement phase (for details of the archaeological stratigraphy see Chap. 1.6.1.3). This burnt layer consist of a huge amount of charred material diversified in terms of number of remains and *taxa*. Large cereal stores with many whole ears (filling of large pots) were preserved *in situ* (see App. 4). This recalls Hornstaad Hörnle 1 (Bodensee, Southern Germany) (Maier 1996, 2001).
Charred remains mainly include cultivated *taxa* (mostly cereals and flax) and other useful plants (gathered species, e.g. *Cornus mas*, *Quercus* sp., *Corylus avellana* etc.). Only some cereal remains (both grains and spikelets) and one fragment of *Linum* seed are preserved partly charred. The preservation is very good both for waterlogged and charred remains.

6.2. General results: densities (concentrations) and number of *taxa*

The 1st settlement phase samples (8 samples fully quantitatively analysed) yielded 18’252 plant remains. 215’410 remains were extrapolated for the total volume of 38.5 litres (Tab. 6.3a). In the 14 samples of the 2nd settlement phase, 14’143 remains were recovered and 146’981 were extrapolated for the total volume of 50.5 litres (Tab. 6.4a).
A total amount of 146 plant *taxa* have been recorded in the two settlement phases (*taxa* occurring in both phases were counted only once; Tab. 6.1). 141 of these were present in waterlogged state, only 30 were preserved in charred state. Only 3 *taxa* were found slightly charred. The identification reached the species level in 98 out of 141 waterlogged *taxa* and 25 out of 30 charred ones. In the table 6.2 a detailed overview of the number of *taxa* in each ecological group is given.

Considering the single settlement phases, the first one appears to be richer in number of remains (see above) and number of *taxa* as well: 123 *taxa* in the first phase versus 95 in the second one (Tab. 6.1). The average concentration of remains per litre of sediment is also higher in the 1st settlement phase (4733.45 n. remains/l with min / max: 343 / 15'978.15). The 2nd settlement phase samples yielded only 2853.2 n. remains/l (min / max: 740.86 / 11'168.22) (see Tab. 6.3a and Tab. 6.4a).

As in the Lavagnone samples the concentration of plant remains per litre strongly changes from one sample to another (Chap. 3.2). This is more evident in the 1st settlement phase samples. The standard deviation of the mean concentration is actually higher than in the samples of the 2nd phase (± 6096.4 comparing to ± 2720.3). Some samples of the 1st phase show a very high concentration of remains (e.g. LUCc1, LUCc107, and LUCc113), these were all collected from the cultural layer SU5 (App. 3; for archaeological details see Ch. 1.6.1.3 and Fig. 1.6.1.3) Only one sample from the same layer is an accumulation of remains belonging to almost exclusively one taxon (LUCc63): charred acorns.

Samples from the burnt layer (SU4, 1st settl. phase) are rich in charred remains (mostly cereals); however, they contain waterlogged remains as well, but only a very few - or none at all - belong to *taxa* of lakeshore vegetation or aquatic habitats (local vegetation; Tab. 6.3b). The samples from the 2nd settlement phase yielded both charred and waterlogged remains, the latter in some samples are mainly represent by more dense and lignified items such as *Rubus* endocarps, *Sambucus*, *Physalis alkekengi*, *Ficus carica* and so on. Nevertheless, there are also samples very rich in waterlogged remains and *taxa* (see Tab. 6.4b and Tab. 6.2).

6.3. The crop spectrum

The crop spectrum is firstly composed of cereal species, secondly of flax and a few remains of *Carthamus tinctorius*. These remains all-together represent almost half of the amount of all remains collected in both settlement phase (45.51 %, Fig. 6.4). A significant percentage of cultivated plants are reached in the 2nd settlement phase, more than 50% (56.6%, Fig. 6.3), while in the first phase they are the second largest group, after the group "Woodlands, wood edges and clearings" (with all the likely gathered plants), with a percentage of 37.8% (Fig. 6.2).

6.3.1. Cereals

In the Lucone D cultural layers, we totally found 7 cereal *taxa* (Tab. 6.3b and Tab. 6.4b). Most of the remains were identifiable to species level, nevertheless, some morphotypes, intermediate between emmer, einkorn and the 'new glume wheat' were identified too.

In most of the samples of both settlement phases, cereal remains consist of spikelet forks, glume bases, rachis fragments and grains (for the composition of the burnt layer of phase 1 see below). Among them, the spikelet forks and the glume bases are the most abundant in all samples. Parts of the ears extremities (spikelets from the lower- and uppermost part of the ear, ear bases), culm and rachis fragments are represented as well, and mostly identified as *Triticum* sp. or Cerealia. Some complete spikelets (spikelet forks with grains) were also found. Charred grains are extremely abundant in the 1st settlement phase (ratio grains/chaff remains is 1:15.26). Contrarily, in the 2nd settlement phase only a few grains were recovered compared to chaff remains (ratio 1:157.62). The composition of the judgement samples (App. 4) collected in the burnt layer was different. These samples yielded strong accumulations of cereals including complete or almost complete ears. These samples are not taken into account in the present analysis.

Cereal remains were preserved both charred and waterlogged. The identification of uncharred remains was problematic as it was for the Lavagnone ones (Chap. 3.3.1), but the flattening of the Lucone D remains is less pronounced allowing somehow a better identification.
Apart from the sample LUCc63 of the 1st settlement phase, which yielded only a very few cereal remains, all the other samples had a good content of remains of the main cereal *taxa*. In the samples LUCc394 and LUCc397 of the 2nd settlement phase the preservation of cereal remains is mainly waterlogged. Uncharred cereals are also frequent in the samples LUCc325 LUCc367, and LUCc372, but very sporadic in all the others.
As in the chapter on Lavagnone, the overall cereal *taxa* spectrum will be discussed primarily based on charred chaff remains, which allow a better identification of the cereals to the species level. Nevertheless, the cereal spectrum based on cereal grains is commented too.
The identified cereal *taxa* are: einkorn (*T. monococcum*), emmer (*Triticum dicoccum*), the 'new glume wheat' (*Triticum* nn), barley (*Hordeum vulgare*), spelt (*Triticum spelta*), maccaroni wheat / rivet wheat (tetraploid naked wheat, *T. durum / T. turgidum*), and bread wheat (hexaploid naked wheat, *T. aestivum*) (for identification criteria, morphological features, and illustrations, see the catalogue of the main species in the App. 7). No remain of broomcorn millet (*Panicum miliaceum*) was found (Tab. 6.3 and Tab. 6.4). The most frequent *taxa* are emmer, einkorn, the 'new glume wheat' and barley (Tab.6.3b and Tab. 6.4b). Actually, in the 1st settlement phase these cereals are present in all samples (100%), except barley, which has a frequency of 92.3%. In the 2nd settlement phase barley is recorded with the highest frequency (92%), while the other three cereals are less frequent (einkorn 64%, emmer 84%, and the 'new glume wheat' 88%).
Based on number of charred chaff remains, the most abundant cereal *taxa* in the 1st settlement phase are firstly emmer and secondly the 'new glume wheat'; huge amounts of einkorn and barley remains have been recovered too. Remains identified to the genus *Triticum* sp. are also very abundant, they have larger proportions than einkorn and barley (Fig. 6.2b). In the 2nd settlement phase emmer changes its place with the 'new glume wheat' which is therefore the most abundant taxon (Fig. 6.3b).
The cereal spectrum based on charred grains is dominated by the 'new glume wheat' and barley in the 1st settlement phase (35.45% and 29.1% of the charred grains). In the 2nd phase the percentage of barley grains is strongly higher than that of any other cereal *taxa*: more than 60% of the identified charred grains come from barley (Fig. 6.2c and 6.3c). Most of the grains recovered in the 1st settlement phase were found in two samples: LUCc1 and LUCc46. Remains from the sample LUCc1 present a better preservation. Also in the 2nd settlement phase we have recorded two samples yielding most of the cereal grains: LUCc305 and LUCc367 (see Tab. 6.4a).
Considering in detail each cereal taxon we can highlight the following results:
<u>New glume wheat' (*Triticum* nn)</u>. It shows the highest ubiquity values (100%) in the 1st settlement phase and is the most frequent after barley in the 2nd settlement phase (88%). In term of chaff remain numbers it is the most abundant cereal in the 2nd settlement phase (36.17%, Fig. 6.3b) and the second one in the 1st settlement phase (26.06%, Fig. 6.2b). In some cases we have found morphotypes intermediate between the new glume wheat type with either einkorn or emmer. Both spikelet forks and glume bases of such intermediate types were found (for identification detail see App. 7: catalogue of the main species). The grains' proportion provides a different spectrum, as the new glume wheat grains are particularly abundant in the 1st settlement phase, with 35.45% of the charred grains, and less abundant (below 10%) in the 2nd settlement phase.
<u>Emmer (*T. dicoccum*)</u>. It has a ubiquity of 100% in the 1st settlement phase and 84% in the 2nd one. It is the most abundant cereal taxon in the 1st phase based on the proportions of chaff remains (33.12%, Fig.6.2b) and the second one in the 2nd phase (23.36%, Fig. 6.3b). Emmer grains have more or less the same proportion (based on number of remains) in both phases (14-15%, Fig. 6.2b and Fig. 6.3b).

Einkorn (*T. monococcum*). Although einkorn is as frequent as emmer in the 1st phase (ubiquity 100%) and similar in the 2nd one (93%), it never reaches very high values of abundance both concerning chaff remains and grains. The amount of its remains is always lower than emmer and the 'new glume wheat'. In the case of grains, it is even lower than barley.

Barley (*Hordeum vulgare*). Chaff remains of barley are in fact less abundant than those of emmer, the 'new glume wheat' or einkorn in both phases (a proportion of around 7-8% based on the number of remains, Fig. 6.2b and Fig. 6.3b). Despite the lower percentages of chaff remains, grains are quite abundant, particularly in the 2nd phase (Fig. 6.2c and Fig. 6.3c). The sample LUCc305 yielded a huge amount of barley grains.

Spelt (*T. spelta*) and naked wheat (*T. durum / T. turgidum* and *T. aestivum*). Finds of spelt and naked wheat are rare but more frequent in the 2nd phase. Spelt remains are glume bases and some grains, while naked wheat remains consist of rachis fragments composed by 2 or more segments.

6.3.2. Oil seeds

Although the production of oil is not attested by any artifacts or evidences in the plant macroremain's preservation, it can be supposed for some plant species as they produce seeds or fruits rich of oily substances. Frequently those *taxa* can also be exploited for other purposes: food, dyeing, textile fibres.

The only taxon of domesticated plants producing oil seeds found in the Lucone D cultural layers are flax (*Linum usitatissimum*) and safflower (*Carthamus tinctorius*). The latter is discussed in the chapter 6.3.4 as likely cultivated taxon.

Remains of flax were recorded in both settlement phases. They were preserved in waterlogged state or as charred remains. They consist of different parts of the plant: seeds, capsules, capsule segments, stem fragments (fibres). Complete capsules were found only in charred state. Waterlogged remains, both seeds and capsules, are much more fragmented. The fragmentation of seeds did not allow any morphological or morphometrical analyses.

The most frequent flax remains in the 1st settlement phase are charred seeds found in 53.85% of the all analysed samples, waterlogged seeds and capsule fragments have a ubiquity of 30.8%. High numbers of flax remains, both charred and waterlogged, are from the sample LUCc1, while samples LUCc107 and LUCc113 yielded a large amount of subfossil flax remains. Stem fragments were recovered in only two samples (ubiquity of 15.4%) (for details see Table 6.3b).

The 2nd settlement phase has a lower amount of charred flax remains recovered in a single sample (LUCc343). In contrast, waterlogged remains are more frequent and abundant. They consist of fibres and seeds that are distributed in 20% of the samples, and capsule segments found in 24% of samples (Tab. 6.4b).

Judgement samples consisting of small accumulation of charred seeds have been collected in the burnt layers of settlement phase 1, too (samples not included in the present analysis, see App. 4).

6.3.3. Pulses

Pulses remains are missing either in the 1st and in the 2nd settlement phase. Charred seeds of Fabaceae (not identifiable to genus or species level), as well as waterlogged pod fragments, were recovered in small amounts in one sample of the 1st phase (Tab. 6.3a) and three samples of the 2nd phase (Tab. 6.4a). The very small size of both seeds and pod fragments excluded any probability that these are domesticated *taxa*.

Pulses certainly played an important role in the diet of the time, but they are under-represented in the plant assemblages. This is likely due to issue of preservation, really problematic in waterlogged sites (see also results in Lavagnone site, Chap. 3.3.3).

6.3.4. Other potential domesticated plants

A few remains of safflower (*Carthamus tinctorius*) were found in both settlement phases (ubiquity of 38.46% in the 1st settlement phase and 20% in the 2nd settlement phase, Tab 6.3b and Tab. 6.4b). They were preserved in waterlogged state and consist of 6 complete (or almost complete) achenes (3 in each settlement phases) and 8 fragments (respectively 3 in the 1st settlement phase and 5 in the 2nd one). The fragments were attributed to *Carthamus* cf *tinctorius* because no diagnostic features of the achene morphology were evident (see App. 7: catalogue of the main species). No remains of *C. lanatus* were found.
It's worth to mention in this plant group another species, which could have been cultivated: *Camelina sativa* (Gold of pleasure). *Camelina* finds are limited to the 2nd settlement phase samples and very few in amount. They consist of 2 half siliques (or countable silique part) and 8 silique fragments found in 3 different samples.

6.4. The wild plant spectrum

6.4.1. Potentially collected resources

The potentially collected plants recovered in the Lucone D layers consist of wild fruits and edible nuts. They have been found in both settlement phases in huge amounts. The preservation of these remains is mainly waterlogged. The number of waterlogged *taxa* amounts to 18 in the 1st settlement phase and 16 in the 2nd phase. Other 8 plant species characterized by starchy seeds and considered as edible plants in literature should be added in both phases. These *taxa* are commented below.
The 1st settlement phase yielded 6 *taxa* of potentially collected plants in charred state (*Cornus mas*, *C. sanguinea*, *Corylus avellana*, *Physalis alkekengi*, *Quercus* sp., *Rubus* gr. *fruticosus*) and the amount of these remains is substantially larger than in the 2nd phase, where 5 *taxa* were identified (*Cornus mas*, *Corylus avellana*, *Quercus* sp., *Rubus* gr. *fruticosus*, *Vitis vinifera* subsp. *sylvestris*).
Most of these *taxa* are tree or shrub species, therefore included in the ecological group of "Woodlands, wood edges and clearings".

<u>FIRST SETTLEMENT PHASE.</u>
Concerning the samples belonging to the 1st settlement phase, the commonest collected species was blackberry (*Rubus* gr. *fruticosus*) found in all the samples (100%) (Tab. 6.3b). In terms of number of remains it is the fourth abundant taxon (6712 calculated items). Charred remains were retrieved only in two samples (Tab. 6.3b).
Corylus avellana, *Quercus* sp., *Cornus mas* and *Physalis alkekengi* were found in 84.6% of the samples (Tab. 6.3b). Hazel (*Corylus avellana*) remains were identified in all the fully quantitative analysed samples (Tab. 6.3a). In the sample LUCc1 the hazelnut concentration is strongly higher than in the other samples (28 items/l). Hazel remains consist of shell fragments; the possible number of nuts was calculated measuring the total surface of fragments (see Chap. 2.6). Complete nuts were found and collected by the archaeologists during excavation. Among them, we mention the odd find of two coupled nuts.
Remains of acorn (*Quercus* sp.) include abundant waterlogged pericarp fragments, acorn bases and cupules (respectively recorded with a ubiquity of 38.4%, 54%, and 15.4%). The possible number of acorns was

calculated measuring the total surface of the pericarp fragments, as done for hazel nuts (see Chap. 2.6). The majority of acorn remains are from three samples (in decreasing order: LUCc107, LUCc113, LUCc1). Carbonized acorn remains include also numerous “kernels” (cotyledons) (ubiquity of 38.4%); mainly they come from samples LUCc58 and LUCc63 (Tab. 6.3a). In the latter, a concentration of more than 250 charred acorns was calculated.

Waterlogged endocarps of cornelian cherry (*Cornus mas*), although as frequent as hazelnuts and acorns (ubiquity of 69.2%), were recovered in low amounts and mainly concentrated in the two samples LUCc107 and LUCc113 (yielding respectively 25 and 140 items) (Tab. 6.3a). Only one sample yielded charred stones of cornelian cherry (LUCc58).

Seeds of bladder cherry or Chinese lantern (*Physalis alkekengi*) are quite copious and frequent (ubiquity of 84.6%). More than 2500 items (both waterlogged and charred) were counted overall the full-quantitatively analysed samples; highest concentrations occurs in the sample LUCc1 (219 items/l).

Stone cells of pear (*Pyrus* sp.) are the most abundant remains. They have been found in 4 out of 8 fully quantitative analysed samples with the highest amounts in the two samples LUCc1 and LUCc113. In the all semi-quantitative analysed samples, waterlogged remains of pear (*Pyrus* sp. and *Pyrus pyraster*), including seeds, calyx tube remains and stalk fragments, were found in 77% of the samples.

The ubiquity of fig (*Ficus carica*) and wild strawberry (*Fragaria vesca*) are respectively 53.8% and 46.15% (Tab. 6.3b). Even considering they produce aggregate fruits or infructescences, the gathering and consumption of these species could have been quite common as their nutlets were found in large amounts. The three samples LUCc113, LUCc1, and LUCc107 are particularly rich of these small nutlets (Tab. 6.3a).

All the other gathered plants recovered in the 1st settlement phase have been found in less than 38% of the samples. Among them the most important as collected resources are wild grape (*Vitis vinifera* subsp. *sylvestris*, ubiquity of 61.5%), and crab apples (*Malus* sp., *Malus sylvestris*, ubiquity of 30.7). Wild grape pips are mainly from the three samples LUCc113, LUCc107, and LUCc34. They are preserved exclusively as waterlogged material. The identification of apple remains is often doubtful and hard to distinguish from pear, particularly for seeds and pericarp fragments (see App. 7, catalogue of the main species). Maloideae pericarp remains – which include *Pyrus* remains too – are abundant and distributed mainly in the three samples LUCc1, LUCc113, and LUCc107 (Tab. 6.3a) (ubiquity of 30.7%). No complete apples have been found.

Other wild fruits probably collected as food, but recorded by only a few remains are cornel or dogwood (*Cornus sanguinea*), hawthorn (*Crataegus monogyna*), blackthorn or sloe (*Prunus spinosa*), probable cherry (*Prunus* cf *avium*), St. Lucie cherry (*Prunus* cf *mahaleb*), rose (Rosa sp.), raspberry (*Rubus idaeus*), and elder (*Sambucus nigra*),

SECOND SETTLEMENT PHASE.

The spectrum of gathered plants in the 2nd settlement phase differs from phase 1 concerning the ubiquities of the *taxa*. Percentages of *taxa* ubiquities decrease compared to the 1st settlement phase. Blackberry (*Rubus* gr. *fruticosus*) is still the most common taxon with a ubiquity of 80%. Endocarps of this species are also the most abundant remains; they were recovered in all the fully quantitative analysed samples in high amounts (Tab. 6.4a).The highest number of remains was counted in the sample LUCc305 (concentration of 5774 items/l).

Acorn remains (found in 60% of the all samples) are mainly represented by waterlogged pericarp fragments and acorn bases, while carbonized remains are exclusively represented by acorn bases, picked up in four samples (Tab. 6.4b). Samples particularly rich in acorns are LUCcNN1, LUCc305, LUCc367 and LUCc372 (see Tab. 6.4a).

Hazelnuts display a ubiquity of 64% (Tab. 6.4b) and the highest concentrations of the remains are in the three samples LUCc242, LUCcNN1, and LUCc367 (Tab. 6.4a).
60% of the 2nd settlement phase samples yielded stones of cornelian cherry and pips of wild grape. Although less common compared to the 1st settlement phase, hundreds of waterlogged cornelian cherry stones were found in the samples LUCc394 and LUCc397 (Tab. 6.4a). The number of wild grape pips remains increase in this settlement phase samples and are especially abundant in the samples LUCc394 and LUCc305.
Bladder cherry (*Physalis alkekengi*) and pear remains (*Pyrus* sp.) have been found in 44% of the samples (Tab. 6.4b). Apart of one sample, bladder cherry is regularly distributed in all the fully quantitative analysed samples. Pear remains are basically represented by stone cells, abundant in all the samples characterized by better preservation. Nevertheless, a fair number of wild pear seeds (*Pyrus pyraster*) have been identified in this settlement phase, too. The large consumption of pears is testified by the abundance of Maloideae pericarp fragments found in 32% of the all samples as well as *Malus / Pyrus* seeds (ubiquity of 20%) (Tab. 6.4b), not identifiable to species level.
All the remaining 'likely collected' plants – fig, strawberry, rose, elder, dogwood (*Cornus sanguinea*) and *Prunus* species (*P. mahaleb*, *P. spinosa* and *Prunus* sp.) – are distributed in less than 25% of samples. Fig and strawberry are less common compared to the 1st settlement phase, but the amount of their remains is still high (the three samples LUCc305, LUCc367 and LUCc372 are the richest ones).

We add here results dealing with some plant species considered as edible plants in literature and recorded in the wild plants spectrum of both settlement phases. Some of them are characterized by a high production of starchy seeds; of other ones the consumption of leaves or roots seems to be likely. As all of these species are common as weeds of crop fields and ruderal habitats, it is not clearly evident whether they have been intentionally collected in the surroundings of the settlement for food purposes or accidentally entered into the settlement (see for a discussion Chap. 8.3). Actually, no heap of pure fruits of any of these species was found in the excavated layers. Anyhow, we mention the following species as probable collected wild *taxa*: fat hen (*Chenopodium album*), black bindweed (*Fallopia convolvulus* syn. *Polygonum convolvulus*), purslane (*Portulaca oleracaea*), some *Polygonum* species (*Polygonum lapathifolium*, *P. aviculare* and *P. persicaria*), *Valerianella dentata* and *Daucus carota*.
The small seeds of fat hen (ecological group 2.2, SW) are quite common in the fully quantitatively analysed samples[20]: their ubiquities reach 87.5 % in the 1st settlement phase (Tab. 6.3a) and 93% in the 2nd one (Tab. 6.4a). The species is a high fruit producer, this could explain the great amount of seeds found in each sample. In the sample LUCc113 some charred seeds were recovered, too.
Purslane (ecological group 2.2, SW) is more common in the 1st settlement phase where it reaches a ubiquity of 87.5% in the fully quantitative analysed samples (36% in the 2nd phase). The amount of seeds found there is much greater as well, particularly in samples LUCc1, LUCc107 and LUCc113. Fruits of *Fallopia convolvulus* (ecological group 2.2, SW) are not very abundant but frequent in the 1st phase (87.5% of the fully quantitative analysed samples). Larger amounts of black bindweed fruits per sample occur In the 2nd phase, but their distribution is limited to the 50% of the fully quantitative analysed samples.
Polygonum species are distributed in less than 40% of the samples in both phases and they are only represented by a few remains. Fruits of *Valerianella dentata* (ecological group 2.2, SW) were found in fair amounts, too, in both phases. Large numbers of fruits were picked up in the sample LUCc1.

[20] For the following *taxa* – producing small seeds retrieved exclusively in the small fraction – we used the ubiquity in the fully quantitative analysed samples where the small fraction was analysed for all samples.

Wild carrot (ecological group 3.1, MP) was found in 75% of the fully quantitative analysed samples of the 1st phase and in 57% of samples of the 2nd phase. Samples yielding the highest amounts are LUCc1 and LUCc305, respectively of the 1st and 2nd phase. Charred mericarps were found as well in one sample of the 1st phase and 2 samples of the 2nd phase.

6.4.2. Potential weeds

Weeds including winter and summer crop weeds, annual and perennial ruderal species are represented by 39 plant *taxa* in the 1st settlement phase and 21 plant *taxa* in the 2nd settlement phase. They correspond respectively to 31.7% and 22.11% of the all *taxa* in each phase (Fig. 6.1).

6.4.2.1. Winter crop weeds (Secalinetea) (WW)

FIRST SETTLEMENT PHASE.

Winter crop weeds found in the 1st settlement phase are represented by 8 *taxa* in a proportion of 6.5% of all *taxa* (Fig. 6.1a). Three *taxa* were preserved through charring and 7 through waterlogging. The commonest *taxa* were black-bindweed (*Fallopia convolvulus*) and narrow fruit corn salad (*Valerianella dentata*) appearing in 46.15% and 38.46% of all the analysed samples respectively (Tab. 6.3b). Both of them occur either waterlogged or charred. *Fallopia convolvulus,* together with *Papaver argemone* (prickly poppy), are the only *taxa* belonging to the Aperetalia Order. Nevertheless, the former can also occur on slightly acidic soils in habitats of the Caucalidion Alliance or in different ruderal habitats.

Valerianella dentata is included in the Caucalidion Alliance , although not exclusively, and is characterized by numerous finds in the fully quantitative analysed samples. 'Character species' for the Caucalidion Alliance are also *Stachys annua*, field hedge parsley (*Torilis arvensis*), and broad-fruited cornsalad (*Valerianella rimosa*). They show low frequencies in the analysed samples of the 1st settlement phase (Tab. 6.3b).

SECOND SETTLEMENT PHASE.

In the samples of the 2nd settlement phase, weeds of winter cereals are represented by 6 different plant *taxa*, corresponding to 6.32% of the all *taxa* found in this phase (Fig. 6.1b). Five *taxa* are preserved in waterlogged state and only two in charred state.

Fallopia convolvulus and *Valerianella dentata* are still the most frequent (respectively 28% and 24%, Tab. 6.4b) and abundant *taxa*. Even if represented by only a few remains (1 or 2 items in each sample), *Camelina sativa* appears in this settlement phase (Tab. 6.4a). It can be ascribed to the Caucalidion Alliance. *Papaver* species and *Valerianella* cf *rimosa* are not anymore recorded.

6.4.2.2. Summer crop weeds/mostly annual ruderals (SW)

FIRST SETTLEMENT PHASE.

Totally 14 plant *taxa* belonging to summer crop weeds and annual ruderals have been found in the first settlement phase. They correspond to a proportion of 11.38% of all flora *taxa* found in this phase (Fig. 6.1a). The preservation of these remains is mainly waterlogged, only two *taxa* were preserved through charring as well: fat-hen (*Chenopodium album*) and purslane (*Portulaca oleracaea*). Fat-hen is the commonest taxon (92% in all the analysed samples and 87.5% in the fully quantitative analysed ones, see Tab. 6.3b and Tab. 6.3a) and the most abundant one. The highest amount of its seeds were found in the samples LUCc1, LUCc107, and LUCc113 (Tab. 6.3a). Purslane has a lower frequency (46% in all the analysed samples and

87.5% in the fully quantitative analysed ones, see Tab. 6.3b and Tab. 6.3a), but is characterized by numerous finds of seeds, particularly in the three samples mentioned above.
Fool's parsley (*Aethusa cynapium*), an annual herb common in ruderal vegetation on clay carbonatic soils, is quite frequent: 54% of the samples yielded parsley mericarps. Remains of *Anagallis arvensis*, although less frequent (23% of the samples), are present in fair amounts. All the other *taxa* were found in less than 8% of the samples. Most of the identified *taxa* require dry and warm open land.

SECOND SETTLEMENT PHASE.
In the 2nd settlement phase only 6 *taxa* of summer crop weeds and annual ruderals were identified, corresponding to 6.32% of the all identified flora *taxa* in the 2nd phase (Fig. 6.1b). No charred remains belonging to these *taxa* have been found. The most common and abundant taxon is still fat-hen with a frequency of 52% (92.85% in the fully quantitative analysed samples) and the highest amount of remains, yielded mainly by the sample LUCc305 (Tab. 6.4a). Other important *taxa* are purslane and *Aethusa cynapium*, with respectively a ubiquity of 16% (36% in the fully quantitative analysed samples) and 8%. All the other *taxa* are less than 4% frequent.

6.4.2.3. Perennial ruderal and crop field ubiquitary species

FIRST SETTLEMENT PHASE.
In the 1st settlement phase 17 plant *taxa* belonging to this ecological group have been found. They correspond to 13.82% of the all *taxa* identified in the 1st phase (Fig. 6.1a). Remains of the all plant *taxa* were preserved through waterlogging, only three *taxa* remains were also charred.
The commonest *taxa* are nipplewort (*Lapsana communis*), creeping cinquefoil (*Potentilla reptans*) and dwarf elder (*Sambucus ebulus*) (Tab. 6.3b). They are recorded in 46.15% of all 1st phase samples. *Lapsana communis* and *Potentilla reptans* are also the most abundant *taxa*, together with vervain (*Verbena officinalis*). The latter one is recorded in 31% of the samples. Apart from knotweed (*Polygonum aviculare*) and redshank (*P. persicaria*) showing still a relative high ubiquity (respectively 38.4% and 23%), all the other *taxa* are characterized by only a few remains, and are less than 15% frequent.
Among all the *taxa* included in this wide-ranging ecological group, we can distinguish a number of *taxa* mostly linked to humid and nutrient-rich soils such as some buttercup species (*Ranunculus* spp.), *Potentilla reptans*, *Polygonum persicaria*, *Lapsana communis*, common nettle (*Urtica dioica*), and dwarf elder (*Sambucus ebulus*). They include the most frequent and abundant *taxa*. Another small group is composed by species of drier environments such as: white campion (*Silene alba*), greater plantain (*Plantago major*) and knotweed (*Polygonum aviculare)*.

SECOND SETTLEMENT PHASE.
The number of remains and *taxa* strongly decreases in the samples belonging to the 2nd settlement phase. Only 9 plant *taxa* have been attributed to this group (9.47% of all *taxa* found in the 2nd settlement phase samples, see Fig. 6.1b). All of these remains are preserved through waterlogging, no charred remains occur. The most frequent and numerous fruits/seeds belong to *Potentilla reptans* (found in 50% of the fully quantitative analysed samples, see Tab. 6.4a). Other abundant remains belong to *Verbena officinalis, Sambucus ebulus* and *Polygonum aviculare*.
Taxa of both humid and nutrient-rich habitats and dry environments are recorded, thus no preference of plants from one of the two ecological conditions can be detected in the fossil assemblage.

6.4.3. Grasslands: meadows and pastures (MP)

The grassland vegetation is represented by 19 *taxa* in the 1st settlement phase (15.45% of the all *taxa* found in 1st settlement phases, see Fig. 6.1a); remains of 18 *taxa* were found in waterlogged state and of only 2 in charred state. The 2nd phase yielded remains of 15 *taxa* (15.79% of the all *taxa* found in 2nd settlement phases, see Fig. 6.1b), only one was found also in charred state.
Within the grassland vegetation, four groups have been distinguished (see Chap. 2.8 for a detailed description).

i) *taxa* of dry fallows (MP 3.1)
In the 1st settlement phase 7 *taxa* are characteristic of dry fallows. The commonest species are wild carrot (*Daucus carota*) and thymeleaf sandwort (*Arenaria serpyllifolia*) found in respectively 46% and 38.5% of the samples (Tab. 6.3b). The most abundant remains belong to *Arenaria serpyllifolia* (Tab. 6.3a). Yellow bugle (*Ajuga chamaepytis*) and childing pink (*Petrorhagia prolifera*) were also quite frequent with ubiquities of almost 31%.
The 2nd settlement phase samples are characterized by a lower number of these *taxa* (6 plant *taxa*) and of remains. Wild carrot is still the most frequent species, it shows a ubiquity of 16% (57% in the fully quantitative analysed samples, Tab. 6.4a). In this phase wild carrot mericarps are also the most abundant remains. *Arenaria serpyllifolia* and *Ajuga chamaepytis* are quite abundant too. The former is characterized by very small seeds, thus more frequent in the fully quantitatve analysed samples (ubiquity of 29%) that included analysis of fine fraction of all samples. All the other *taxa* are less than 8% frequent.

ii) *taxa* of dry pastures/meadows (MP 4.1)
The number of *taxa* assigned to this group amounts to 6 in the 1st settlement phase samples and 4 in the 2nd settlement phase samples. The most commonly found species in both settlement phases is wall germander (*Teucrium chamaedrys*) recorded in 23% of the 1st settlement phase samples (Tab. 6.3b) and in 12% of the 2nd settlement phase samples (Tab. 6.4b). All the other *taxa* were found in only one sample each. All these remains were preserved through waterlogging.

iii) drained pastures/meadows (MP 4.2)
This vegetation is not documented in the Lucone fossil plant assemblages of both settlement phases.

iv) indistinct pastures and meadows (MP 4.3)
This group includes 6 *taxa* from the 1st settlement phase and 5 from the 2nd settlement phase. One out of the 6 *taxa* of the 1st phase was found only in charred state (*Bromus* cf *hordeaceus*). The ubiquity of all these *taxa* is limited to one sample. In the 2nd settlement phase all the remains are preserved only in waterlogged state, the most frequently found are *knautia* sp. (likely field scabious, *Knautia arvensis*) and self heal (*Prunella vulgaris*), respectively found in 12% and 8% of the samples (Tab. 6.4b).

6.4.4. Woodlands, wood edges, clearings (F)

The group of plants from ‘woodlands, wood hedges, and clearings’ includes 30 different *taxa* (7 charred, 30 waterlogged) in the 1st settlement phase samples and 28 *taxa* (9 charred, 27 waterlogged) in the 2nd settlement phase samples.
Most of these *taxa* can be considered as species selected and gathered for food supply in the woodlands surrounding the settlement. Due to this selection they cannot give a realistic picture of the natural forest

vegetation. Distribution, abundance, and preservation of these *taxa* were discussed in the chapter dedicated to gathered plants (Chap. 6.4.1).
Apart from the likely useful plant species, a small number of trees and shrubs species was found (*Carpinus betulus* and *Fagus sylvatica* in both settlement phases*, Alnus* sp. and *Frangula alnus* only in the 1st settlement phase). Besides, some herbs, growing as forest undergrowth or at woodland edges were present (7 *taxa* in the 1st settlement phase, 9 *taxa* in the 2nd settlement phase) (see Table 6.3b and Tab. 6.4b).
Beech (*Fagus sylvatica*) is distributed in 38.5% of the 1st settlement phase samples and 20% in the 2nd settlement phase samples (Tab. 6.3b and Tab. 6.4b). It might have been intentionally collected as well. The amount of its remains is almost equivalent in both settlement phases (respectively 55 and 65 items, see Tab. 6.3a and Tab. 6.4a). Among the herbs, common agrimony (*Agrimonia eupatoria)* is the most frequent *taxon* (ubiquities of 38.5% in the 1st settlement phase and 36% in the 2nd settlement phase, see respectively Tab. 6.3b and Tab. 6.4b). All the other *taxa* are less frequent. They were recovered in only one or two samples.

6.4.5. Lakeshore vegetation

The lakeshore vegetation has been divided into three ecological groups (6.1-6.3) whose definition was presented in the chapter 2.8. The proportions of plant *taxa* in these groups are more or less similar in the two settlement phases. The "wet terrestrial herbs" communities (group 6.1) are documented by a higher number of *taxa*, followed the habitats including the telmatic and seasonally dried-up belt (group 6.2) and finally the strictly littoral zone colonized mainly by helophytes (group 6.3).
The lakeshore vegetation consists altogether of 16 different *taxa* in the 1st settlement phase (remains of 1 in charred state, 15 waterlogged) and 12 *taxa* in the 2nd settlement phase (all the remains preserved in waterlogged state), corresponding respectively to 13% and 12.63% of the all *taxa* found in each settlement phase (Fig. 6.1a-b).
The commonest *taxa* in the wet meadows communities (group 6.1) are gypsywort (*Lycopus europaeus*) and hairy buttercup (*Ranunculus sardous*). They have been found with a ubiquity of respectively 23.07% and 15.38% in the 1st settlement phase and of 23.07% for both of them in the 2nd settlement phase (Tab. 6.3b and Tab. 6.4b). In the 1st settlement phase samples other frequent *taxa* are mint species (*Mentha spicata / M. suaveolens* and *M. aquatica / M. arvensis*). All the other species have been recorded in only one sample.
The most significant species of the group 6.2 were pale persicaria (*Polygonum lapathifolium*), and celery-leaved buttercup (*Ranunculus sceleratus*), high amounts of their seeds/fruits were found in both settlement phases. Due to the size of their fruits/seeds the record of these *taxa* is better in the fully analysed samples where the fine fraction was analysed. In these samples pale persicaria has a ubiquity of 62.5% in the 1st settlement phase and 36% in the 2nd settlement phase; celery-leaved buttercup was recovered in 50% of the samples of 1st phase and 21.4% of the 2nd phase (Tab. 6.3a and Tab. 6.4a). All the other *taxa* were found in only one sample.
The last group (6.3) includes only a very few *taxa*: three in the 1st settlement phase (*Alisma plantago-aquatica*, *Typha latifolia / T. angustifolia* and *Phalaris arundinacea*) and two in the 2nd one (*Typha latifolia / T. angustifolia,* cf *Poa palustris*). The ubiquity of these *taxa* is also very low; they were actually retrieved only in one or two samples (Tab. 6.3b and Tab. 6.4b). The most abundant remains were fruits of *Alisma plantago-aquatica* in the 1st settlement phase and of *Typha latifolia / T. angustifolia* in the 2nd settlement phase.
Reed beds are documented by the abundance of common bulrush / lesser bulrush (*Typha latifolia / T. angustifolia)* in both phases, and, in the 1st settlement phase, by the occurrence of *Phalaris arundinacea* as well.

6.4.6. Aquatic plants

In the 1st settlement phase 5 aquatic *taxa* have been recorded, they represent a proportion of 4.07% of the all identified *taxa* (Fig. 6.1a). The commonest finds are *Characeae* oogonia, they occur with a ubiquity of 38.45% (Tab. 6.3b) and were found in huge amounts. Other significant species recovered in high amounts are *Najas* species, particularly *N. flexilis* (Slander Naiad) and *Potamogeton* sp. (likely broad-leaved pondweed, *P. natans*). European white waterlily (*Nymphaea alba*) is documented only by a single remain.
In the 2nd settlement phase 4 aquatic plant *taxa* have been found. The most abundant remains are still *Characeae* oogonia (Tab. 6.4a). Remains of *Najas minor* were also found in large amount (despite they were retrieved in only two samples, see Tab. 6.4a). A few remains of pondweed species *(Potamogeton* sp.) and of common hornwort *Ceratophyllum demersum* (both with a ubiquity of 8%, see Tab. 6.4b) were found as well.

RESULTS 3: THE COPROLITES ANALYSIS
7. Spectra of micro- and macroremains in the goat/sheep coprolites

Goat and sheep coprolites recovered from sediment samples of Lavagnone and Lucone D (see Tab. 2.2, 7.1, and 7.3) have been analysed following the methods described in chapter 2.4. Results of plant macro- and micro-remains analysis, as well as of pollen analysis, are presented below. Discussion of these data and general remarks on animal husbandry are presented in chapter 8.5.

Lavagnone

The analysed 49 goat/sheep coprolites have been selected from 86 complete or almost complete pellets found in 35 surface samples and samples from column profiles (Tab. 7.1). Coprolites were selected from the highest possible number of different sediment samples in order to get more complete information about animal husbandry. Only two coprolites are from MBA layers (coprolites LAV48 and LAV49). Besides coprolites belonging to goats and sheep, many not nearer identifiable ruminant dung fragments were recovered, too (Tab. 7.1). No evidences of high concentrations of dung remains, i.e. places where animal were kept, were detected during the archaeological excavations. The sediment embedding dung remains was mainly composed by waterlogged mixed coarse organic matter (charcoal, wood fragments, twigs, seeds and fruits etc.). The faeces from Lavagnone (only the entire pellets were considered) weighed between 0.03 g and 0.24 g (mean 0.10 g, standard deviation 0.054 g) in waterlogged state. Some of them were more or less compressed, resulting in a flat shape, others were rounded and only a few were pointed. 30 out of 49 pellets contained determinable plant macrofossils (> 0.5 mm).

The analysed coprolites yielded macroremains, including not only plant but also insect remains (11 coprolites) and small stones (23 coprolites). Also charcoal fragments were quite frequent (11 coprolites). Among the botanical remains, the diversity of *taxa* is fairly high, and the macro- and micro-remain spectrum is quite different from one coprolite to another (Tab. 7.2 and App. 5a).

The most abundant and frequent remains in the analysed coprolites are: undefined tissues ("thick" and "thin"), leaf fragments, seeds/fruits fragments not determinable, followed by prickles (mostly of *Rosa/Rubus*) (Tab. 7.2 and App. 5a). Unfortunately, not all epidermis, leaf fragments and tissues could be identified. Since fruits of *Rubus* sp. and *Rubus* cf *fruticosus* (blackberry) were found, it is more likely that *Rosa/Rubus* prickles are from *Rubus* too. Small prickles occur abundantly on blackberry leaves, even on veins and petioles and they are eaten by goat and sheep without problems (Akeret *et al.* 1999).

Trees are poorly represented, we have only evidences of *Quercus.* Oak remains consist of leaf epidermis (frequency of 8.16%) and pericarp fragments (4.08%). In one coprolite (LAV13) a huge amount of *Quercus* pericarp fragments were found (App. 5a). The oak species could have been identified only in one coprolite remain (LAV21); a small leaf fragment was determined as *Q. pubescens* (App. 5). Remains of shrubs and climbing *taxa* such as *Rubus* cf *fruticosus* fruit fragments, *Rosa/Rubus* prickles and *Hedera helix* epidermis are numerous. Wood remains are quite sporadic.

The only fragments of cultivated plants are those of *Triticum* testa, found in 9 coprolites. Although *Linum* was regularly cultivated, as suggested by the analysis of plant remains from the cultural layer samples, we have no finds in the coprolites.

The list of identified seeds/fruits from various herbaceous *taxa* includes *Arenaria serpyllifolia, Verbena officinalis*, *Campanula* cf *bononiensis*, *Potentilla* cf *reptans*, *Juncus* cf *compressus*, *Juncus* sp., *Polygonum* sp., *Fragaria vesca, Hypericum* sp., *Poa palustris*, *Ranunculus sceleratus*, Cyperaceae as well as Caryophyllaceae

(Tab 7.2, and App. 5a). All these *taxa* were solely found in one or two coprolites. The group of ferns/mosses (Bryophyta and Pteridophyta), documented by epidermis and sporangia, are recorded in only a small number of coprolites.

The pollen concentration in the 36 samples from Lavagnone was partly high, partly very low (Fig. 7.2). Microcharcoal was present in only some of the samples in larger amounts. The coprolites from Lavagnone can be divided roughly into two groups: a smaller group with high percentages of arboreal pollen (AP), and a large group, which mainly contains non-arboreal pollen (NAP). The AP percentages in the first group amounts to 80% (or even more), with oak (in one sample together with beech) dominating. Pollen concentration (grains/mg) in 2 coprolites are very low and the sample spectrum consists mainly of highly decomposed leaf fragments, whereas minerogenic particles are largely missing. The NAP spectra are poor in species. Within the second group of coprolites with low AP there are some with a large amount of wetland *taxa* such as: *Succisa pratensis*, *Filipendula*, *Sparganium*, Cyperaceae, and, in some samples, also pollen of aquatics and epidermis fragments of Nymphaeaceae appear.

<u>Lucone</u>

13 surface samples yielded >500 goat/sheep coprolites suitable for plant macroremains and pollen analysis (Tab. 7.3). Most of these coprolites were found in the sample NN1 of the 2nd settlement phase corresponding to the quadrants N496-E485 and N495-E485 (north-western sector of the excavation surface; for details of the excavations etc. see chapter 1.6.1.3 and Fig. 2.3). This high concentration of goat/sheep coprolites could correspond to a place where animals were kept inside the settlement.

As in Lavagnone, the sediment embedding the dung remains was mainly composed by waterlogged mixed coarse organic matter. In the sample with a high concentration of coprolites (NN1) the coarse fraction composition was as follows: twigs 40%, wood fragments 20%, bark 10%, charcoal 10%, dung remains 10% and 10% of still aggregated sediment.

The average weight of the complete faeces in waterlogged state is 0.15 g (standard deviation of 0.09 g), ranging between 0.04 g and 0.40 g. Some pellets are strongly compressed, resulting in a rounded flat shape. 64 pellets from 8 different samples were selected for plant macroremain and pollen analysis. 24 out of 64 are from samples of the 1st settlement phases (Archaeological Stratigraphical Units SU5) (coprolites from LUC1 to LUC24), all the others are from the 2nd settlement phase. 53 out of 64 pellets contained determinable macrofossils (> 0.5 mm).

The analysed dung pieces included waterlogged plant remains, charcoal fragments, and small stones (minerogenic particles). The last ones have been found in discrete amount in some coprolites. The most frequent (>30%) plant macroremains are: undefined tissues (“thick” and “thin”), *Rosa/Rubus* prickles, and *Rubus* sp. fruit fragments (Tab. 7.4). Leaf fragments and bud scales are quite well represented too. Small wood remains have been found in six coprolites.

Apart from *Malus/Pyrus* (detected by Maloidaeae pericarp), the only arboreal taxon is *Quercus* sp., identified by leaf epidermis and pericarp fragments. In three coprolites epidermis of *Quercus* cf *pubescens* were identified.

Several coprolites yielded numerous fragments of *Rubus* sp. fruits, in few circumstances they were identified as blackberry (*Rubus* gr *fruticosus*) endocarps. *Rubus* remains altogether (fruits and prickles) were recorded in 49 out of 64 samples. Epidermis fragments of other two evergreen *taxa* (*Hedera helix* and cf *Ilex aquifolium*) were identified in 12 samples.

The recorded cultivated plants are *Triticum* (small testa fragments remains) and a few remains of *Linum usitatissimum* (capsule fragments). The latter were found in only one coprolite. Among gathered plants, in addition to *Rubus fruticosus* that more likely was eaten by the animals in the wild, several fragments of Maloidaeae pericarp were found in 9 pellets.

Identified seeds/fruits of various herbaceous *taxa* are: *Origanum vulgare, Chenopodium album, Picris hieracioides, Solanum* sp.*,* and Poaceae. A quite large amount of *Pteridum aquilinum* epidermis remains have been identified (App. 5b). Macrofossils of Bryophyta and Pteridophyta occurred regularly in pellets.

Concerning the pollen content, the Lucone coprolites (10) are quite different one from another (Fig. 7.4). A few coprolites have a high percentage of arboreal pollen (AP), e.g. LUC7. The AP spectrum is not highly diversified: the dominant tree species is oak in almost all coprolites, together with beech in one coprolite. *Corylus* is the most important shrub and is the dominant species in some samples, e.g. LUC5 and LUC6; it might be however completely missing in others, like e.g. LUC3 and LUC4. Most of the coprolites mainly contain non-arboreal pollen (NAP). Within the NAP spectra there are no evidences of wetland habitats while instead some ruderal species are present in high amount.

8. DISCUSSION

8.1. The formation and interpretation of the plant assemblages

8.1.1. Contexts in which plant remains are found

Lakeshore settlements are usually waterlogged archaeological sites characterized by extensive occupation layers rich in well-preserved organic materials, that is to say important sources of information about the daily life of past people, the surrounding landscape and the economic resources. The wet-site deposits resulted by several concomitant factors. The taphonomical factors influence the site formation as well as preservation processes. Therefore, the interactions between layer formation, degradation of organic materials, influences of lacustrine waters, human and animal input, and taphonomical aspects have to be considered for an accurate interpretation of archaeobotanical data. The importance of this approach has been pointed out by many archaeobotanists in methodological papers or general overviews on archaeobotany through many case studies (e.g. Jacomet 2013, Van der Veen 2007).
Occupation layers are considered to be mainly composed by anthropogenic sediments i.e. accumulation due to human or domestic animal activities. Evidences of these activities could be singled out during the excavation or by results of the performed bio- and geo-archaeological analyses. Rentzel *et al.* (unpub. documents 2013; research plan of an ongoing SNF-project since January 2014) suggested the following *lines of activities* detectable in an occupation layer: i) architectural activities (construction, installation, insulation, renovation, dwelling, destruction); ii) nutritional activities (production and gathering of food, cleaning, storing, processing, cooking, eating and excretion); iii) artefacts (production and gathering of raw material, processing, storing, production and use of tools and manufacturing residue). In addition, it has to be taken into account that remains of different lines can mix or be interchanged through recycling.
The interpretation of the plant assemblages from the Lavagnone and Lucone sediment samples are discussed below according to the relative archaeological context and with the aim to define the origin of the plant remains assemblages within the archaeological deposits. Bases for the interpretation of botanical remains have been laid down in chapter 2.9 and are taken into account for the following discussion.

LAVAGNONE

EBA sediment samples from Sector A of the Lavagnone site

All the EBA samples (except one) consist of sediment from cultural layer SU338 (subunits 338a and 338c) (see Chap. 2.1, and for a detailed description of the US338 see the App. 3). This layer formed a *cumulus*-shaped deposit among posts (see Chap. 1.6.2.4, Fig. 8.1.1, Fig. 8.1.2 and Fig.2.5) and is mainly composed of macroscopic organic remains (abundant wood, twigs, charcoal, bones) embedded in a matrix of brown detritus gyttja. In addition, pottery remains were also found; in the subunit 338c some of them were complete and in vertical position (de Marinis *et al.* 1996). This heap is interpreted by the excavators as waste disposal underneath the pile dwelling i.e. an accumulation of discharged material. Actually, the space under the pile dwelling could be used as place to discharge rubbish through some kind of opening in the floor or just at the edge of the building structure (e.g. the 'Abfallhaufen' structures described in Hornstaad site, Dieckmann *et al.* 2006). Waste disposal is also documented on the floor inside or around houses, e.g. in Chalain III, rubbish heaps were singled out in the open space shared within houses, near the doors (Ebersbach 2013, p. 287). The heap of Sector A in Lavagnone site is supposed to be formed underneath the pile dwelling in a submerged environment, as a consequence of a prolonged accumulation of material thrown from above.

The well-defined stratification of the heap (different subunits are described) and the arrangement of the deposited material allows discarding the hypothesis of a house floor collapse (Fig. 8.1.1-8.1.3). Although micromorphological investigations on deposition features of these layers are missing, the preservation of plant material and the occurrence of aquatic plants, as well as plant species of the lakeshore vegetation, support the hypothesis of the deposition in a permanent water body. The high abundance of the subfossil organic remains, the huge amount of different *taxa* per sample and their good preservation (Fig. 8.1.4 A, C, E) can only be explained by fast embedding in anaerobic conditions and a persistence of these conditions, i.e. any emergences of this material from water is to be excluded.

Rubbish accumulation in settlement layers normally consists of leftovers of food preparations, kitchen and/or table waste, residues of crop processing, cleaning remains of fireplaces, insulation and roofing material, etc., as well as faecal remains both of animals wandering freely through the settlement and of humans (Jacomet 2013). The majority of plant macro remains recovered in the EBA samples (SU338a and SU338c) is indeed part of waste products from human activity (secondary refuse), but a small part is from natural sedimentation including plant remains from the local vegetation (Fig. 8.1.4 D). Thus, the plant assemblage represents a mixture of different deposits of human as well as of natural origins; the latter reaches usually amounts of 10 to 20%. The waste products range from kitchen refuse to crop processing debris, to faecal material (small ruminants droppings) and a huge amount of wooden fragments and twigs. On the base of these results, it is possible to discern the following different human activities:

– Food plants, especially small-seeded ones, such as strawberry, blackberry, fig, fragments of apple/pear pericarp, pear stone cells, and so on, which can survive the digestion processes passing through the intestinal tract without any damages, could be interpreted as faecal remains of humans or animals as well. Yet, no mineralised plant remains are recorded as they are normally preserved in large amount only on dry soil sites (Jacomet 2003: pp. 178-180). Some of these food plants remains are particularly abundant and ubiquitarian (Tab. 8.1.1), e.g. wild strawberry and blackberry. Waterlogged cereal remains (testa fragments and chaff remains) which can possibly originate from faecal remains, too, are also frequent. Such remains are very common in waterlogged latrine sediments, e.g. from the middle ages (see e.g. Knörzer 1984, Hellig 1989). However, in the Lavagnone EBA samples, chaff remains are more likely remains of the by-products of cereal processing (see below), as their surface is not corroded and frequently they are so much compressed that an inclusion in excrements is not plausible (see Chap. 3.3.1.). Cereal bran remains can e.g. originate from milling processes, too.

– The presence of kitchen refuse (or snack food) is highlighted mainly by large fruit stones (e.g. *Cornus mas*, *Prunus spinosa*, *Prunus* sp.), wild grape pips, and shells of nuts (hazelnut, acorn?).

– Crop processing activities are documented by cereal remains and many arable weeds. Actually, the majority of cereal remains are charred chaff including frequently the uppermost part of the ears and the ear base, too; only a few charred grains were found (Fig. 8.1.4 B).

The crop processing activities, yielding huge amount of straw and chaff remains, were likely performed inside the settlement. Glumed cereals were stored as spikelets or complete ears (as documented by finds from the Lucone D burnt layers) and their dehusking and sieving took place piecemeal throughout the year (e.g. Hillmann 1981) and the waste of these operations were tossed into the domestic fire. While the burning of cereal grains could represent an accident (Hillman 1984), the large quantity of charred chaff remains represents cereal by-products, often burnt into fire in order to get rid of them or used as fuel/tinder. In addition, burning can also happen during the crop processing practices. Actually, ethnographic sources documented the use of fire in order to remove the awns, e.g. operations of singeing ears of spelt and emmer in Asturias region, northern Spain (Peña-Chocarro 1999, p. 47). Cereal chaff and straw had also an economic

value in prehistoric and roman times. Considerable amount of this material could have been used or traded as animal fodder, source of fuel, or building material (tempering material), particularly in arid and semi-arid regions due to the scarcity of firewood, grazing and timber. In temperate Europe, the role of chaff and straw as a resource should have played a role in areas where resources such as firewood and building material were scarce as in wetland areas, river estuaries, upland areas, or areas in the very northern part of Europe (van der Veen 1999).
Arable weeds could have been introduced to settlements with the harvest, as associated impurities.
– The ruderal and wetland plants are not ascribable to any use, but mainly represent the local environment and could reach the deposit through humans and animals, or were directly blown by wind or floated by water.
– In addition, *taxa* of meadows and pasture vegetation, consisting of exclusively wild and not of useful plants, are well-represented. They could enter into the settlement more likely as part of hay fodder, bedding or ruminant dung (see Chap. 5). Distinguishing between these possible origins, from hay or via dung of animals, which have browsed the same plants in the field, is difficult (Kenward & Hall 1997).
– The use of dung as fuel is excluded, as charred remains are almost exclusively limited to cereal chaff, and no spores of coprophilous fungi were found in charred material. The occurrence of other charred seeds is sporadic, thus they could be considered as accidents.
As samples were not systematically collected on the surface (see Chap. 2.1), their spatial distribution is not homogenous (see Fig. 2.1). However, no significant differences have been observed among the samples.

<u>MBA sediment samples from the Sector D of the Lavagnone site</u>
The cultural layers so far investigated are dominated by the organic components with abundant macroscopic plant remains and pottery finds. No archaeological structures have been singled out yet. Numerous posts, scattered on the whole surface, have been found in the SU4006 seeping into the lowermost part of the deposit with an inclination W-E of 45°ca. Due to the still on-going excavation and the limited dug surface, a clear interpretation of these layers is not yet available.
The MBA samples argue for a different outline of the preserved remains compared with the EBA samples of Sector A (Fig. 3.1). The average concentration of waterlogged remains is lower (1:1.9) whereas the concentration of charred remains is strongly higher (4:1). Even the number of recorded *taxa* is different (135 in MBA samples vs. 187 in EBA samples). As no evidence of burnt layers was found there, all accounts for a worse preservation of the plant remains, likely ascribable to periodic exposure to oxic environments due to the lesser depth of layers. The oxydation and decay in the uppermost part of the deposit is actually depending on the seasonal water table oscillation within the basin, which is strongly influenced not only by the yearly meteorological trend, but today even by the water charging for the modern maize field irrigation around the Lavagnone farmhouse. The seasonal decreasing groundwater may have favoured processes of decay of the most perishable remains. The diagram A in figure 8.1.5 shows that the amount of *taxa* with low resistance to decomposition (medium and weak classes) is really lower than in the EBA samples (Fig. 8.1.4 A).
Nevertheless, the subfossil plant assemblages point to the presence of a mixed deposit, too: part of the recovered plant material is coming from human activities (food consumption, crop processing, kitchen waste, etc.), part from natural sedimentation (aquatics and wetland herbs). On the base of the occurrences of specific *taxa* and their abundance, a strong contribution of faecal remains on the subfossil plant record is not discernible. Small-seeded plants are documented by only a small amount of remains, uncharred cereal chaff remains are very few (except for c4061 and c4034), and the amount of uncharred grains (testa fragments) is almost null. *Taxa* from meadows and pastures are also represented only in low amounts. Animals were likely not kept in this part of the settlement. On the other hand, crop processing is well documented by a large

quantity of charred cereal chaff remains (both glume bases and spikelet forks). As discussed above, such operations could have taken place inside the settlement as day-by-day activities and cereal by-products could have tossed directly into the fire and used as fuel/tinder. The accumulation of kitchen waste or food snacks could explain the record of several useful plants (stone fruits, nuts, etc.), also in charred state. Hearth sweeping might have been responsible for the occurrences of charred cereal grains and horse bean seeds accidentally burnt during food preparation.

Samples collected in the quadrants A-E/1-2 (samples LAVc4025, LAVc4034, LAVc4061, LAVc4072, LAVc4073; for location see Fig. 2.2) point to a different context of sedimentation. Here the cultural layers sloped toward the centre of the basin and the sediment is composed by high concentrations of macroscopic plant material (fruits, seeds, twigs and wood fragments), with an abundant inorganic sandy-gravel component. These facts can be seen as evidence of the settlement edge and the stranding of waste material thrown directly into the lake or washed into the lake in case of intense precipitation and surface run-off, or during seasonal flooding. The better preservation of plant material recovered in these samples (Fig. 3.1, Fig. 8.1.5 and Fig. 8.1.6) might have been favoured by deep water and fast embedding into the detrital deposit. On the other hand, samples from the quadrants A-E/3-5 yielded less amounts of remains and number of *taxa* (Fig. 8.1.5 and Fig. 8.1.6; samples LAVc4065, LAVc4074, LAVc4075, LAVc4069, LAVc4078, LAVc4076, LAVc4064, LAVc4063; for location see Fig. 2.2). The depositional context might have been characterized by shallow water and slow accumulation rate, the place could have been part of the seasonal dried up area.

LUCONE D

<u>Sediment samples from the first settlement phase, Lucone D site</u>

Samples belonging to the first settlement phase (Fig. 2.3) can be divided in two groups. The first group is composed by five samples (LUCc1, LUCc46, LUCc63, LUCc107, LUCc113) from the lowermost waterlogged layers (SU5). Among them, the sample LUCc63 was collected as 'judgement sample' as it appeared to be an accumulation of charred acorns. It really yielded a huge amount of them (more than 250 complete acorns) and a few other remains of useful plants (hazelnut shell fragments, blackberry fruits, *Prunus* stones, Chinese lantern seeds a few charred chaff remains) (Fig. 8.1.7C). It is not clear if this huge amount of charred acorn was due to the fire event at the end of the 1st settlement phase, or if they were burnt during food processing (e.g. toasting). The stratigraphic transition from the waterlogged layer to the burnt one (SU4) is not really sharp and charred material falling down into the water could have been mixed with the waterlogged organic fraction. As a matter of fact, the sample LUCc46 was recorded as belonging to a mixed sediment of both stratigraphic units (SU4/SU5). Both of the two mentioned samples (LUCc63 and LUCc46) are characterized by a low concentration of plant remains, which are mostly charred (Fig. 8.1.7E and Fig. 8.1.8). The remaining three samples yielded a higher amount of waterlogged remains belonging to a much higher number of *taxa*. Especially high is the number of *taxa* presenting a weak resistance to decomposition (Fig. 8.1.7A-A'). Due to their depth, these layers were standing in permanently saturated condition and were obviously not affected by seasonal water table oscillation. These circumstances favoured an excellent preservation of plant remains as well as of several rare archaeological finds such as wooden artefacts and textile tissue fragments.

The second group includes eight samples from the burnt layer (SU4). Three out of 8 where full quantitatively analysed (LUCc34, LUCc51 and LUCc58). The amount of charred remains is high in these samples (Fig. 8.1.8) but a discrete amount of waterlogged remains is also recorded. They could have been embedded because suspended again by the collapse of the above housing structures or they could have been deposited soon after the fire event.

Despite the different taphonomic features of the two groups of samples, the subfossil plant assemblages gave evidences of mixed deposits for both. Most of the plant remains were introduced into the deposit for food consumption and were discharged as kitchen and table waste or as by-product of crop processing. Moreover, parts of plant remains were brought by natural sedimentation (such as aquatics and wetland herbs *taxa*) (Fig. 8.1.7D-D'). Within waterlogged layers a huge contribution of faecal material was also detected (likely both human and animal excrements). This is proved by large abundance of small plant parts easily surviving the digestion process. Stone cells of pear are actually the most abundant remains in the first settlement phase (Tab. 8.1.3), other plant remains that could have followed this route of entry and were abundantly recovered are strawberry and fig nutlets, blackberry fruits, Chinese lantern and pericarp fragments of apple/pear. These samples yielded also several small ruminants coprolites (Tab. 2.2).
The fire event destroying the first settlement phase allowed an excellent preservation of cereal ears, especially those found in a large assemblage (judgement samples). The huge storage of cereal ears, likely in pots, avoided the direct exposure to fire, allowing a slow combustion, which preserved even thin plant tissues such as the glumes of cereals or fragile parts such as the awn. In addition, the falling in water of this material, due to the collapse of the burnt houses, interrupted the combustion and improved the preservation of soft tissues, too. In these circumstances, the inner part of the ears could be frequently only partly carbonized.

<u>Sediment samples from the second settlement phase, Lucone D site</u>
Samples from the second settlement phase could be divided in different groups according to their origin. A part of them were collected in the stratigraphic units forming the huge heaps of discharged materials (defined as '*cumulus'*) described in chapter 1.6.1.3. So far, three *cumuli* were described and samples from two of them (*cumulus* 84 and 160) were analysed. Other samples were collected in cultural layers rich in organic remains around or underneath the aforementioned *cumuli*. The organic layers got thinner beneath the *cumuli* because compressed by the full weight of the overlaying high density discharged heap, due to the abundant minerogenic fraction.
In the northwestern sector of the dug area, the cultural layers deepened towards the lake, reaching there the maximum depth of the 2nd settlement phase layers. These circumstances favoured a better preservation of plant remains in these samples. Waterlogged remains are predominant in these samples (see Fig. 8.1.8 samples LUCc372, LUCc394 and LUCc397), contrasting the general trend of prevalent charred remains in all the other samples.
The archaeobotanical assemblages found in the 2nd settlement phase derive from mixed deposits as in the other archaeological contexts examined. We have evidence of waste disposal, cooking activities, faecal remains, crop processing and husbandry practices, and natural sedimentation (Fig. 8.1.9D-D'). Cereal remains are particularly abundant in this phase (Tab. 8.1.4) and are mostly represented by charred chaff remains (Fig. 8.1.9B), waterlogged remains are recorded almost exclusively in those samples with a better plant remain preservation. These large amounts of cereal chaff as well as the arable weeds could have been introduced into the settlement as part of the harvest or be part of general waste disposal. Particularly, cereal chaff fragments could have been related to crop processing activity and their use as fuel/tinder on fireplaces. Frequent remaking and cleaning of fireplaces could have been the reason for such an accumulation of these remains.
In these layers, we also see the presence of faecal remains by the abundance of particular plant remains e.g. blackberry fruits, small-seeded food plants (strawberry, fig, etc.), pear stones, and pear/apple pericarp. These remains could have been released by the disintegration of human excrements into the water. Besides, small ruminants' droppings (goats and sheep) were found in large amount in the samples from the deepest layers.

The two settlement phases are very close in time (likely spanned not more than ca. 70 years, see Chap. 1.6.1 and 1.6.1.2), thus, the plant spectra are not significantly discriminated by a different use of plant resources. Differences are mainly due to taphonomic conditions (preservation of plant remains) and to the presence of different archaeological structures (pluristratified heaps of discharged material, formed by layers with a high inorganic component) still to be properly defined by the archaeologists.
The spatial distribution of waterlogged and charred remains, as well as of some important groups/*taxa* of wild, cultivated and useful plants are plotted in the figure 8.1.10 (for a comment on the cereal remains' distribution see Chap. 8.2.1). Even if different concentrations of remains over the investigated surface did not detect so far any areas of special activities. Unfortunately, we do not have any evidence of houses as, during both phases, houses were raised above water and the only preserved part are the vertical posts. Moreover the excavated surface is relatively small, thus, considering the average house size and their architecture known in the lakeshore villages around the Alps (Ebersbach 2013), only a very few houses might have been intercepted. Pile dendrochronological analysis is in progress but did not concluded yet about spatial pile correlation. Thus, so far no circumstances allowed recording intra-side patterning in the Lucone D site, apart from location of waste disposal. Spatial analysis should be properly performed after the end of the archaeological excavation, enlarging the number of investigated samples and integrating the carpological data with the dendrochronological analysis for a possible interpretation of houses and intra site patterns.

8.1.2. Integration of micro- and macroremains data

Recent palynological investigations of on-site sediments proved that pollen spectra from cultural layers could provide important additions to the results of macrofossil analysis with regard to nutrition, food imports and local cultivation (Vandorpe & Wick 2014). Furthermore, a multidisciplinary approach allows pointing out taphonomic inferences both of pollen and of fruits/seeds, especially regarding the transport vehicle responsible of their accumulation in the anthropogenic sediments. These could help interpreting both on-site proxy data and off-site pollen sequences by comparison. A few systematic studies integrating pollen and macrofossil analyses have been so far carried out (Willerding 1986, Wasylikova 1986, Gaillard & Jacquat 1988, Brombacher & Jacomet 1997, Vandorpe & Wick 2014). The waterlogged sites are the best conditions where such analyses can be performed as usually the preservation of both remains is excellent, avoiding any bias due to selective preservation.
The comparative analyses of pollen and macrofossils carried out on samples from the section 98 (Sector A) of the Lavagnone site (see Chap. 5) pointed out interesting issues, notably about the taphonomic factors which have to be considered in the interpretation of subfossil plant assemblages from archaeological deposits. The results of the two analyses are not quite homogenous. As expected in the macrofossil assemblages more anthropogenic *taxa* are recorded and in greater amount. The more detailed identification of fruits and seeds allows reconstructing more carefully the anthropogenic habitats and human activities. On the other hand, pollen analysis gives a better overview of the structure of the environment surrounding the settlement.
As regards plant remains from forest vegetation (both woody and herbaceous *taxa*), they were gathered and brought into the site almost exclusively for food consumption, thus they can provide information above all about diet but are unsuitable to reconstruct reliably the palaeoenvironment, as the relative spectrum is incomplete (Tab. 5.3, Fig. 5.5).
Arboreal pollen (AP) (*Carpinus, Quercus* and *Corylus*) shows the highest % in the master core LAV1 where a major contribution of pollen transported over long distances (extralocal / regional airborne pollen) is

recorded. A contribution to AP influx in the cultural layers could also be ascribed to animal dung, as shown by the high % of *Corylus* found in two of the studied coprolites (Fig. 5.4).

Concerning herbaceous *taxa* from open habitats, the wide range of *taxa* gives rise to the discussion of different aspects of daily life and exploitation of natural resources from the surrounding environment (see below).

In order to explain the great abundance of Poaceae pollen in the cultural layers, a possible use of grasses as building materials for roof, wall or straw beds etc. can be argued, as well as the storage of hay fodder inside the settlement. In addition, the spreading of particular grasses in the surrounding vegetation - like e.g. *Phragmites australis* or *Glyceria maxima* in the lakeshore vegetation - has to be considered, and evaluated in comparison with the off-site pollen sequence. Further investigations are therefore needed to explain the high Poaceae % in the pollen record. Unfortunately, we do not have so far any evidences from macroremains concerning Poaceae producing small pollen grains.

On the other hand, cereal pollen was likely partly transported into the settlement on cereal plants themselves. Due to self-pollination, a high amount of pollen produced by self pollinating cereal genera such as *Hordeum* and *Triticum*, is not dispersed but stays on the ear within the glumes (Robinson & Hubbard 1977).

High pollen % of Apiaceae in the pile dwelling might be explained both by the strong pollen influx of lake littoral vegetation *taxa* and by the abundance of small ruminant dung pellets in the cultural layers. The pollen types of Apiaceae species included in coprolites are really quite numerous but mainly linked to meadows (e.g. *Daucus carota, Peucedanum, Seseli libanotis* type and *Torilis arvensis*) rather than to wetland habitats (Fig. 5.4), as well as those identified in the macroremain analysis of cultural layers samples (*Daucus carota, Torilis japonica* and *T. arvensis*) (Fig. 5.5). The find of macroremains of plants with adhesive seeds, like most of the Apiaceae, connotes the presence of mammals with hair e.g. sheep. Based on plant remains analysis of small ruminants' coprolites, the animals are considered to have browsed mainly in open environments whereas woodland is not well represented and the most favourite habitats were dry meadows and fallows. Even the strong abundance of Cichorioideae and Scrophulariaceae pollen in the cultural layer should most probably be ascribed to the contribution of dung to the pollen influx. A possible honey contribution, suggested by floral preferences of honeybees for some of the abundant pollen types so far found, such as Odontites and Cichorioideae (Proctor *et al.* 1996) needs further evaluation.

Most of Caryophyllaceae species, mainly detected in the macroremains record, are typical of more or less dry pastures; they are largely widespread even today on the hills around Lavagnone and likely intensely browsed by goats and sheep (Chap. 8.5.2 and Chap. 8.6.2). These species are normally small-seeded plants characterized by large seeds production. These seeds owe their dispersal to their lightness and are usually carried off from the capsule by wind and dispersed on a relative short distance (Ridley 1930), but they could also be eaten by animals and dispersed through excrements (see our results of coprolites analysis Tab. 7.2). Even human activities could also be involved in their dispersal.

The abundance of *Helianthemum nummularium* pollen (see details of SEM identification in Bolgiani 2002/2003) in the master core LAV1 further testifies as well the spreading of dry pasture around the settlement (Arpenti *et al.* 2002). *Helianthemum* pollen is recorded in some of the coprolites retrieved in cultural layers, reaching over 22% in the coprolite LAV-7 (see Fig. 7.2). Despite this species is considered one of the plants distinctly associated with the wool of sheep concerning seeds dispersal (Ridley 1930 p 599-601), it has not been recorded in plant macroremains assemblages. *Helianthemum* spp. display a very wide distribution in dry pastures of Eurasia and all species are evergreen dwarf woody plants; hence, comparing the modern studies about *Helianthemum* grazing is fruitful for past reconstructions. Grazing on *Helianthemum* is a characteristic feature of goats and sheep diet in calcareous grasslands of Europe and the

Middle East, particularly in regions with a Mediterranean and semi-arid climates, where evergreen and seasonally-evergreen woody plants dominate the overall proportion of life forms. In the semiarid grasslands in Sierra de Cazorla (Spain, province of Jaen), *Helianthemum* sp. may represent up to 25% of micro-epidermis fragments detected in fresh faeces of *Caprini* species (Garcia-Gonzales & Cuartas 1989). The latter values are largely over-represented when compared with the covers in the browsed vegetation, with *Helianthemum* not reaching over 2%. A seasonal preference for *Helianthemum* in autumn has been detected at this site, which compares favorably with a preference for evergreen shrubs against graminoids (Garcia-Gonzales & Cuartas 1989). A constant occurrence of *Helianthemum* cuticles in faeces has been detected even in non-calcareous pastures of Catalunya (Bartolomé *et al.* 1998). Evidence for *Heliathemum* preferences has been documented even in the subtropical Middle East (Al Harthi *et al.* 2008).

Concerning Lamiaceae, the high diversity of habitats they belong to, let consider quite different 'entry routes' to the cultural deposit. Seed dispersal mechanisms relevant for explaining their accumulation into archaeological deposits are linked to seeds buoyancy especially for those *taxa* growing on lakeshores or on other wet habitats. This is the case of *Mentha* spp., which own an outer coat of dry fleshy substance composed of air-cells with thin walls that allow floating for several days, or *Lycopus europaeus* which possesses triangular nutlets half surrounded by a corky float (Ridley 1930, p. 222). In addition to buoyancy, all the other Lamiaceae species, mainly inland plants, owe their dispersal on a larger distance to the adherence of seeds, or fruits, or portions of the plants e.g. the calix, to fur, feathers, or feet of birds, mammals or man. A large number of Lamiaceae have sepals with stout spines and hairs on the tube, which may serve to attach the calyx with still nutlets inside to fur or plumage (Ridley 1930, p. 574). Some of them might also have been brought inside the settlement with harvested cultivars as weeds.

Taxa belonging to Cyperaceae family, which are dominant in wet habitats, were mainly part of the local vegetation. Therefore, their occurrence allows characterizing the local sedimentary environment and reconstructing oscillations of the water table, which is immediately reflected by the perilacustrine and aquatic vegetation (see Chap. 8.6.3 and Chap. 8.7.2).

Although these results refer to one site and are limited to only a few samples, the exisiting data allow very valuable contributions to the taphonomic aspects of the plant fossil assemblages and some general conclusions can be drawn.

The possibility to apply both analyses types gives additional value to the results and reinforces their interpretation. The consistency of the results along a sequence may suggest that continuously similar activities were performed during the whole period at a place. If there is no homogeneity between the two kinds of analyses an alternative explanation should be searched, especially for the modality how the remains were accumulated in the deposit.

The above discussion may be summarized as follows. The most important vehicles for the accumulation of plant remains (both macro- and microremains) in the archaeological deposits are man, animals, wind and water. Pollen is mainly transported by wind, but in an archaeological context, human activities can play an important role and cause high concentrations of specific pollen types. Man is responsible for the accumulation of most of the plant remains we found in the cultural layers above all through the introduction of products of farming, gathering and foraging activities together with numerous related species e.g. weeds. Even domestic animals could take part in the transport of pollen or fruits/seeds.

The identification of pollen to species level is not always feasible and thus limited to genus or family level. In these circumstances, the macrofossil data could help the interpretation of the family groups of pollen.

Both analyses can contribute to palaeoenvironmental reconstructions. The pollen data give information about the forest composition, or about those species, which are not documented by diaspores (e.g.

Helianthemum or *Plantago* spp.) and are likely transported into the settlement as flowering plants i.e. when fruits are not yet ripe (e.g. hay fodder). On the other hand, macroremains allow reconstructing crop husbandry and related habitats.

8.2 The plant economy in the sites Lucone D and Lavagnone

Although in the Bronze Age society trade and craft production played an important role in the economic life, quite a lot of people were involved in food production and procurement (Harding 2000). Farming and pastoralism were still the mainstay of economy. Furthermore, attempts to produce surplus food should have been made. As documented in the Lavagnone and Lucone D sites, crop husbandry involved most of all cereals and flax. Likely, the latter satisfied mainly textile purposes. Pulses are only rarely recorded, most probably for taphonomic reasons (see Chap. 3.3.3), but they should have been important crops too during the BA as pointed out by findings in several sites on mineral soils in northern Italy (Castelletti *et al.* 2001, Fiorentino *et al.* 2004). Their important role in the diet could be easily supposed for their high nutritional value, the easy cultivation and the long term storage of their seeds. Other possibly domesticated plants were oil or dying species such as *Carthamus tinctorius* and maybe *Camelina sativa*. Furthermore, a large variety of species was still intensely gathered and maybe tended in the surroundings of the settlements.
On the whole, a high diversity of cereal crops in both sites has been detected (see Chap. 3.3.1 for Lavagnone and Chap. 6.3.1 for Lucone D). Emmer and the ‘new glume wheat’ are the most common cereal crops during the EBA. Barley and einkorn were also important crops but occurred in lesser amounts. Later on, in the MBA (Lavagnone), new cereal crops were introduced (broomcorn millet) and the importance of individual cereal species changed: ‘new glume wheat’ and einkorn became dominant, whereas emmer and barley became a bit less important. Spelt and naked wheat remained - as at the beginning of the Bronze Age - secondary crops. Moreover, flax growing is not anymore practised during the MBA at Lavagnone site. This is consistent with the archaeozoological record which testified a higher interest in wool production in the MBA layers (see Chap. 1.6.2.6), as shown by the prevalence of sheep over goats (ratio 6:1) and by a high % of slaughtered goats/sheep (59.7%) more than 3 years old (De Grossi Mazzorin & Solinas 2013).

8.2.1. Intra-site crop distribution

Most of the plant assemblages recovered from the different archaeological contexts identified in the Lucone D and Lavagnone sites originate from waste deposition. In these circumstances, the distribution of cereal remains appears to be of little significance.
All the samples of the EBA layers of the Lavagnone site (Sector A) were collected from the huge ‘*cumulus’* of discharged material placed under the pile dwelling (see Chap. 1.6.2.4, Chap. 5). As a matter of fact, the distribution of cereal remains doesn’t reflect any particularly differences inside this area (Fig. 8.2.1A-B). Chaff remains, including all parts of the ear, strongly outweigh grains in all samples. Samples with abundant waterlogged cereal remains are normally poor in charred remains compared to others (LAV RP02, LAV c195bis, and LAV W04), but they are not placed in distinct areas of the ‘*cumulus’*. So far, we cannot argue that material was discharged from different spots of raised houses, despite the large size of this accumulation.
In the samples from the MBA layers of Lavagnone (Sector D) cereal species with the highest concentration values are also ubiquitarian (frequency of 100%) (Fig. 8.2.2A-C). A good correlation is observed between

charred chaff remains of einkorn and the ‘new glume wheat’ (Fig. 8.2.2A), whereas emmer shows an opposite trend in some samples. As suggested by ethnographic evidences, previous authors interpreted the co-occurrence of einkorn and the ‘new glume wheat’ as a maslin crop (Jones *et al.* 2000; Kohler-Schneider 2003). All the other wheat species occur in low numbers and are recorded only in the samples LAVc4076 and LAVc4078. Chaff remains of barley and broomcorn millet are found in almost half of the samples, distributed over the whole surface.

In the MBA samples, cereal grains are more abundant and frequent compared to the EBA layers, also for those species less represented by chaff remains such as barley and broomcorn millet. This could be interpreted as a larger contribution of kitchen waste to the deposit.

The Lucone D settlement phases are also characterized by the ubiquitarian presence of abundant cereal species (100% frequency). In the 1st settlement phase, two samples (LUC c1 and LUC c51) resulted to be particularly rich in charred chaff remains, which were recorded in both samples in the same order of abundance (Fig. 8.2.3A-C). The sample LUCc1 yielded also lots of charred grains, as well as charred linseeds. It was likely stored stuff charred during the fire event; firstly, it fell down into the water and was then embedded in the underlaying organic deposit. In the 2nd settlement phase, charred chaff remains of all species were found in almost all samples apart from those from the deepest layers such as the samples LUCc394 and LUCc397. In contrast, these samples yielded most of the recorded waterlogged cereal remains (Fig. 8.2.4A-C). Considering chaff remains, higher concentrations of einkorn, ‘new glume wheat’ and barley are recorded in the samples from the ‘*cumulus’* 160 (LUCc305 and LUCc310). On the other hand, emmer is more abundant in samples from the ‘*cumulus’* 84 (LUCc207 and LUCc237) and the surrounding area (LUCc220). This may point to differences between house units; however, the evidence is premature for such an interpretation extent.

8.2.2. Crop husbandry

The methods farmers used to grow crops could include different practices focusing to enlarge the productivity, to reduce labour demands, and to maintain a long-term sustainability of crop growing. These husbandry practices embraced activities performing over one-year e.g. tillage, manuring, sowing, weeding, watering, and harvesting, alongside a inter-annual planning e.g. crop rotation or rhythms of fallowing. Ethnographic and historical analogues highlighted how strong the links between husbandry regimes and several aspects of farming communities including settlement pattern, land ownership, social structure and animal husbandry are (e.g. Bogaard 2004). Thus, an investigation of crop husbandry regimes can shed light on agricultural society and daily life of people of the time.

Sources for the reconstruction of crop husbandry practices should be drawn from different disciplines. The approach should be of multidisciplinary character in order to define the proper outline of such a veiled topic. Tools used for soil preparation and harvesting can provide direct evidence of the crop husbandry methods. Archaeozoological data can detect the use of cattle as draught animals but this does not prove their use in crop husbandry (e.g. Deschler-Erb Marti-Grädel 2004). Only through the cultivated plants, it is not possible to get unambiguous information on cultivation methods as a crop species can tolerate a range of growing conditions and may be grown under different husbandry practices (e.g. Behre & Jacomet 1991). At the moment, crop weed ecology and abundances provide the most useful and potential approach for the identification of past husbandry practices.

8.2.2.1. Weed ecological data: what do the weeds tell us about husbandry regimes?

Given the importance of the crop weed spectrum analysis for reconstructing husbandry practices, the rising problem is to define which weeds were actually arable weeds in former times.
In traditional archaeobotanical investigations, weeds are recognized and grouped according to criteria of modern plant ecology and geobotany, applying ecological indicator values and species phytosociological status (e.g. Braun-Blanquet 1928, Oberdorfer 2001, Ellenberg 1979, 1991). This means to adopt an actualistic and uniformitarianistic approach assuming that no essential changes occurred in the ecological requirements and inter/intra-species competitiveness during the Holocene. However, habitats affected by human activities, particularly those linked to farming practices, underwent considerable changes since the Neolithic. Main alterations concerned the form of agriculture, the introduction of new cultivars and the unintentional spreading of exotic species (Behre & Jacomet 1991). Since 1990's, many authors had been discussing problems connected with the actualistic methods and the reconstruction of agricultural practices through the weed spectrum (e.g. Behre & Jacomet 1991, Jones G. 1992, Brombacher & Jacomet 1997 and 2003; Hosch & Jacomet 2004). Thus, new efforts to find out a more suitable approach were carried out in the recent years. First, Behre & Jacomet (1991) suggested adopting flexible criteria in the plant grouping so as to have room for further interpretations and finer classifications. Statistical analyses were later applied. For example, in the mixed deposits of the Late Neolithic settlement of Arbon Bleiche 3 (around 3400 BC cal) a statistical approach (Spearman's rank correlation coefficient) was used by Hosch & Jacomet (2004) in order to define which species represented arable weeds. Nine different weed species showed a significant correlation with one or more cultivated plants (cereals, poppy and flax) (Jacomet *et al.* 2004: tab. 101 p. 130). These nine weed species are still today arable weeds and possibly represented the most common arable weeds at that time. More recently, researchers at Sheffield University developed the method of functional ecology (FIBS – Functional Interpretation of Botanical Survey) for arable weed flora. They use easy-to-measure functional attributes as measures of plant ecological characteristics (arable weed in our case) in order to infer the role of ecological processes on species distribution. These processes are then connected with specific crop husbandry practices (irrigation, fallowing and rotation, tillage, manuring etc.). For the application of FIBS, it is fundamental to investigate samples that do not derive from mixed deposits, where it is more difficult to establish the source of the plant material. Theoretically only samples from 'closed contexts' i.e. representing one single event, should be considered. Unfortunately, these kinds of samples are only occasionally found. Currently, new attempts are made to reconstruct past agricultural systems (e.g. land use, manuring, water management practices, etc.) by investigating stable C and N isotopes in archaeobiological remains (e.g. Bogaard & Outram 2013, Bogaard *et al.* 2013, Wallace *et al.* 2013, Fraser & Bogaard 2013).
At the moment, the reconstruction of the weed communities in the Lavagnone and Lucone D sites has been persecuted mainly through actualistic assumptions as so far no uncleaned grain store has been investigated in detail in the Lucone D site and no such samples were found in Lavagnone. Additional information was collected from a series of Late Neolithic sites of the northern Alpine foreland (e.g. Hornstaad-Hornle IA, Maier 2001; Arbon Bleiche 3, Jacomet *et al.* 2004). Particularly, Brombacher & Jacomet (1997) made a compilation of weeds found in Late Neolithic stores of cereals and flax, which forms an important basis for the reconstruction of the weed flora.

8.2.2.2. Time of sowing

The identified segetal spectrum of Lavagnone and Lucone D did not provide clear evidences of the kind of cultivation (Tab. 3.2-3.3, Tab. 6.3-6.4 and Tab. 8.2.1). In 'closed' samples the predominance of summer or

winter annuals is normally used to indicate the season in which the crop was sown. In the mixed deposit we analysed, both summer crop weeds (growing within crops sown in early spring) and winter crop weeds (growing within crops sown in September to October) (see Chap. 2.8) were identified. Summer crop weeds (including annual ruderals) are represented by higher amounts of *taxa* and of remains in all archaeological contexts, especially in the MBA layers (Fig. 3.1-3.3 and Fig. 6.1-6.4). Apart from broomcorn millet, which is an exclusively summer crop and was found only in the MBA layers, and spelt, which should be sown in winter time, all the other crops identified in the Lucone D and Lavagnone sites, can be cultivated as summer or winter crops.
Annual plants mainly compose the weed spectra (Tab. 8.2.1). In the ruderal spectra instead biennial and perennial plants prevail. This composition accounts for an effective soil preparation. Actually, the find of a plough and half of a yoke in the EBA cultural layers of Lavagnone document tillage practices. This kind of plough (Triptolemo-type) is suited for working on level ground, in light soil. The wooden ploughshare did not allow working properly on rocky or highly clayey soils (de Marinis 2000, 202; Harding 2000, 128). Moreover, its symmetric shape could not turn over the clod and give effectively air to the ground thus increasing its fertility (de Marinis 2000).

8.2.2.3. Soil types and soils preparation

The most suitable soil types for growing the crops in the Lavagnone basin and the surrounding area (area of about 1km radius) occur in a restricted belt around the lake (eAq in Fig. 1.2.5) and in the large fertile plain surrounding the basin (Alf + uEnt(alf) in Fig. 1.2.5). This mollisols belt (for description of the soils see Chap. 1.2.2 and Appendix 1) is estimated to have occupied about 12 hectares during the EBA when the lake was still a surface of open water. These are organic soils, characterized by thin texture and low density that could have been successfully worked by the Triptolemo-type plough. According to the modern soil evaluation of the area, a problem in cultivating the mollisols belt was the seasonal flooding because of the rising in ground water table (ERSAL Minelli 1997). The lowermost area was concerned with this limitation, being seasonally occupied by the lake during the BA. Instead all the soils covering the wide fluvioglacial plain surrounding the Lavagnone basin may be considered alfisols-type soils in the BA time. These alfisols, which were covering a substantial surface around the village, with an estimated surface of 220 hectares in an area of 1 km radius, are characterized by an argillic horizon, thus holding a good water capacity, and were rich in carbonate. All this makes them suitable for growing plants, and ploughing limitations could depend on high stoniness. The subsurface horizons had a rich and naturally well selected pebble fraction between 5 and 10 cm, and stone ridding is expected not to have been effective to improve the texture of these soils. Overall, the area cultivated during the BA times, most probably extended over a surface of more than 230 ha. Which areas were chosen to be cultivated, depends on crop requirement; we argue that the area around the lake could be likely assigned to summer crops, which favoured thin texture and rich-humus soils; besides, during the summer season this area should have been drained and more suitable to cultivation.
In the Lucone basin the area that could have supported mollisols is very restricted within a surface of ca 10 ha (eAq in Fig. 1.2.6) (excluding the lake surface during BA times, estimated on the base of landscape morphology and pile dwelling distribution). The mollisols preserved up to now, furthermore, do not show a thick and fertile organic horizon as seen in the Lavagnone buried sequence (see Chap. 1.2.2.3). Besides, the northern sector of the basin is occupied by loamy and sandy soils with low to moderate drainage rate, holding good water- capacity and fine texture (32 ha) (aqlnc in Fig. 1.2.6); such soils are very well suited for cereal cultivation. The plain area occupied by alfisols covered a surface of about 82 hectares in a 1 km radius from the lake. All in all, the most suitable arable surface estimated in 1 km area around the settlement of Lucone

D was about 124 hectares, smaller than in the surroundings of Lavagnone. This is mainly due to the higher elevation and proximity of hills which slopes are too steep and unsuitable to cultivation.
The winter crop weeds recovered in all archaeological contexts (both EBA and MBA) belong to different ecological types. The majority of them are species belonging to the Caucalidion Alliance (Chap. 2.8), including some 'character species' such as annual hedge nettle (*Stachys annua*), field hedge parsley (*Torilis arvensis*), and broad-fruited cornsalad (*Valerianella rimosa*). They prefer a warm dry climate and calcareous soil conditions, which are thoroughly confirmed in the lowermost belts of the Garda region. Nevertheless, the most frequent and abundant *taxa* are not exclusively linked to these ecological features e.g. narrow fruit corn salad (*Valerianella dentata*).
On the other hand, a few species could be ascribed to the Aperetalia order, i.e. species growing on acidic-neutral or lime-deficient soils. Among these, black-bindweed (*Fallopia convolvulus*) which is highly ubiquitarian and abundant, is not limited to this group. It can also easily occur on slightly acidic soils sharing even the ecological features of the Caucalidion Alliance or of different ruderal habitats; it has therefore a broad ecological amplitude. All the other weeds distinctive for slightly acidic (or neutral), free of lime and well-drained soils – *Camelina sativa*, *Scleranthus annuus*, *Aphanes arvensis*, *Papaver argemone* and *P. dubium* – could also occur in ruderal habitats where human activities can shift the range of edaphic tolerances over the limits observed in the landscape's natural variability. The area surrounding the Lavagnone and Lucone basins is characterized by soils developed on calcareous parent material (see Chap. 1.2.2) thus presenting alkaline or neutral conditions. Only in restricted localities on the stable morainic surface, more common in the Lucone area, the pedogenetic evolution developed decarbonated soils.
Taxa of summer crop weeds are particularly numerous [21] and reflect different soil types for growing the crops. Almost all of the identified *taxa* require nutrient- and humus-rich soils, from sandy to loamy texture. In addition some of them indicate a high content of nitrogen in the soils; such *taxa* include fat-hen (*Chenopodium album*), common chickweed (*Stellaria media*), black nightshade (*Solanum nigrum*), high mallow (*Malva sylvestris*), shepherd's-purse (*Capsella bursa-pastoris*), and red deadnettle (*Lamium purpureum*). Particularly, fat-hen – the most abundant and frequent summer crop weed in all the EBA cultural contexts – grows faster and absorbs nutrients more effectively than any crop or other weed, it can grow almost everywhere on acid to alkaline soils, from sandy to clayey, as long as the soil is nutrient-rich.
Other *taxa* favour dry and warm open land such as purslane (*Portulaca oleracea*), possible little lovegrass (cf *Eragrostis minor*), blue pimpernel (*Anagallis arvensis*), and European heliotrope (*Heliotropium europeum*). Purslane – the most abundant summer crop weed in the MBA context – is extremely widespread in the area also today, colonizing the corner areas of maize fields close to farmhouses. Humid conditions are required especially by *Chenopodium album*, *Stellaria media*, *Solanum nigrum*, common fumitory (*Fumaria officinalis*) and fool's parsley (*Aethusa cynapium*).
In the MBA contexts, nitrogen-indicator species are still well documented; although high mallow (*Malva sylvestris*) and shepherd's-purse (*Capsella bursa-pastoris*) are lacking, a new species typical for such conditions is appearing, henbit deadnettle (*Lamium amplexicaule*). Plant *taxa* with a preference for dry open land incremented their frequencies and general amounts (e.g. purslane), even if possible little lovegrass (cf *Eragrostis minor*) is not anymore recorded. Instead a new *taxon*, green or bristly foxtail (*Setaria viridis / S. verticillata*), fits these ecological features. Common fumitory (*Fumaria officinalis*) and sun spurge (*Euphorbia*

[21] The abundance of Chenopodietea character species has been noted in many archaeobotanical assemblages of cereals and pulses from several prehistoric sites in central and southern Europe. Jones G. (1992) argued that it could indicate the use of garden-like methods of crop husbandry but she also discussed the numerous factors involved in determining such a predominance.

helioscopia) are the only plant species linked to humid soils.
Concluding, more fertile and tillable soils were located just around the lake in both basins. They were mostly alkaline and neutral, and characterized by a thin texture and a good water content. The surrounding flat areas were suitable for cultivation as well, although ploughing was a bit harder because of abundant pebbles. There was winter and summer crop growing; winter crop fields were preferably located in the moistureless flat areas (they should avoid stagnation during germination, i.e. autumn), while summer crop requiring loamy and fertile soils, and germinating in the dry season, might have been grown closer to the lake.
Crop fields were likely manured as indicated by the record of nitrogen-indicator species (see Chap. 8.2.2.5).

8.2.2.4. Fallowing and crop rotation

The weed spectra are also strongly influenced by fallowing and crop rotation. The regular presence of annual weeds was considered as signal of permanent cultivation plots with only short fallow periods in Neolithic lake dwellings of the northern alpine foreland (Jacomet *et al.* 1989, 168-169; Brombacher & Jacomet 1997, 264-272; Maier 2001). Indication of crop rotation were also inferred in the Late Neolithic by the high frequency of treading resistant species e.g. *Potentilla reptans, Trifolium repens* and *Ranunculus repens* (Brombacher & Jacomet 1997).
In the Lucone D and Lavagnone sites, we do not have clear evidences of crop rotation; nevertheless, this practice is widely suggested by the large number of annual species and fallow indicators found in all archaeological contexts. Fallow land could include two main different types of habitat, according to water availability, nutrient content and loamy texture of the soils:
i) on drier spots, like on open land in the fluvioglacial plain or flat areas on the top of the morainic hills, a dry fallow land could develop (see Chap. 2.8: ecological group 3.1);
ii) on moister and loamy soils, perennial weeds requiring such ecological conditions can increase during a fallow period.
The dry fallow land is quite well represented both by the number of *taxa* and abundance of remains. The most characteristic species are *Arenaria serpyllifolia, Petrorhagia saxifraga, Daucus carota, Orlaya grandiflora* – the latter widespread since MBA onwards (Perego *et al.* 2011). All these species are monocarpic, annual or biennial plants. Thus, the fallow period should span over at least two years. This habitat was also important as pastureland. Actually, it was intensely grazed as documented by the ruminant's coprolites analysis (see Chap. 7, Chap. 8.5.2 and Chap. 8.6.2). The interruption of ploughing and weeding on moister soils favoured the wide spreading of perennial weeds. First of all of those which could quickly regrow from small pieces of their fragmented (by plough's work) rhizomes and successfully colonize the bare ground, e.g. *Agropyron repens, Convolvulus arvensis*, and among the species recorded in both, the Lucone D and Lavagnone sites *Potentilla reptans, Ranunculus repens, Trifolium repens, Cirsium arvense* (Hillman 1981).
The huge amount of creeping cinquefoil (*Potentilla reptans*) remains and its strong increase in the MBA deserves a closer examination. It is a stoloniferous herb nowadays found in moderately disturbed pastures and mown grasslands, on lake and river shores, road margins and other man-made habitats (Van der Meijden 1996). The numerous nutlets of *Potentilla reptans* in the analysed archaeological layers might be an indicator of the great importance of ruderal habitats in the settlement surroundings (or in the settlement itself). The commonest habitat associated to this plant is usually rich in species demanding high moisture, nutrient availability, loamy or clayey-loamy soils frequently without gravels. In these stands, *Potentilla reptans* could be one of the dominant species mainly forming a lower herb layer (height 10-15 cm). In warmer and drier climates, by desiccation of the habitats, plant species requiring higher moisture retreat and *Potentilla reptans* strongly prevails (Elias 1978). Nevertheless, the spread of this pioneering species even in ecosystems prone

to natural disturbances and characterized by high dynamics such as flood meadows cannot be excluded. Lacustrine banks influenced by lake water level fluctuations, as could be more likely the Lavagnone basin in accordance with Garda region climate, can also represent a suitable habitat for this species. Thanks to its creeping habitus, *Potentilla reptans* is one of the few species, which is able to colonize flood sward. In conditions of low competition, *Potentilla* plants successfully grow out along the surface, quickly covering the bare earth (Ellenberg 1988: 607).

8.2.2.5. Soil fertility

High productivity level of fields is supposed to be maintained by manuring in order to enrich the soils of N-components. This practice consisted of scattering manure on fields from a midden or, more easily, letting animals enter the fields for grazing and thus providing directly manure. The abundance of pigs in some Neolithic sites was for instance related to intensive disturbance and manuring of fields, as «pigs are known to break up soils effectively and clear plots of weeds while also providing manure» (Bogaard 2004, 150: cf Rowley-Conwy 1988, 95; Brombacher & Jacomet 1997, 271-272; Kreuz & Schäfer 2011).

Anyway, clear archaeobotanical evidences for these activities are hardly achieved. Recent stable isotope investigations on archaeobiological remains may help refining our understanding of farming regimes (Bogaard & Outram 2013). Particularly, the practice of manuring with animal dung to enhance the soil productivity can be detected on stable nitrogen isotope ratios in cereals and pulses (Bogaard *et al.* 2007, Fraser *et al.* 2011, Bogaard *et al.* 2013). These recent works have shown that manure was used as a resource since early farmers in Europe, only limited by the scale of herding and by the labour cost of its dispersal.

In traditional archaeobotanical investigations, the predominance of species with high Ellenberg-values for nitrogen are normally used to reconstruct soil fertility. In the Lucone and Lavagnone plant assemblages, these species are mainly recorded in the summer crop weeds group (Tab 8.2.1). Character species of the Chenopodietea are actually more nitrogen-loving than those of the Secalinetea (winter crop weeds). As all our samples are from mixed deposits, the record of these species could not unambiguously prove manuring fields. In addition, the Chenopodietea class includes weeds growing within either summer cereals, garden cultivation plots and ruderal stands, thus reflecting conditions of different habitats. More frequently, summer crop weeds «tended to be associated with the intensive cultivation of small gardens within villages», whereas winter crop weeds «with the more extensive cultivation of larger fields at some distance from settlements» (Jones, Bogaard and Charles, 2000). The intensive cultivation of small plots required hard tillage (hoeing), watering, weeding and likely manuring. In central Europe from later Bronze Age onwards, this division between intensive infield (‘garden plots’ near the houses) and extensive outfield (larger size cereal fields a bit far away from the houses and less intensively managed) cultivation based on weed spectra, becomes more evident (see references in Bogaard 2011).

The arable weed spectra of Lucone D and Lavagnone assemblages accounts for a diversification and intensification of the agricultural system and support the idea of distinct crop growing conditions. More likely, the agricultural system consisted of garden-like crops, linked to warm season and intensively managed including manuring in order to maintain a high soil productivity, and extensive winter cereal crops. Broomcorn millet and broad bean cultivation, amongst other pulses, took likely place in the small plots close to the settlements. Thus, what seems to be established already in the Early and Middle Bronze Age in northern Italy will be as much evident only in the later Bronze Age in central Europe (Jacomet & Brombacher 2009). On the other hand, further hints can be inferred from archaeozoological data. The prominence of pigs in the domestic animals detected in the Lucone D site could support the hypothesis of soil fertilization in a crop husbandry regime based on the exploitation of permanent fields (see above and Chap. 1.6.2.6).

8.2.2.6. Harvesting methods

Cereal ears can be harvested in different ways. According to Hillman (1981, 148-153), on the base of ethnographic evidences, the possible methods are as follows:
a) Harvesting of cereals by uprooting. This method is quite effective in dump soils.
b) Harvesting ears and straw simultaneously by sickle-reaping. This is a very fast method because each cut can take more than twenty plants. Cutting low on the straw can imply cutting many of the weeds that will be mixed with the cereal grains. Cleaning operations are thus required to eliminate weed seeds. These operations (separating the chaff contaminants) are a bit more complicated in the case of glume wheats. How close to the ground the straws were cut can be inferred by the weeds height range (see e.g. Maier 2001).
c) Harvesting the ears and the straw separately. This method allows cutting only a few ears at the same time because of the uneven height of the ears and needs a second operation for cutting the straw.
d) Plucking the ears, followed by reaping or uprooting of straw.
The abundance of weeds in our samples suggests that the harvesting method used was that of cutting straw and ear together. Besides, in the ears accumulations preserved in the burnt layers of Lucone D, several ears still show a portion of culm and many culm portions are associated with the ears (Fig. 8.2.5). The majority of the segetal weeds (WW and SW groups) identified in our mixed samples were low/medium-growing herbs reaching a height of about 30 cm (Tab. 8.2.1). This suggests the harvesting height of cereals was very likely in the lower part of the culm.
Two types of harvesting tools were recovered in the Lavagnone and Lucone D sites. In the earlier phases of the Polada culture (EBA IA, Lavagnone 2) a reaping-knife with straight wooden body and knob-handle, ending in a long curved appendix (ear-hook), was in use in the Garda region (Fig. 8.2.6). The ear-hook was used for holding a bunch of cereal culms that, once grasped in the left hand, were sawed with the flint blade by the right hand griping the knife. Flint blades – normally four – were inserted in a groove of the body (Fig. 8.2.6). So far (de Marinis 2000), twelve more or less complete reaping-knifes were found in the region, including the one recovered in the site of Lavagnone (Plate XVII, de Marinis 2000) and one in the site of Lucone A (Simoni 1970). Recent excavations in Lucone D yielded another harvesting knife (Baioni M., pers. com.).
The second harvesting tool was the wooden jaw-sickle with flint inserts forming a curving blade and a distinct handle (Fig. 8.2.7). De Marinis (2000) mentions nine of such finds dated to EBA in the Garda region (Plate XVIII, de Marinis 2000). One of them was found by Renato Perini in the EBA IB layers (Lavagnone 3) at Lavagnone. In addition, four more sickles – with a slightly different shape and dated to MBA – were recovered in the pile dwellings of Fiavè. In the recent excavations of Lucone D, other three jaw-sickles were brought to light (Baioni M., pers. com.) (Fig. 8.2.7).
Traces of sickle gloss were identified on most of the flint blades of these artefacts suggesting they were used to cut plants with abundant phytolits, like grass and cereals (de Marinis 2000). The recent finds in Lucone D of the two types of harvesting tools in the same chronological context (EBA IA), arose some doubts about the previous theory of a typological sequence from the reaping-knife (earlier phases of EBA) to jaw-sickle (later phases of EBA) and then to the Fiavè type jaw-sickle (MBA) (de Marinis 2000, Primas 1986).
The co-occurrence of these two types of harvesting tools suggests that they were used for different purposes or that one of the two has been just recently introduced, i.e. the sickle, whereas the reaping-knife was soon dropped off. Indeed, the reaping-knife was not a handy tool, for an effective use as harvest-tool it should have been provided with a further handle. With such a knife, the stalk could hardly be cut near the ground since in the process of reaping turned the hook downwards (Clarke 1968, p.110). Thus, the use of this tool clashes with our observations on weeds height or we have to assume it was used for a different purpose.

Sickles are more suited to reap stem near the ground. While tightening a bunch of cereal culms, a simple sickle blow at the lower part of the stalk, where the tension is higher, can easily cut the plants. Furthermore, in case of cereals allurement – more frequent in the ancient cereals – these harvesting methods could be effective anyhow. During harvesting time, cereal sheaves knotted with twisted culms were likely prepared in the field, left drying – as suggested by local ethnographic sources (Capra 2012) – and then brought to the settlement or at the place assigned to crop processing. Reaping the plants with a long portion of the stem could be an advantage also for an easier displacement of cereal harvest. Threshing could be performed by lashing separate sheaves on a hard surface or by trampling them by animals etc. (Hillman 1981, p. 130).
We can speculate that first reaping-knife was used for harvesting the ears, while sickles for reaping the straw (see above, harvesting methods). Later, people gave up with reaping-knife and two cutting operations, and opted for using only sickles, which were in their turn replaced by metal sickles in the later phases of MBA.

8.2.3. Crop processing analysis

Crop processing consists of subsequent operations related to crop plants after the harvest and before storage or consumption. During 1980's, many authors argued for the importance of the effect of cereal crop processing on samples composition (e.g. Van der Veen 1992). Thus, identifying crop processing stages is relevant for the interpretation of plant assemblages, especially in the study of crop husbandry and plant economy through the ecology of weeds. Ethnographic models from areas where traditional methods were still applied (e.g. northeastern Turkey, Greece), were used to interpret assemblages of crop remains (Hillman 1981, 1984, Jones G. 1984, 1987). Information about the type of husbandry, processing methods, composition of the crop products and by-products were obtained and applied to archaeological contexts with the assumption that the basic processing sequence should be fairly constant (Hillman 1981, 1984). The crop processing sequence varies slightly depending on the cereal crop type. It can be simplified as follows (Van der Veen 1992):
- *Harvesting*
- *Threshing* (releasing spikelets – in the case of hulled cereals – or grains – in the case of naked cereals – from straw and chaff)
- *Winnowing* (removing light chaff, straw fragments, and light weed seeds)
- *Coarse sieving* (removing large weed seeds, unthreshed ear parts/spikelets and straw nodes)
- *Fine sieving* (removing small weed seeds).

For processing glume wheats and hulled barley (grains strictly enclosed by their glumes), additional operations are needed:
- *Parching* (rendering the glumes brittle)
- *Pounding* (releasing the grains from the glumes)
- *Second winnowing* (removing light chaff fragments and light weed seeds)
- *Second coarse sieving* (removing remnant large weeds, straw nodes, etc.)
- *Second fine sieving* (removing glume bases and small weed seeds).

Each stage of the crop processing sequence creates products and by-products, which can be discriminated on the basis of their proportions of grains, chaff, straw, and weed seeds. According to Jones G. (1984, 1987, 1991) the study of weeds alone can be successful if characteristics relevant to crop processing are considered, such as grains size, aerodynamic qualities (especially density), and tendency to remain in heads. For applying these methods, it is necessary to select appropriate samples (Jones 1987, Boogard 2004). Samples should concern only plant remains preserved by charring, and contain at least 100 crop items and 50 weeds remains.

In addition, they should be preferably in primary context, corresponding to a single crop processing stage and preferably include one single crop species. It is important to avoid mixed samples where plant remains could derive from different sources (habitats, contexts of use, depositional events, etc.). This means to use only samples from 'closed context' (high density of plant remains deposited in one single event, e.g. crop stores). Therefore, the use of waterlogged samples could be as much problematic since waterlogging preserves almost any plant material from a wide range of potential sources. In the case of arable weeds, which are also edible plants or can grow as well in non-arable habitats, it is difficult to define their 'entry routes' into the deposit. All these conditions make the availability of suitable samples in lakeshore sites quite rare. So far, all samples studied in Lavagnone and Lucone D represent waterlogged mixed deposits (see Chap. 8.1). There are only a very few wild plant *taxa* recovered in charred state and their amount is significantly lower than 50 items per sample. Moreover, most of these *taxa* cannot be exclusively attributed to one ecological group. Thus, the identification of differences between the crop processing debris of the single stages of cleaning was not possible. Considering the charred cereal remains from our mixed samples, they could represent by-products of grain deshusking, fine sieving and coarse sieving (Jacomet *et al.* 1989). Therefore, we can at least state that crop processing activities certainly occupied an important part of the daily life after the harvesting season both in Lucone D and Lavagnone villages.

8.3 The importance of gathered plants

The environment surrounding the settlement was intensely exploited in both, the Lavagnone and Lucone D sites. Many natural resources available in the wild were collected and used for different purposes. In particular, plant sources supplied for food, fuel, handicraft, construction, dying, fodder, medicine, etc. All these uses prove a deep knowledge of the plants' properties and a wide range of usable wild plants. The exploitation of cultivated and wild resources might be a very successful survival strategy allowing such prehistoric communities to face up to times of need, for instance due to crop failure (Jacomet *et al.* 2004, p. 393). Potential of wild foods used in the past is usually underestimated by archaeobotanists because of the reduced chance of many wild food items being preserved (e.g. flowers, leaves, fresh fruits, etc.) (Ertug 2009). Ethnographical investigations played an important role to understand the nutritional and economic value of wild plant food, as well as the processes, tools and techniques used to prepare the plants as food (Ertug 1997). Almost all the gathered species are included in the ecological group of 'Woodlands, wood edges and clearings' (Chap. 2.8) as most of them are woody species or herbs growing at the forest edges. These species were most probably not cultivated in the sense of sowing them in a dedicated plot but some of them might be tended over the years and favoured by specific practices e.g. keeping the forest thin or opening stands in the forest cover. For some species, a replanting in spots close to the settlement might be supposed e.g. figs (see below).

8.3.1. The Fruits

The fruits are represented by a huge amount of species rich in vitamins, proteins and calories. All of them can grow well in the Garda region thanks to the mild climate. A wise management and shaping of the landscape can effectively favour most of these species.

Fruit consumption presented problems linked to their conservation over time. Actually, the fruit required to be eaten up soon after collecting unless it was dried in the sun or transformed into a drink or a sort of jam, which could anyhow be stored for a relatively short period. Dried fruits were likely produced, especially for highly sugary species such as figs and grapes. In the north-alpine lake dwellings, also the drying of crab-apples was quite common as documented by many finds of apple halves (e.g. Jacomet *et al*. 2004).

The most common fruits found in Lucone D and Lavagnone were blackberry, wild strawberry, fig, pear, cornelian cherry, and wild grape. Several other species might have been also collected in the surroundings of the settlement for food consumption as fruit, even if they are less frequent in the archaeobotanical record. These are raspberry (*Rubus* cf *idaeus*), danewort (*Sambucus ebulus*), elder (*Sambucus nigra*), blackthorn or sloe (*Prunus spinosa*), hawthorn (*Crataegus monogyna*) and rose (*Rosa* sp.).

Some of the fruit plants produce aggregated fruits, thus a huge amount of their remains can be preserved in the archaeological deposits. This should be taken into account for a more realistic picture of the most common fruit remains (Jacomet *et al.* 2004, p. 393).

Fruit stones might also be used for ornamental purposes e.g. several *Prunus* stones (likely intentionally smooth) were used as beads in one of the necklaces found in Lucone D (LUC RR1349).

Blackberry (*Rubus* aggr. *fruticosus*) pips were found everywhere in the cultural layer (in all the analysed samples). The production of numerous aggregated tiny fruits and the thick and woody wall of their endocarps favoured their preservation in archaeological deposits. Nevertheless, a regular consumption of great quantities of these fruits could be confirmed both in Lavagnone (concentration of fruit units in EBA layers 6/litre; in MBA layers 2/litre) and Lucone D (in 1st settlem. phase 5/litre, in 2nd settlem. phase 20/litre). Blackberry can largely grow in woodlands disturbed by human activities, at the forest edges or in forest clearings. In sunny spots, it can produce huge amounts of fruits. During wintertime, it could still bear leaves and dried fruits, thus it could be frequently browsed by animals (sheep and goats) (see Chap. 7). Strawberry (*Fragaria vesca*) was also very abundant both in Lavagnone (concentration of fruit units in EBA layers 8/litre; in MBA layers 1/litre) and Lucone D (in 1st settlem. phase 11/litre, in 2nd settlem. phase 2/litre). It is also a species widespread at the forest edges.

The pips of grape found in Lavagnone and Lucone D could be undoubtedly ascribed to wild grape (*Vitis vinifera* subsp. *sylvestris*) as they are markedly and steadily rounded in shape and very similar to the iconography of wild forms. As a matter of fact the spreading of cultivated grape has been attested in northern Italy since the 5th c. BC (Castelletti *et al.* 2001), probably introduced by the Etruscans (Helbaek 1956). During the Bronze Age, wild grape was likely eaten as fresh fruits.

The problem of distinguishing wild grape from cultivated forms has been largely discussed in the archaeobotanical literature (Stummer 1911; Terpo 1976, 1977; Mangafa & Kotsakis 1996; Jacquat & Martinoli 1999; Kohler-Schneider 2001, Tolar *et al.* 2008, Terral *et al.* 2010). On the base of morphological features, it is not always possible to discriminate domesticated from wild grape pips. However, in general the latter ones are smaller, robust and have a rounded outline and a short stalk (Stummer 1911). Biometrical approaches were also applied and calculations of indexes were suggested to discriminate between the two subspecies (Stummer 1911, Mangafa & Kotsakis 1996; Terral *et al.* 2010). Terral *et al.* 2010 came to a similar result as already Stummer obtained; however, there are always some cultivars with round seeds, too. Wild grape is regarded as a native creeper in the Po plain. In the Garda area, *Vitis* pollen is found as continuous record throughout the Middle Holocene (from Neolithic and Copper Age); for instance in the pollen record of Lavagnone (Arpenti *et al.* 2002). At Fimon in the Berici Hills (Valsecchi *et al.* 2008) *Vitis* pollen constantly occurs in the Early to Middle Holocene between 9,5 and 5 ka cal BP, without evidence of anthropogenic impact over the local forest mantle belt settling the lake shores. Indeed, the grape may be considered a component of the forest mantle of the wetland forest surrounding the small lake ponds, being related to the light spots created by forest interruptions glades in front of the aquatic environments (Arpenti *et al.* 2002).

Grape pips were found with high concentrations in the cultural layers of both Lavagnone (concentration of fruit units in EBA layers 13/litre; in MBA layers 2/litre) and Lucone D (in 1st settlem. phase 3/litre, in 2nd settlem. phase 9/litre), which points to their very regular use.
Cornelian cherry (*Cornus mas*) stones are frequently found in Bronze Age sites in northern Italy (e.g. Jones *et al.* 1984: Fiavè; Castelletti *et al.* 1992: La Quercia di Lazise; Rottoli 1997, 2001: Castellaro del Vhò). They were found with high concentration also in the cultural layers of both Lavagnone (concentration of fruit units in EBA layers 6/litre; in MBA layers 5/litre) and Lucone D (in 1st settlem. phase 5/litre, in 2nd settlem. phase 24/litre). They were presumably eaten as fresh or dried fruits or for producing a kind of beverage from the fruits (Fiorentino *et al.* 2004, Castelletti *et al.* 2001). The hypothesis of producing a fermented drink from Cornelian cherry and of the cultivation of this plant suggested by Castelletti *et al.* (2001, p.59) is actually not corroborated by any direct evidence. The authors argued the drink production for explaining the huge amount of its remains in archaeological sites and the strong decreasing of this species during the Iron Age, when grape started to be cultivated. A second spread of this species in northern Italy occurred during the Roman period. A morphobiometric analysis of cornelian cherry stones from BA and roman archaeological sites of the Emilia Romagna region has pointed out a trend to slimmer cornelian cherry stones due to probable selection/cultivation carried out in Roman times (Bandini Mazzanti *et al.* 2005). All in all, the Cornelian cherry cultivation during Bronze Age is not demonstrable based on our investigations. Certainly, Cornelian cherry, which can grow with different habitus from bushy shrub to a small tree up to 5 meters high, can take great advantage by tending practices which might be suggested: cleaning the area around the plant can enlarge its canopy and fruit production. In the Garda region, it is largely widespread even in broad-leaved forests and ripens fruits more abundantly compared to other geographical areas of northern Italy where only plants growing on sunny spots in coppiced cleared forests, or tendered along paths produce abundant ripe fruits (pers. observ.).
Fig (*Ficus carica*) is one of the common fruits in Lavagnone and Lucone D. The occurrence of fig pips in archaeological sites is documented in northern Italy since the Late Neolithic period and characterized by a later increase during the Bronze Age (Castelletti *et al.* 2001). As it is impossible to distinguish between pips of wild and domesticated figs, the archaeobotanical finds can be interpreted as either wild or cultivated (Zohary *et al.* 2012: p. 129). Indeed, the native status of fig is not supported by palaeobotanical evidences outside archaeological sites due to its low pollen production and its primary habitat far from any condition of potential preservation. Although the distribution of wild fig seems to be restricted to the Mediterranean region and its occurrence in continental Italy is excluded (Zohary *et al.* 2012: map 17, p. 129), Zohary *et al.* support the idea that the Italian finds are collected from the wild. Fig spreading in northern Italy was favoured by a warm climate, especially in the Garda region where the climate has a (sub)-mediterranean touch, and higher atmospheric humidity. Modern occurrences of fig in this region are mainly referred to secondary man-made habitats (Armiraglio, pers. comm.). Brullo & Guarino (1998) mentioned *Ficus carica* in a new phytosociological association they describe for the Garda region: Lauro-Alnetum glutinosae. This hygrophilous woodland vegetation develops along stream banks and is characterized by the tree species *Alnus glutinosa, Populus nigra, Salix alba,* and *Fraxinus excelsior*; and by the presence of *Laurus nobilis* and *Ficus carica* in the shrub/sapling stratum. The primary habitats of fig (rock crevices, gorges, streamsides etc.) are in any case far from the pile dwelling areas considered here. Replanting fig trees close to the settlement could have been possible, but it could have also grown by seeds, abundant in the settlements, especially on waste disposal places, due to its consumption. The limiting factors in the dispersion of fig in a warm-temperate climate are linked to the edaphic humidity. Besides, fig is a relative fast-growing plant, producing fruits three or four years after germination.

Pears and crab apples were found in fair amount in the EBA cultural layers of Lucone D and Lavagnone, while in the MBA layers they were not so abundant. Some samples from the Lucone D site are particularly rich in pear/apple seeds and pear stone cells. A large consumption of pears seems to characterize the site of Lucone D. Crab apple and pear thrive in similar environments, they both need winter chilling to ensure normal flowering and fruit setting. Thus, they are widely distributed in the temperate zones of Europe, south-west Asia, and Siberia (Zohary *et al.* 2012, p. 138). Charred remains of pear and crab apple fruits were found in several Neolithic and Bronze Age sites in Europe. These fruits were often halved and probably dried for winter consumption. We did not find such remains in Lucone D and Lavagnone.
Considering the high amount of Chinese lantern (*Physalis alkekengi*) remains found in Lavagnone and Lucone, this species was clearly collected for consumption. According to its ecological requirements, it could extensively grow in unshaded stands of meso-hygrophilous woods as well as in the canebrake along the lakeside near the settlement. A direct evidence of its consumption was documented in the Late Neolithic lake dwelling site of Arbon Bleiche 3 (around 3380 BC; Jacomet *et al.* 2004) where seeds of bladder cherry were found encrusted in cooking pots. In addition, *Physalis*-seeds regularly occur in Neolithic cultural layers in the surroundings of the Alps (Jacomet 2006; 2007).

8.3.2. Nuts

Nuts are represented only by three species: oak (*Quercus* sp.), hazel (*Corylus avellana*), and beech (*Fagus sylvatica*). Beech nuts were well documented in Lucone D, but only one single find was retrieved from the EBA layers of Lavagnone. These finds are too few to support an intentional collection, more likely they arrived in the settlement by chance from locations in a larger distance (animals?). In contrast, the occurrence of beech trees in the basin of Lucone is proved by beech nuts found in an off-site sequence (pers. observ.) and by pollen % recorded in the off-site deposit (see Chap. 1.6.1.4).
Hazelnuts are common finds in BA archaeological deposits e.g. in Fiavè (Jones *et al.* 1984). The tasty nuts of hazel are easily collected, shelled and can be stored for several months. Furthermore, a single hazel bush can produce a huge amount of hazelnuts. Its fruits production can be highly increased by tending practices. This species was quite abundant in the thermophilous woods of the Garda region as documented in pollen diagrams of both the Lavagnone and Lucone D deposits. Abundant remains of hazelnuts were actually found in Lucone D and in the MBA layers of Lavagnone. They mainly consist of shell fragments, as only a few complete shells were recovered (see Chap. 3.4.1 and Chap. 6.4.1).
Acorns could have been collected to feed domestic animals, but a human consumption cannot be excluded as many *Quercus* species may yield edible acorns, whose palatability can greatly diverge even between specimens of the same species and even population (Renfrew 1973; Vencl 1985; Karg & Haas 1996). In these circumstances, a detailed knowledge of the natural resources is required (selection and care of single trees). Acorns of *Quercus virgiliana*, a mediterranean oak occurring in the Garda region too (Brullo & Guarino 1998), are sweet acorns peeled for human consumption (Helmut Kroll, comm. in the archaeobotanical mailing list). Besides, roasting of acorns, as supposed in many archaeological sites, corroborates the hypothesis of human consumption as the exposure to heat eliminates the bitter taste. In addition, historical and ethnographical sources give further hints to argue the human consumption (Primavera & Fiorentino 2014; Mason & Nesbitt 2009; Deforce *et al.* 2009; McCorriston 1994; Mason 1992; Schneider 1989). Acorn finds are frequent in both the Lucone D and Lavagnone sites and include both charred and waterlogged remains. The huge accumulation of charred acorns found in Lucone D is more likely produced by the fire event at the end of the 1st settlement phase. Therefore, we can only state that acorns were gathered and stored inside the settlement, but acorn processing (e.g. roasting) is not provable.

8.3.3. Other edible plants

Other wild species with starchy seeds were also found in large amounts in both, the Lucone D and Lavagnone sites. Some of them as e.g. *Chenopodium album* are characterized by a very high seed production, which made it easy to collect them. Moreover, their thick seed wall made them suitable for storage (Maier 2001, Fairbairn *et al.* 2007).

Among these species, the most common were fat hen (*Chenopodium album*), black bindweed (*Fallopia convolvulus,* syn*. Polygonum convolvulus*) and purslane (*Portulaca oleracea*). The latter is particularly abundant in the MBA cultural layers of Lavagnone. In addition, fruits of *Polygonum* species such as *P. lapathifolium, P. persicaria,* and *P. aviculare* might have been collected for food purposes. As most of these species were weeds commonly occurring in the crop fields or in nitrogen-rich places/soils linked to anthropogenic activities, it is not easy to get clear evidences that they were intentionally collected or accidentally brought inside the settlement. Indeed, we did not find any heap of pure fruits of none of these species.

Seeds of fat hen (*C. album*) are frequently recovered in archaeological sites. This plant is usually quite common in weed communities, especially in fallow land, and is characterized by a high fruit production. Finds of large pure assemblages of its fruits are known in several archaeological sites of different periods and its consumption is supported by finds of intestinal contents and according to historical sources (Behre 2008).

The assured use of black bindweed (*F. convolvulus*) as supplementary food is documented since the Iron Age mainly in archaeological sites north of the Alps (van Zeist 1970; Renfrew 1973; Behre 2008). Behre (2008) mentioned the use of this plant for flour still at the beginning of the 19th c. in northern Germany. Nevertheless, large assemblages of this herb could be easily misinterpreted, as it could be a common by-product of crop processing considering its low fruit production, its abundance as a weed in cornfields and its climbing habitus, which assured that it was picked up even in case only the heads of cereals were cut.

Purslane (*Portulaca oleracea*) has a high nutritional value; its consumption is known in northern Italy in the Roman period and throughout the Middle Ages (Bosi *et al*. 2009). All parts of the plant can be eaten, including seeds used as condiments/aromas or to produce flour, but its main consumption is as leafy vegetable (young leaves and stems). It is also avidly eaten by animals especially pigs. *Portulaca oleracea* is an invasive weed in crop fields. It is a pioneer plant characterized by strong resistance to salinity and high seed production.

Valerianella dentata and *Daucus carota*, found in high amounts in the two sites of Lavagnone and Lucone D, are also edible plants respectively for leaves and roots. They were likely widespread as weed species in the crop fields and could have been also collected for food purposes.

The gathering of a large spectrum of plants is thus documented in the Lavagnone and Lucone D sites during the Early and Middle Bronze Age; mainly berries and nut species can be considered as surely gathered food plants. Food gathering and food production were complementary in the survival strategy of the prehistoric communities of the Garda region during the Bronze Age. They strongly exploited for food supply wild resources in the environments surrounding the settlements, and some tending of these resources might be envisaged.

8.4 Oil seeds, dye plants and fibre crops

Among oil and fibre plants, flax is the most important and well documented crop in prehistoric times. It was one of the eight founder crops of south-west Asia and it was cultivated since the Neolithic times to the present day (Zohary *et al.* 2012 p.100). Although it was firstly domesticated for its seeds (Fu *et al.* 2011), it was probably the earliest cultivated plant used for weaving clothes (according to Zohary *et al.* 2012 p. 105 ff. earliest flax textiles from PPNB). Flax fibres are actually stronger than cotton or wool. Nowadays, two flax varieties are cultivated: the oil variety, characterized by a short stem, richly branched and bearing large seeds, and the fibre variety with taller stems, sparsely branched and with smaller seeds. A recent morphometric investigation on linseed remains from wetland settlements of south-west Germany has pointed out the probable introduction of the fibre flax variety in the Late Neolithic (Herbig & Maier 2011).

The occurrence of *Linum usitatissimum* is attested in northern Italy since the Early Neolithic, referring to a single seed found in Sammardenchia (UD) (Rottoli & Castiglioni 2009 p.96). In the Middle and Late Neolithic, more abundant flax remains were retrieved in the three waterlogged sites of Palù di Livenza (PD), La Lagozza (VA) and Isolino di Varese (VA) (Corti *et al.* 1998, Castelletti *et al.* 2001), as well as in the two dry sites of Vela di Trento (TN) and Maserà (FE). During the Bronze Age flax finds become more frequent, but not numerous (Fiorentino *et al.* 2004 p.224), and are mostly linked to waterlogged sites. Due to their oil-rich seeds, flax remains are extremely vulnerable by fire and have lower chances to get charred.

The presence of short flax stem fragments in cultural layers are considered as by-products of flax processing (Maier & Harwarth 2011) in order to produce the fibres. Nevertheless, the cultivation of flax for food consumption and oil production is also very probable, as it was attested in many lake-dwelling sites north of the Alps since the Neolithic period. The mixture of complete seeds and capsule fragments (segments or half segments) are considered as evidence for the nutritional purposes of flax as they occurred as threshing of flax capsules (Maier & Schlichtherle 2011).

We still know very little about flax processing techniques both for oil and fibre's exploitation in prehistoric times. Most likely, oil was obtained by crushing seeds, pouring hot water on the linseed meal, and scooping the oil after setting (Zohary *et al.* 2012 p. 100). In order to obtain fibres, flax stems were retted, dried, and subsequently beaten and broken in order to free the fibres. Methods of flax retting were already known in Late Neolithic times, as well as hackling, as documented by rib spikes and by the nature of the fibres found (Maier & Schlichtherle 2011).

In both, the Lucone D and Lavagnone sites, we mainly found flax remains as a mixture of seeds and capsules fragments, whereas only a few stem fragments have been retrieved. Consumption of flax as food is also proven by findings of small concentrations of bare flax seeds preserved in the burnt cultural layer of the Lucone D site. Particularly, these seeds were kept in small wooden vessels, of which only small burnt fragments are left. The small amount of seeds and the absence of any capsule fragments let us suppose they were stocked for food consumption. Oil production is apparently not documented by any artefacts that could be used for extracting oil from seeds. Anyway, the high fragmentation of seeds and capsules in most of the samples might suggest it. The cultivation of flax for fibre production is, however, testified by a textile remain identified as linen by M. Gleba (Institute of Archaeology, Univ. of College - London, UK) (Gleba & Baioni 2011). This remain was found in the cultural layers of the first settlement phase of Lucone D (Stratigraphic Unit SU5). Flax cultivation is documented also in the pollen record. Flax is a low pollen producer, thus the low percentages recorded in both pollen records of Lucone D and Lavagnone can be interpreted as evidences of flax fields in the surroundings. The lack of flax macroremains in the MBA layers of Lavagnone is most likely due to taphonomic reasons (uncharred seeds are prone to corrosion) as flax pollen was recorded in one sample dated to the MBA. Flax capsules fragments were found in one coprolite from the Lucone D layers. As documented in other waterlogged sites (e.g. Arbon Bleiche 3, Jacomet *et al.* 2004), flax processing by-products were often used as fodder for domestic animals.

Another plant found in Lucone D and Lavagnone producing oil-seeds is safflower, *Carthamus tinctorius*. The importance of this plant is also linked to its use for dying textiles. Fossil finds of safflower are quite rare. The

reasons of its cultivation and its use are thoroughly discussed by Marinova & Riehl (2009). They suggest that the use of safflower during the EBA in the Near East was not only as a dye plant but also as an oil crop.
Concerning its ecological requirements, safflower tolerates dry atmospheric conditions during its growing, flowering and seed formation periods. It grows well on drained soils and its deep root system makes it drought tolerant. High humidity and rainfall are unfavourable ecological factors for its cultivation as they increase damages from fungal diseases (Dajue & Mündel, 1996).
The Lavagnone and Lucone D finds are very few to support a real cultivation of this species on large areas. Nevertheless, most of the sites with *Carthamus tinctorius* finds from Neolithic to the Roman period listed in Marinova & Riehl (2009: table 1) yielded less than 10 achenes, despite the huge amount of the total seeds/fruits recovered at those sites. According to Kroll (1990) the low amount of safflower achenes could be interpreted as being related to dyeing and the preservation of seeds, collected for the next sowing time, could be fortuitous. Furthermore, the ecological requirements for cultivation of safflower match quite well with the environmental features of the Garda region, even under an un-irrigated system. Residual moisture in deep soil is critical to safflower growing; moreover, high atmospheric humidity at blooming time could produce insect attack to heads precluding the complete growth (Knowles 1955). Early domesticated *Carthamus tinctorius* was most probably a summer annual as wild *Carthamus* species are. The reduction of seed dormancy of some cultivars is a secondary feature acquired late in its domestication process (McCorriston 1996). Therefore, the appearance of *Carthamus* should be considered as a signal of summer cropping. The spread of *Carthamus lanatus* (saffron thistle) together with *C. tinctorius* - as a weed or as exchanged seeds mixed with safflower as supposed by Kroll (1990) - has not been yet proved. Saffron thistle remains of Lavagnone (Early and Middle BA samples, see Tab. 3.2a and Tab. 3.3) are the only finds of this species known from northern Italy. Nowadays the species grows in sporadic stands of fallow habitats or as a weed in the Garda region (Pignatti, 1982; Armiraglio S., pers.com.; pers. observ.). A probable ancient use of this species is supported by the numerous achenes found in the Early Neolithic lakeshore site of La Marmotta (Central Italy) (Rottoli, 2001), but it still needs to be clarified.
Finally, among oil plants we should mention the finds of *Camelina sativa* (gold of pleasure), a secondary crop used for its edible, oil-rich seeds. *Camelina* is supposed to develop as a weed in south-eastern Europe and south-western Asia, and was later grown as independent oil crop (Knörzer 1978). In fact, C*amelina* remains are often associated with flax seeds in archaeological contexts and thus interpreted as a weed of flax fields (e.g. Hornstaad Hörnle IA: Maier 2001; Zürichsee: Brombacher & Jacomet 1997). The oldest finds of *Camelina sativa* in Europe date back to Late Neolithic (Auvernier La Saunerie (CH): Villaret von Rochow 1971 and Yverdon Avenue des Sports (CH): Schlichtherle 1981, 1985). During the Bronze Age, they became more frequent but usually consist of small quantities of seeds, whereas large samples are quite rare. From Iron Age onwards this oil crop became more common in some parts of Europe (Karg 2012, Pollmann 2014).
In both Lucone D and Lavagnone *Camelina sativa* finds consist of only a few remains, mainly represented by silique fragments. Actually, the cultivation of this plant is poorly plausible as the finds are very few; most probably *Camelina* occurred in flax or cereal fields as a weed.

8.5. Animal husbandry regimes: evidence from plant remains

8.5.1 General remarks on animal husbandry

Animal husbandry was an important economic factor in the Neolithic and Bronze Age communities. The benefits of this activity were several: meat and milk production, dung (manure and fuel source), labour (draught cattle), and wool (from sheep). In addition, bones, skin, horn, tendons etc. were raw material for handicraft. Furthermore, a cult and/or religion reason of keeping cattle in small numbers in early Neolithic societies was argued by Ebersbach (2002). Therefore, activities connected to breeding of domestic animals had for sure an important role in the daily life of the prehistoric settlers, e.g. herding or the management of fodder provision.

Even the impact of grazing on the surrounding vegetation detected by pollen investigation would require knowing which habitats were actually browsed by domestic animals.

Direct evidence of the animal husbandry regimes can be obtained by analysing the dung content, especially of ruminants (e.g. Akeret & Jacomet 1997; Kühn & Hadorn 2004; Kühn & Wick 2010). Plant macroremains (fruits, seeds, wood, buds, and epidermis fragments) are what is left after digesting processes, thus they exactly reflect what the animal ate. Several complete or fragmented seeds/fruits of different species survive the digestion thanks to their protective coating or small size. The pollen content reflects not only the fodder but also the habitats where the animals fed, as it is possible that the pollen was deposited from the surrounding vegetation onto the fodder before it was eaten (Argant 1988, 1990). Also fungal spores and many non-pollen palynomorphs, as well as insect remains are good indicators of the feeding places of the animals and of the surrounding of the settlement (see e.g. Van Geel 1978, 2001, 2003; Innes & Blackford 2003, Schmidt 2004, 2011). As a consequence, as many disciplines as possible should be involved in animal dung research to allow more reliable reconstructions of animal management and its implications. At least a combination of pollen, fungi and macroremains is advised (Kühn *et al.* 2013).

Dung of ruminants has been found and described in cultural layers of waterlogged archaeological sites since the 19th century, but it's only at the end of the 1990's that a decisive impulse was given to this research topic (see Kühn *et al.* 2013 for a short overview of the state of the research). The achieved knowledge, a more accurate excavation technique and sediment sieving, allowed collecting a huge amount of dung finds during recent excavations, especially in waterlogged sites.

Dung pellets of small ruminants (goats and sheep) are the most investigated dung remains, as they are more easily recognizable, even if not discernible between goats and sheep (Kühn *et al.* 2013). On the contrary, dung cattle is very difficult to recognize and isolate in the cultural layers (Akeret & Rentzel 2001).

In the recent paper of Kühn *et al.* (2013) an updated list of all the sites north of the Alps (Switzerland and neighbouring territories of Austria, Southern Germany and France) yielding dung remains is given. The authors listed 48 sites/occupation layers of Neolithic Age, 1 site of Neolithic/Bronze Age and 3 sites of the Bronze Age. Most of these remains are goat/sheep pellets (from 37 sites/occupation layers), a few probable cattle dung (from 15) and others are unidentified dung fragments (from 19 sites). So far, only dung remains from 22 Neolithic and 3 Bronze Age sites/occupation layers were analysed. Therefore, the state of the art is not satisfactory; nevertheless, in the last 10-15 years some important basics of animal husbandry could be elaborated. Some results of these analyses are summed up below.

Goat and sheep coprolites from two dung concentrations in the early Late Neolithic site of Egolzwil 3 (around 4300 cal BC) at a small lake in Central Switzerland suggested - according to Rasmussen (1993) - the harvesting of leafless, but flowering twigs and branches as fodder for livestock during late winter and early spring. This interpretation was based on the pollen content (dominated by hazel, alder and birch), on macroremain analysis (finds of anthers of hazel and alder) and on the twig spectrum associated with the coprolites, also dominated by hazel and alder. More recent investigations on a more copious number of coprolites from the same site have pointed out that not only late winter foddering was practised, but also the pasturing in the vicinity of the settlement during the whole of the year was usual (Kühn *et al.* 2013.).

For the final Neolithic site St. Blaise Bains des Dames (around 2450 cal BC) at Lake Neuchâtel the pollen

spectra of the coprolites of ruminants indicate that the animals were kept the whole of the year in the surroundings of the settlements (Hadorn 1994). In two sheep/goat coprolites large amounts of lime pollen were found. In addition, in some of the pieces numerous cereal pollen grains were found, which indicates the foddering of the animals with straw or/and chaff.
The investigation of twigs associated with dung from the site of Thayngen-Weier (around 3700 cal BC) at a small lake in northern Switzerland showed that a diverse spectrum of twigs was collected. The authors concluded that these were animal fodder. Ash, one of the most treasured leaf-hay species, was the most frequent *taxon*. Beside ash, large amounts of alder and hazel were also identified. The plant macroremains' composition in the dung layer suggests that the animals were also fed with cereals. Finds of twigs of ivy and mistletoe from Thayngen-Weier let one suppose that these evergreen climbers were also fed to the cattle. Hints of this are also provided by high pollen percentages of these two evergreen *taxa* in different settlement layers (Rasmussen 1989).
In one of the investigated sheep/goat coprolites from the site Nussbaumersee-Insel (3700 cal BC), at a small lake in NE-Switzerland, hazel pollen is dominant, in the second place comes cereal pollen (Haas & Hadorn 1998). Although these results are not really representative, they point to the fact that the animals were fed during late winter with hazel twigs, and that in addition they obtained some cereal remains as supplementary fodder.
In Horgen-Scheller (31st mill. cal BC) at lake Zürich 213 goat and sheep faeces were analysed for plant macroremains (Akeret & Jacomet 1997; Akeret 2002), but only a low percentage contained identifiable remains. The most frequently encountered macroremains were prickles of rose/blackberry, fruits of blackberry and sporangia of ferns. Remains of other herbaceous plants were only represented by a few specimen. On the whole, the plant spectrum was poorer than one would expect from feeding in summer or autumn seasons; therefore, the animals were likely fed when the flowering and fruiting period was over. The evergreen leaves of blackberries and ferns are particularly attractive as food in winter, also because dried blackberry fruits still persist on branches. The authors conclude that all the coprolites found in the settlement layers were produced during the winter, that means that the Neolithic farmers let their animals forage outside as long as possible and that they were kept inside only during the night or when the climatic conditions were too harsh.
In Arbon Bleiche 3 (34th mill. cal BC) 434 goat/sheep coprolites were analysed for plant macroremains and 22 for pollen (Akeret *et al.* 1999; Kühn *et al.* 2004; Haas 2004). Two kinds of fodder were detected, both of them were referable to the winter season (including late autumn and early spring). The most frequent one, similar to that described in Horgen-Scheller (see above), was characterized by abundance of rose/blackberry prickles and fragmented fruits of *Rubus* sp., but poor pollen content. The second type of coprolites contained abundant leaves of silver fir (*Abies alba*), ivy (*Hedera helix*), mistletoe (*Viscum album*), and anthers of *Corylus avellana*. Also leaves from deciduous trees were used in foddering: leaves of oak (*Quercus*) and alder (*Alnus*) were identified. All this suggests that goats and sheep browsed outside near the village even during the cold season when fodder was available. They were kept inside the houses presumably only during the night. In times of shortage of fodder the animals were fed with collected fodder including leaf hay.
Results of the goat/sheep faeces analysis from the sites mentioned above allowed expanding our knowledge about small ruminant husbandry practices in the Neolithic. So far, only coprolites from only a few Bronze Age sites were analysed. Within the Swiss National Science Foundation projects (n. 105312-110406/1 and n. K-13K0-117897/1) the investigators present the coprolite analysis of three BA sites north of the Alps (Wädenswil Vorder Au: Early Bronze Age - 1700 cal BC; Horgen Scheller: Early Bronze Age – 1700 cal BC; Zürich Alpenquai: Late Bronze Age - 900-860 cal BC). The results show that animals browsed in the vicinity of

the settlements, preferably in grassland habitats (high values of grassland *taxa* in the macroremains). Also fallow land and ruderal places show an increasing importance as fodder sources. On the other hand, woodland habitats seem to play a lesser role as grazing ground than in the Neolithic. The practice of foddering twigs with catkins was still widely in use. Foddering of leafy hay from evergreen and deciduous trees during winter could be clearly shown for all of the BA sites (high amounts of macroscopic leaf fragments and low concentration and *taxa* diversity of the pollen). This combination of pollen and macroremains suggests that the animals were kept in shelters (stable or enclosure) during winter time and were fed with leaf hay as well as hay from herbs.

The only site from south of the Alps where dung analysis has been carried out is the Early / Middle BA pile dwelling of Fiavé-Carrera (Karg 1998). This site is situated at 650 m a.s.l. in the inner mountain region of the Valli Giudicarie near the northern sector of Lake Garda (see Fig. 1.5.1). Ten goat/sheep pellets were analysed for macroremains and their pollen content. The pellets were embedded in organic matter mainly composed by twigs, fruits/seeds and vegetative plant remains. This organic mix was interpreted as remains of twig/leaf fodder. The tree-rings show that hazel was collected during the winter, whereas beech twigs were gathered with the green leaves in spring. Supposing that pellets of the same cultural layer were deposited at the same time (winter/early spring according to the twigs analysis) the author suggests that the animals were kept inside the settlement and fed with twig fodder as well as with herb and grass fodder.

8.5.2 Keeping of small ruminants in Lucone and Lavagnone sites
(discussion of the coprolites spectra presented in Chap. 7)

The spectrum of plant *taxa* and the different types of remains can highlight different kinds of fodder. Grazing of animals is detected by plant *taxa*, which could not be collected by humans mainly because they bear prickles or release irritant substances. Also the huge amount of charcoal or minerogenic particles in the coprolites can be considered as indicator of browsing outside on burnt surfaces. Cultivated and gathered plants are considered as typical indicators of foddering by humans, although grazing on fallow land, as well as feeding on ripe fruits fallen down on the ground and not collected (e.g. crab apples or pears), cannot be excluded. Leaf fragments of high trees in the coprolites are usually interpreted as leaf foddering in winter periods. Concerning this, it is important to keep in mind that some oak species keep dried leaves on for a long time until late in winter (e.g. *Quercus pubescens*). Thus, animals could fed leaves themselves in the wild, especially in the case of *Quercus pubescens* trees, which are frequently small trees, or leaves can be collected by humans during winter too. The possibility to derive the season of consumption from the pollen content of the faeces could help to interpret correctly the type of foddering. Nevertheless, the pollen analysis of faeces has to consider different pollen sources as the pollen content can also reflect the harvesting time of dried fodder or could have been deposited in earlier times before it was ingested (Akeret *et al.* 1999: 178).

As mentioned in the chapter presenting the results of the coprolites analysis (Chap. 7; Tab. 7.2), the most frequently identified macroremains in the Lavagnone coprolites are prickles, most likely of blackberry. They could be associated with oak leaf epidermis (in a coprolite with a huge amount of acorn pericarp fragments: LAV13), with ivy (*Hedera helix*) leaf fragments or with fern and moss remains. These are all *taxa*, which can be easily found in the woodland in the surrounding of the village in winter times. In addition, minerogenic particles and charcoal were found in many coprolites (respectively 23 and 11). All these evidences together suggest that animals grazed outside all year long, even during the cold season, and were kept in the settlement only during the night. They grazed not only in woodland habitats (forest or glades) but also on fallow land or harvested fields where they could eat cereals remains (*Triticum* testa fragments), in late summer or autumn time. There are also evidences of dry grasslands (*Arenaria serpyllifolia, Campanula cf bononiensis*), as well as ruderal places (*Potentilla* cf *reptans*, *Verbena officinalis*) or wet habitats (*Poa palustris*, *Ranunculus sceleratus*, *Juncus* cf *compressus*) as pastures. All these habitats could be easily reached during the day in the Lavagnone basin; this could be also the reason why we have different habitats represented in single coprolites.

Pollen content divided the coprolites of Lavagnone in two groups (see Fig. 7.2). All the first group features suggest feeding on leaves based on their content of leaf epidermis and a low pollen concentration. In one sample of this group, however, the pollen concentration is much higher, and it shows a wide range of grassland plants, so it can be concluded that the tree pollen was eaten in pastures near flowering trees.

The composition of the second group points to strong evidences for grazing in open habitats in the surrounding of the settlement (see Fig. 7.2). Pollen of *Artemisia, Daucus carota, Agrimonia, Fallopia*, and even cultural plants, can represent open habitats like ruderal places or fallow fields. *Filipendula, Succisa pratensis, Angelica sylvestris, Peucedanum palustre* t., and *Sparganium angustifolium* t. suggest browsing in the forest-free wetlands near the lake. *Taxa* like Poaceae, *Helianthemum, Centaurea jacea* t., *Achillea* t., *Seseli libanotis, Plantago lanceolata, Onobrychis*, and *Lotus* t. may come from dry grazing areas in the hinterland.

In the Lucone-coprolites *Rubus* remains (fruit fragments and prickles) were as much abundant as in Lavagnone (Chap. 7; Tab. 7.4). The macrofossil assemblages of single coprolites can also include other evergreen species like ivy, holly (*Ilex aquifolium*), fern and mosses. In some cases, it was possible to determine Pteridophyta remains as bracken fern, *Pteridium aquilinum*. Its occurrence was confirmed by spores found in both, the Lucone and Lavagnone coprolites. Bracken normally grows on neutral to very acid soils (carbonatic-poor soils), in light woodlands or grasslands. It is favoured in disturbed habitats, especially after forest fires, thus its abundance could be correlated with clearing of forest by humans. Its occurrence in the Lavagnone and Lucone D basins, which are mostly characterized by carbonatic soils, is only possible on lime-free red soils, i.e. thick alfisols. The latter are common on the flat top of some morainic ridges or on the colluvium of these soils formed at the bottom of moraines, like Monte Brassena in the Lucone basin (In a distance of less than 1 km of the site) or Monte Nuvolo, 2 km West of Lavagnone basin. It also is possible that lime-free alfisols, supporting bracken stands, occurred even closer to the Lavagnone basin, and were disrupted by ploughing.

The only deciduous tree identified in the macroremains of Lucone D is oak (*Quercus* sp.), represented by leaf and pericarp fragments. Few epidermis-fragments belong to *Quercus pubescens*, which is nowadays the dominant tree in the woodland of the area.

The presence of all these *taxa*, the types of remains and the high frequencies of minerogenic particles and micro-charcoal support the hypothesis that the animals pastured in the surroundings even in the cold season, spending the night in the village. The limited area with a high concentration of pellets could correspond to the place where the animals where kept inside the village (it corresponds with the north-eastern sector of the excavated area, Fig. 2.3).

Some samples can be related with the practice of feeding cultivated plants, most probably by-products of the Cerealia crop-cleaning. This practice seems to be more common in Lucone D than in Lavagnone. Remains of cultivated or collected plants are more abundant in Lucone D and include not only cereals, but also flax capsule fragments and apple/pear pericarp, too. Crab apples and pears were collected in the wild in large amounts, as suggested by the analysis of the plant macroremains of many surface samples (see Chap. 6.4.1). The few detected herbaceous *taxa* indicate mainly ruderal habitats and fallow fields, which could be an important source of fodder, too.

The pollen spectra of the examined Lucone D samples contained evidences that in spring and summer the animals grazed in a largely open landscape with scattered shrubs and stands of trees (especially oaks). In some cases, the high concentration of pollen grains of cereals, arable weeds and ruderal plants point to the grazing of harvested fields and fallow lands. Also in the area of Lucone D, there was wetland vegetation, which was used as animal pasture. In contrast to Lavagnone, where *Corylus* pollen is rather rare, a couple of samples from Lucone D are strongly dominated by *Corylus, Carpinus betulus* and *Alnus* (see Fig. 7.4). High concentrations of charcoal fragments in these coprolites suggest that the animals were grazing outside in early spring, and not fed in stables. Clear indications of possible (winter) feeding in Lucone D are so far absent.

Comparing results of the Lucone D and Lavagnone coprolites analyses, it is clearly evident that there is a higher diversity of herbaceous *taxa* in the Lavagnone coprolites. The combination of all detected *taxa* for both sites indicates above all open environments as pastures, as woodland is not well represented by macroremains. Animals seemed to browse mainly in dry meadows and on fallows.

The forests in the hinterland were probably rather thin and were important resources for food and timber. Light-loving trees and shrubs such as *Rosa, Rubus, Prunus,* and *Sambucus,* point out a relatively open, diversified landscape with hedges and bushes. Relatively high pollen percentages of *Carpinus betulus, Corylus avellana, Ostrya carpinifolia* and *Fraxinus ornus* could indicate coppiced forest. It is striking that *Fraxinus ornus* and *Ostrya* occur regularly in Lavagnone, while these woody *taxa* are quite rare at Lucone. The high charcoal concentrations combined with the dominance of *Corylus* in some samples from Lucone might indicate landscape management by fire.

In the vicinity of both settlements there were probably extensive wetlands that were used as pasture for ruminants, and possibly also used for collecting litter. Wet habitats are quite well represented in Lavagnone. In contrast, in the Lucone D coprolites we have no evidences of wetland habitats.

Only a few finds in the coprolites indicate ruderal habitats in Lavagnone while instead some ruderal species are present in Lucone D.

Leaf foddering by humans was not so common in both sites, as only a few wood and no twigs remains have been found. Probably animals browsed by themselves in the surrounding of the settlements even during winter times. The high frequency of *Quercus* epidermis could be explained with the storage of oak branches close to the settlement. This is in agreement with the evidences of a massive exploitation of oak wood for buildings in Lavagnone (Griggs *et al.* 2002). It seems reasonable to suppose that animals could find food in the countryside even in the cold season as the climate of the Garda region is very mild in winter with little snow or no snow at all.

8.6 The landscape surrounding the settlements

8.6.1. Woodlands, wood edges, clearings

The landscape around both, the Lavagnone and Lucone basins before the EBA settlement period was characterized by dense broad-leaved forests. The pollen analysis (Arpenti *et al.* 2002, de Marinis *et al.* 2005, Valsecchi *et al.* 2006; Badino & Ravazzi 2011) reveals a forest type dominated by deciduous oaks (deciduous *Quercus*) with co-dominance of hazel (*Corylus avellana*) and hornbeam (*Carpinus betulus*). Other accessory tree species were beech (*Fagus sylvatica*), elm (*Ulmus* sp.), birch (*Betula*), *Ostrya* and lime (*Tilia*). High percentages of *Alnus glutinosa* type account for an alder swamp forest along the lakeshores or in wet areas surrounding the lakes. Low percentages (<2%) of coniferous pollen (*Picea* and *Pinus sylvestris/mugo* type) have been related to long distance transport from the Alps. A special case is *Abies,* whose values (average around 1%) are close to the significant threshold level for its regional occurrence in the amphitheatre area. There are no *Abies* finds in the Garda region during the Copper Age. However, macrofossils of *Abies* (charcoal) and pollen values between 1-3% occurred in the lowermost Mincio valley, i.e. 20 km south of the Garda amphitheatre during the Iron Age (Ravazzi *et al.* 2013). These are referred to the occurrence of tree individuals scattered in the broad-leaved forest.

During the settlement period, the forest composition does not change. Even on the basis of plant macroremain-abundance, the dominance of oak (*Quercus* sp.) in the forest surrounding the settlements is confirmed. Beech (*Fagus sylvatica*) and hornbeam (*Carpinus betulus*) diaspores were also found, corroborating their occurrence in the surrounding of the two settlements. The environment around the Lavagnone settlement could not easily host beech trees as such species require a humid atmosphere and moderately fertile soils, thus beech was most likely introduced from further distances. Actually, the closest suitable habitats are located at least 10 km northwards, close to the Lucone basin. Hornbeam macroremains, even if in low amounts, agree with the pollen record. This species is characteristic of lowland forests; it spreads also along mountain fringes at a maximal altitude of 600 m a.s.l. It rarely occurs in pure stands in northern Italy, but it is commonly mixed with oak, lime, elm, maple, ash and in some places even with *Ostrya*. It favours warm climate and well-drained but moderately humid soils. Besides trees, a rich shrubby component including hazel (*Corylus avellana*), common hawthorn (*Crataegus monogyna*), common dogwood (*Cornus sanguinea*), cornelian cherry (*Cornus mas*) etc. is documented by our macroremain spectra. Unfortunately, oak species could not be identified to species level due to the lack of diagnostic features in the acorn remains.

Currently, deciduous meso-thermophilous oak forest is the dominant forest type in the morainic amphitheatre of Lake Garda (pers. observ.; Crosato 1986; Brullo & Guarino 1998). The main tree species composing this forest formation are *Ostrya carpinifolia*, *Fraxinus ornus*, and pubescent oak (*Quercus pubescens*) and they refer to the *Querco-Fagetea* phytosociological class. Therefore, such a type of forest could have been also present during EBA, although some differences of EBA forest concern a higher relative abundance of hornbeam and the occurrence of beech, nowadays extinct in the amphitheatre, northward until the first residual plot living at Monte Covolo.

In the plant macrofossil record, we have only a few evidences of palustrine/riparian woods (fruit scales of *Alnus* sp. in EBA samples of Lavagnone and Lucone and *Salix* sp. remains in MBA samples of Lavagnone).

Most of the species important for their fruits, especially tree species (e.g. apple, pear, *Prunus* species), normally light-requiring, could have mainly grown in thinned out forests or in open woodlands on natural/seminatural grasslands (park landscape) or in shrubby meadows.

8.6.2. The open environment: types and extension of meadows and pastures

During the settlement period, human subsistence activities, mainly animal and crop husbandry, required a large extension of open land. This was occupied partly by crop fields and places exploited for different purposes (e.g. waste disposal, woodpile, wood and pottery works, cereal processing, etc.), partly by grassland vegetation. Fallow land probably played an important role in this landscape as well.

Grassland vegetation, as detected by the plant macroremains found in both, the Lucone D and Lavagnone sites, includes four different types of open habitat (Chap. 2.8). Apart from the indistinct group of 'pastures' (group MP 4.3), the other three groups are distinct mainly by the edaphic conditions of the soils. The 'pasture' group includes ubiquitary plant species with broad ecological amplitude thus occurring in different grassland vegetation types. A discrete number of *taxa* in the fossil record supplies evidences of dry and semi-dry habitats (groups MP 3.1 and MP 4.1), whereas meadows and moist pastures (group MP 4.2) are poorly represented in the open vegetation spectra from the fruits and seeds analysis. The identification of species with broad ecological amplitude (group MP 4.3) does not allow drawing conclusions on the types of the open environment.

Dry and semi-dry grasslands, mainly assigned to the *Festuco-Brometea* class (group MP 4.1), are nowadays among the most species-rich plant communities in Europe containing a large number of rare species. Their maintenance is regarded to be significantly related to human activities (grazing and cutting). When their exploitation is at low/moderate intensity, shrub species can establish and develop in direction of a scrubland vegetation, which represents a transition to the reintegration of forest formations (Calaciura & Spinelli 2008). Also in prehistoric times, patches of woody vegetation or scattered trees and shrubs could fragment these open habitats. Plants exploited for their fruits such as crab apple, pear, cornelian cherry, *Prunus* spp., *Rubus* aggr. *fruticosus* etc., spontaneously growing in these grasslands could have been tended and intentionally preserved thus allowing a wise management of the land both for grazing animals and as human food sources. The other recorded dry open habitats (MP group 3.1) are ascribable to secondary habitats developed in anthropogenic contexts on stony disturbed substrates, above all by trampling and browsing of animals, or by human activities (paths, trails, waste disposal, etc.). They could have been distributed in areas close to the settlement where human activities were highly intensive; this has hindered the growing of a continuous tall herb formation. Other places where such communities could develop are the tops of the highest hills characterized by a gravelly substratum and intensive grazing by goats and sheep, as it can be observed nowadays. This type of karstic open herbs vegetation can also develop on weathered outcrop as on the top of Rocca di Manerba (17 km far from Lavagnone, 6 km from Lucone) (pers. observ.). The Rocca di Manerba is however an isolated spot in the surroundings of the two settlements, which are otherwise entirely covered by glacial/fluvioglacial deposits (Chap. 1.2.1.).

All in all, in the Garda morainic amphitheatre, especially in the outermost part where higher hills present steep slopes (hills 2 km far to west from Lavagnone and hills delimiting the basin of Lake Lucone on its southern and western sides), the spread of dry grasslands is favoured by the coexistence of climatic, lithological and pedological factors supplying dry soil conditions all over the year. Submediterranean climate with warm summers causes strong evaporation and water deficit in the soils. Glacial deposits consisting almost entirely of limestone lithotypes, developed on level surface mainly soils characterized by slightly silty to coarse-sandy granulometry, favouring good drainage and scarce water retention. On the contrary, on hill slopes, colluvial processes can produce a thick argillic horizon in the soil profile developing a good water-holding capacity (Chap. 1.2.2). More humid conditions could be found in the inframorainic depressions hosting in some circumstances small lacustrine/palustrine basins such as in the cases of Lavagnone and Lucone. During the Bronze Age, both of the two mentioned groups of dry habitats were likely intensively grazed (together with fallow land), as inferred by the investigations of the coprolites of small ruminants (Chap. 7 and Chap. 8.5). Therefore, most of grassland species remains could have reached the settlement through animal droppings as well as adhering to animal fur and/or human clothing. We have evidences of it in the relative abundance of diaspores with adhesive mechanisms (spines and hooks) relating to the epizoochory seed dispersal mechanism e.g. pod remains of *Medicago minima,* mericarps of *Orlaya grandiflora* and *Daucus carota*.

Despite the increase of the extension of the grassland vegetation detected by the pollen record, the open habitat spectra based on the fruits and seeds analysis of the Lavagnone MBA samples recorded a lower amount of *taxa* comparing to the EBA samples. Taphonomic reasons can be accounted to explain this: firstly, the lower amount of waterlogged remains preserved in MBA samples (see Fig. 3.4); secondly, the lower contribution of faecal remains to the subfossil plant record (Chap. 8.1). Anyway, dry grassland is still dominant in the macroremains coming from open vegetation.

In the MBA layers, the occurrence of *Orlaya grandiflora* macroremains is recorded. This species is regarded as a strong indicator of the spread of a rural landscape and dry pastures in northern Italy[22]. Pollen of *Orlaya grandiflora*, sporadically recorded in Neolithic successions, shows a synchronous and sudden expansion occurring at different pile-dwelling sites during the 19th century cal BC. Its pollen subsequently reaches significant values (5%) revealing a well-defined establishment of the species in the structured vegetation. This event marks an important change in the agrarian and pastoral activities of the Bronze Age. In addition, it points to active interchanges among distant populations that promoted the expansion and migration of new plant species like *Orlaya*.

Orlaya grandiflora, originally from the Balkan-Pannonian region and from a part of the Mediterranean region (Fig. 8.6.1), occupied in the Po plain those seminatural open habitats (like xerophilous and shrubby meadows or dry seminatural grasslands) of which it is nowadays in some cases a character species. The environmental and climatic conditions of the Garda region well satisfied its ecological requirements, favouring its spread. Besides, *Orlaya* is well adapted to intensive grazing, growing as dwarf form in case of persistent browsing (pers. observ.). Furthermore, the expansion of *Orlaya* could have been promoted by recurrent secular phases of marked warm and dry conditions – especially the 'Bronze optimum' which is currently referred to the 14th and 12th c. BC (see Perego *et al.* 2011 for details) – that characterized the development of the Terramare culture.

8.6.3. Littoral zone and aquatic habitats

The construction of the pile-dwellings had a strong impact on the aquatic and perilacustrine vegetation. The daily activities for the settlement subsistence, the grazing of domestic animals, and the rubbish accumulation on the lakeshores or directly in the water (underneath the houses) altered the original ecosystems producing a strong water eutrophication and a nitrate-enrichment of the surrounding humid soils.

A detailed plant macroremains analysis carried out along the core LAV37 of the Lavagnone deposit has pointed out significant changes of the littoral zone and the aquatic habitats during the Bronze Age, related to the shifting of the village in the basin (Chap. 4).

The great amount of plant macroremains from the aquatic and lakeshore vegetation found in the cultural layers of Lucone D and Lavagnone is a consequence of the construction of raised houses on posts emerging from the lake (Chap. 8.1). These remains were accumulated by natural sedimentation at the bottom of the lakes underneath the pile dwellings, mixing with remains from human activities.

The littoral zone is characterized by different habitats discriminated on the basis of their position referred to the water depth (Chap. 2.8):

The wet terrestrial herb communities of the upper eulittoral zone (LS group 6.1), which represent an open environment of transition from the perilacustrine vegetation belt to the palustrine woodland (alder-willow woodland), are well documented in the macrofossil spectra of both sites. Considering the relatively small size of the two basins, this habitat was originally extended over a limited area. Domestic animals grazed it as

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[22] The occurence of *Orlaya grandiflora* in lacustrine/palustrine sequences and archaeological deposits of northern Italy and its meaning for the palaeoenvironmental reconstructions have been deeply discussed in a separate paper included in the Appendix 8: Perego R., Badino F., Deaddis M., Ravazzi C., Vallè F., Zanon M. (2011) – L'origine del paesaggio agro-pastorale in nord Italia: espansione di *Orlaya grandiflora* (L.) Hoffm. nella civiltà palafitticola dell'età del Bronzo della regione del Garda. Notizie Archeologiche Bergomensi 19: 161-173.

suggested by the coprolites analysis (Chap. 7 and Chap. 8.5). Human activities could have enlarged it, especially through the thinning of the swamp forest. The most significant species of these communities recorded in the fossil spectra of fruits and seeds are *Lycopus europaeus* and *Ranunculus sardous*. *Lycopus europaeus* can also be frequent in the undergrowth of the alder woodland (pers. observ. in the Lavagnone basin). Tall herbs like *Eupatorium cannabinum* and *Epilobium parviflorum* often grew at the swamp woodland fringe.

Telmatic vegetation (LS group 6.2) forms the most characteristic group with a particular significance in the Lavagnone basin. This basin is smaller compared to Lucone and is fed only by ground water, thus it is more prone to the seasonal oscillation of the lake level. The most significant and frequent species recorded are *Rumex maritimus* (not retrieved in the Lucone D samples), *Polygonum lapathifolium* and *Ranunculus sceleratus*. *Rumex maritimus* and *Ranunculus sceleratus* are diagnostic species and dominants in the Association *Rumici maritimi-Ranunculetum scelerati* (see Chap. 2.8), which can reach a cover of 100% on bare ground emerged by desiccation within a few weeks. They both can also grow well on sludge beds of sewage in farmland or near cattle drinking places, excessively rich in nutrient and intolerable for most other species; they are also tolerant of brackish water (Ellenberg 1988).

The telmatic vegetation spread on areas which emerged and dried up following a drawdown of the groundwater table. Very likely, this could have happened also underneath the pile dwellings considering their position close to the lakeshore. This may explain the high amount of fruits and seeds of these species in the cultural layers. Moreover, the posts are supposed to have emerged from the ground and if they were high enough to create suitable light condition, telmatic vegetation could have also grown underneath them. The distribution of this peculiar habitat and the occurrence of *Rumex maritimus* in the basin might have been favoured by the human activities (e.g. by opening the vegetation around the lake and grazing animals) and enhanced by some warm phases characterizing the Bronze Age period (Magny 2004, Magny *et al.* 2009). The rarity of *Rumex maritimus* in the modern vegetation in Italy underlines both the specificity of its ecological niche, and the instability and fragmentation of the habitat. Pignatti (1982) regarded it as a rare species restricted to Sardinia and to the northern Adriatic shores close to the Po delta (Veneto and Friuli Venezia Giulia). A recent floristic compilation noted the rare occurrence of this species also in Emilia-Romagna in ditches, ponds and humid spots (Piccoli *et al.* 2014). The ecological requirements of *Rumex maritimus* in the Lavagnone sequence are discussed more in detail in chapter 8.7.2.

Reeds mainly composed the flooded or waterlogged littoral zone (LS group 6.3). The extension of this vegetation belt is hard to estimate on the basis of the abundance of fruits and seeds as the probable dominant species differ quite a lot for their fruits production. Reeds could largely extend towards the centre of the lake after a strong water eutrophication. The probable dominant species were bulrush species (*Typha latifolia / T. angustifolia*) and *Phalaris arundinacea*. In the Lavagnone lake, other two more species could have taken part in the lakeshore vegetation belt as character species: *Schoenoplectus lacustris* and *Sparganium erectum*. Remains of the latter were found only in the MBA samples. In the Lavagnone record, a higher number of *taxa* were identified including rare plant species (see below). This leads to suppose a more diversified environment along lakeshores compared to Lucone D. The sedimentological features of the two deposits also highlight these differences. In the Lucone D sequence, no layers of peat have been detected (Chap. 1.6.1.1). Apparently, the biomass production was not high enough to produce peat accumulation, while the C/N ratio remained very high throughout the Holocene (Furlanetto et al., in prep.), thus denoting water oligotrophy. The reasons for such differences may depend on several factors affecting hydrological and geochemical differences of the two basins. Both lakes are closed basins, missing an outlet, but the size and hydraulic properties of the ground-water catchments are much different, thus explaining different water chemistry influencing the aquatic and littoral vegetation. A wider ground-water catchment is expected for Lake Lavagnone, given its catchment includes a substantial volume of porous gravelly deposits acting as an aquifer supporting a high flow of water, while it is mostly made up of low permeable glacial deposits in the Lucone basin. As a consequence, poorer salt concentration and wider seasonal water level changes are expected at Lucone, limiting the nutrients and preventing the development of littoral vegetation.

Among the rare species attributable to the waterlogged littoral vegetation, it is worth mentioning *Caldesia parnassifolia*, Parnassus-leaved water-plantain, found in the Early and Middle BA layers of Lavagnone site (see App. 7, Plate 6). Recently become extinct in Italy (Conti *et al.* 2005, Gennai 2012), its occurrence in the Lavagnone basin was reported by Ugolini (1897) and documented by a specimen in the *herbarium* of Padua. It is a species well adapted to strong oscillations of water level, but not surviving in water deeper than 1 m. It favours oligotrophic to meso-eutrophic water and tolerates even high nitrate contents. Its extinction was likely due to the modern human impact on humid areas in consequence of modern land reclamation works for agricultural activities.

Cyperus glomeratus is a species occurring today in northern Italy as a rice crop weed or along ditches and rivers. Common in the Po plain, it is rare in other regions of northern and central Italy (Pignatti 1982). Its attestation in the Bronze Age layers allowed discharging the hypothesis of its introduction in Italy together with the rice crop (Pignatti 1982).

A good number of *taxa* document the aquatic habitats of the Lavagnone basin. The identified *taxa* survive in still or slowly flowing waters, not exposed to strong wave action and far from the reed beds. The attested *taxa* favour nutrient-rich water, from mesotrophic to eutrophic conditions. *Ceratophyllum demersum* occurs especially in waters of high alkalinity and needs highly eutrophic conditions; according to Ellenberg (1988) it also requires high phosphorus content in the water. Moreover, it is tolerant of muddy water and shading by floating and emergent vegetation and it can colonize deep (even up to 5-6 m) and quite overgrown waters. On the other hand, *Potamogeton natans* tolerates different trophic states, but avoids eutrophic waters (Rodwell 1995). It can grow on different substrates and with its floating foliage it can survive in fairly turbid water conditions. The abundant occurrence of these two species points out a diversification of the aquatic environment. Secondary species, as *Myriophyllum spicatum* and *Nymphaea alba*, point to a modest amount of eutrophication. The aquatic plant species found in the MBA samples and their abundances seem to indicate a general decline of the open water environment in the Lavagnone basin, corroborating the hypothesis of the strong terrestrialization of the area during the MBA, highlighted in the analysis of the whole sequence of the basin (Chap. 8.7).

In contrast, in the aquatic plant record in the Lucone D deposit a lower number of plant *taxa* were recorded. Here the most significant *taxa* are *Najas* species: *N. flexilis* in the first settlement phase and *N. minor* in the second settlement phase. They denote a modest eutrophicaton of the water, particularly *N. flexilis*. Also Characeae played an important role whose oogons were found in large amounts. The aquatic environment features are consistent with the signal of the littoral vegetation of a lower degree of water eutrophication in Lucone.

8.7. Palaeoenvironmental history and human impact in the Lavagnone basin inferred by plant macroremains analysis

The analysis of the plant macroremains along the stratigraphic sequence of LAV37 core (Sector D, Lavagnone) allowed reconstructing the palaeoenvironments in the Lavagnone basin before and during the lacustrine Bronze Age settlement (since 5000 to 1400 cal BC). The main environmental changes due to human activities could have been detected thanks to changes in the plant assemblages along the sedimentary records (see Chap. 4.1 and Fig. 4.1 and Fig. 4.2, for the results of this analysis).

8.7.1. Settlement phases inferred by plant macrofossil assemblages

We distinguished two pre-anthropic phases where no anthropogenic *taxa* were recorded (LavMZ1a, LavMZ1b, LavMZ2 in Fig. 4.1 and Fig. 4.2), and four different subsequent reflecting the settlement history in the central basin area (Sector D) (LavMZ3: Ist phase, LavMZ5: IInd phase, LavMZ7: IIIrd phase and LavMZ9: IVth phase, see Fig. 4.1 and Fig. 4.2). The settlement phases are separated by intervals where the anthropogenic signals are absent or scant (LavMZ4, LavMZ6, LavMZ8), in some case very short in time as between the IIIrd and IVth phases.

The Lavagnone basin was continuously inhabited during the whole time interval spanning from the Early to Middle BA, but several settlement displacements were highlighted by the archaeological investigation all over the area (see Chap. 1.6.2.4 and Fig. 3 in de Marinis *et al.* 2005). The first three settlement phases (LavMZ3: Ist phase, LavMZ5: IInd phase, LavMZ7: IIIrd phase) and part of the fourth (LavMZ9: IVth phase) are included in the Early Bronze Age period, the last one overpasses the EBA extending partly into the Middle Bronze Age (MBA I and II) and lasts till the end of our sequence. In the macroremain assemblages, these phases are well defined by charcoal remain abundances and are more or less evident by the presence of anthropogenic *taxa*, above all crop species like *Triticum*.

In order to interpret more precisely the plant macrofossil assemblages' changes we tried to calculate the accumulation rate of the deposit (i.e. the sediment accumulated in one year, calculated on the basis of the age depth model, see Fig. 4.1 on the right of the diagram and Chap. 1.6.2.3). We applied it to the anthropic part of the sequence as well. Here the sedimentation is not exclusively due to natural processes, but it is strongly conditioned by matter supplied by human activities and thus variable in its flux rate. Nevertheless, these data are useful when comparing the different settlement phases we detected along the sequence.

As expected, the accumulation rate varied with settlement phases (Fig. 4.1). During the first two phases (LavMZ3 and LavMZ5) the average annual accumulation of organic matter was quite less than 1 cm (respectively 0.15 and 0.38 cm/year). Subsequently it increased, and during the IIIrd settlement phase a mean annual accumulation of 3.5 cm of organic matter is calculated. The IVth settlement phase is characterized by a lower accumulation but persisting over 1 cm of sediment per year (1.19 cm/year). Mean accumulation rates around 1 cm or lower, even considering the sediment compacting, are rather low for a cultural layer. A significant distance from the source of anthropogenic matter has to be supposed, or instead, erosion or organic matter decay (or both) may be envisaged during these phases. Taking into account the small size of the Lavagnone lake and the absence of any inflowing or outflowing stream, these fluctuations of accumulation rates are hardly imputable to erosion of wave action or water streams which could eventually reduce the amount of sediment accumulated. A possible redistribution or removal of the fine organic matter might be hypothesized as due to surface run-off along the dried-up lakeshore during seasonal lake-level oscillations, especially in case of heavy rainfall. Nevertheless, this does not explain the low accumulation rate, which more likely resulted by an increasing distance of houses and human activities.

The Ist and IInd phases (LavMZ3, LavMZ5) are characterized by low quantities of plant remains, low biodiversity and low accumulation rates. They likely refer to a period when the pile dwelling was not placed at the coring site. Indeed, a pile dwelling is recorded in Sector A, around 60 m westwards of the core which lies in Sector D (see Fig. 1.6.2.2, map of Lavagnone basin). The sediment accumulation during these phases consists of a limnic sediment, with sporadically embedded anthropogenic detritus, most probably washed up from the nearby pile dwelling.

The LavMZ3 zone (2180-1940 cal BC, EBA IA and IB) records the Ist settlement phase (Fig. 4.1 and Fig. 4.2) at/near the coring site. Its main evidence lays in the appearance of anthropogenic plant *taxa* and charcoal remains. Due to human activities, the eutrophication of waters raised and the ecological conditions changed favouring aquatic plants typical of warm eutrophic open waters, 0.5-2 m deep, such as *Ceratophyllum demersum* and *Nymphaea alba*. Besides, human impact in the area close to the lake favoured the expansion of the perilacustrine vegetation, as detected by the increasing of some specific *taxa* (see Chap. 4.1).

The LavMZ5 zone (1800-1688 cal BC, earlier EBA II) reflects the IInd settlement phase (Fig. 4.1 and Fig. 4.2) at/near the coring site, characterized by the appearance and expansion of *taxa* indicating mainly fallow land, ruderal habitats (e.g. pathways) and nitrophilous communities. Woodland and wood edges vegetation is almost exclusively represented by *taxa* of gathered plants. Trees and shrubs with edible fruits could grow on (or at the edge of) fallows or fields around the settlement. Even oak, exploited for fruits and wood, could form thin forest with large area for shrubs and herbs. In addition to dryland plants, the aquatic *taxa*, testifying not too deep water, are still present as well as perilacustrine vegetation *taxa* (eulittoral belt), favoured by human activities. The abundance of typical species of telmatic habitats (ecological group LS 6.2, Chap. 2.8) indicate seasonal fluctuating lake-levels.

In the subsequent IIIrd and IVth settlement phases (LavMZ7 and LavMZ9), the dwelling should have been closer to the coring site. This has been partly highlighted by the recent excavation in Sector D that so far affected only the uppermost layers (MBA II) (Marta Rapi and Candida Sidoli pers. com. and excavation reports 2007, 2011, 2012, unpub.).

The LavMZ7 zone (1660-1635 cal BC, EBA II) corresponding to the IIIrd anthropic phase (Fig. 4.1 and Fig. 4.2) recorded at/near the coring site, is characterized by a large increase of the concentration values of the anthropogenic *taxa* and of the biodiversity of the fossil plant assemblage in general. The quantitative representation of each ecological groups is consistent with the results of EBA surface samples from Sector A (Fig. 3.2). The cultivated plants still includes abundant remains of flax and a higher amount of wheats compared to barley. A few remains of broomcorn millet, recorded in the subzone LavMZ7b, forestall the main change characterizing the subsequent settlement phase. Summer and winter crop weeds are well documented, as well as a great diversity of ruderal flora. Species of grassland vegetation have been also found. Among them, a few *taxa* suggest indistinct pastures (ecological group 4.3, see Chap. 2.8 for a detailed description), whereas the majority occurs in sunny and dry or semi-dry habitats of warm regions, with low rainfall, usually on carbonatic soils. They belong to the ecological groups of dry fallow and dry pastures with summer water deficit (respectively ecological group 3.1 and 4.1, see Chap. 2.8). These types of vegetation could have been widespread on the top of the small hills around the Lavagnone basin. These areas were probably less suitable for cultivation due to superficial soils characterized by coarse granulometry (see Chap. 1.2.2) and thus could have been intensely grazed by domestic animals, especially goats and sheep. Most of the *taxa* of the ecological group 3.1 are therophytes or short-lived perennials and they can easily tolerate the use of fire to maintain the open land. As in the previous settlement phases, *taxa* of woodland and wood edges are almost exclusively composed by species producing edible fruits. Aquatic and eulittoral *taxa* in the LavMZ7a subzone appear in reduced number (e.g. *Ceratophyllum demersum*, *Myriophyllum spicatum, Ranunculus* gr. *batrachium* in the former group, and *Cyperus flavescens, Rumex maritimus, Ranunculus sceleratus, Typha* spp. in the latter), marking a certain degree of terrestrialization of the investigated area. Aquatic habitats seem to be limited to eutrophic and shallow waters.

The LavMZ9 (1631-1460 cal BC; later EBA II, MBA) is the last anthropic phase recorded in the analysed stratigraphic sequence (the IVth one, Fig. 4.1 and Fig. 4.2) and persists until the end of the sequence. After an initial phase where the concentration values of the aquatic and perilacustrine plant remains are still high (LavMZ9a), a strong decreasing of the aquatic habitats and a progressive terrestrialization of the area took place. Anyway, the open water habitats are always registered in the fossil assemblages as it is demonstrated in the last subzone (LavMZ9c).

Some *taxa* mark a strong change during the IVth settlement phase LavMZ9 (at ca. 110 cm depth), just a little before the transition to the Middle BA (1600 BC, ca. 96 cm depth). The most important of these *taxa* is *Panicum miliaceum* (bromcorn millet). Its previous occurrences were very sporadic and consisting of only a few remains; from this time onwards its cultivation seems to be verifiable and extensively widespread (see Chap. 8.8.1 for a detailed discussion).

Such a strong increase is also observed for *Portulaca oleracea* (common purslane) and, less pronounced, for other *taxa* such as *Arenaria serpyllifolia*, *Stellaria media*, *Chenopodium album*, *Legousia* sp., *Aphanes arvensis*, *Valerianella dentata*. Most of these *taxa* favour dry and warm open land. These environmental conditions well fit with the cultivation of broomcorn millet, which requires warm climate, as it is normally sown very late in the spring and it does not bear frost during germination. The expansion of bromcorn millet (*Panicum miliaceum*), synchronous to that of *Portulaca oleracea* could indicate a significant change in the agricultural system in connection with an improvement in crop practices. In addition, considering the ecological requirements of both of these species, a change in the palaeoenvironmental conditions of the area or the climate component, can also be argued. Flax cultivation lost its role and disappeared at the end of the IVth phase. The absence of flax is corroborated by the analysis of MBA surface samples from Sector D (see Chap. 3.3.2).

The high peaks of several *taxa* (mainly occurring in the LavMZ9b subzone) have to be carefully evaluated as they correspond to a time interval (at 90-75 cm depth) when the accumulation rate was very low. Thus, the number of years recorded in a single sample is larger and the concentration of remains could be higher (see above).

No evidences of an *in situ* settlement are recorded in the LavMZ4 zone (1940-1800 cal BC, EBA I B and C): housing structures and human activities seem to be rather far away from the investigated area. So far, archaeological evidences dated to EBA I B have been found in Sectors A, B, and C, whereas EBA I C is documented only in Sector B by structures still to defined (see the scheme of Fig. 1.6.2.8).

The plant macrofossil record of the LavMZ6 zone (1675-1660 cal BC, EBA II) registered a low number of *taxa* and low concentrations of remains. Several taphonomic factors could have played an important role in the preservation of plant remains, but their interpretation is quite difficult. Based on the charcoal and the crop remain concentrations, this zone seems to correspond to a shifting of human settlements far from the investigated area. The settlement is documented in Sector A by houses built on 'bonifica' layers (see note 18) and by structures still to define in Sectors B and C.

The LavMZ8 zone (1635-1631 cal BC, later EBA II) is characterized by low anthropic signals, but the very short duration of this phase makes difficult to suppose a receding of the settlement from the investigated area. In addition, the spread of wet habitats seems to be linked to marked seasonal lake-level oscillations that could have biased the preservation of plant remains. Indeed, the preserved remains are charred or characterized by medium/strong resistance to decomposition, such as *Fragaria vesca, Portulaca oleracea, Solanum nigrum* and *Polygonum aviculare*.

8.7.2. Aquatic habitats changes - inferences for lake-level oscillations

Water level depths are reflected in the macrofossils composition of aquatic submerged, floating-leaved and emergent lakeshore vegetation (Hannon & Gaillard 1997, Coops *et al.* 2003, Gaillard & Birks 2007). Nevertheless, in addition to water depth, the structure and composition of aquatic vegetation within a single basin could be affected by other main factors such as water chemistry, nutrient status and temperature (Hannon & Gaillard 1997). Water chemistry and nutrient status can be strongly influenced by human activities inside or around the lake, especially in a small lake.

In the macrofossil concentration diagram (Fig. 4.2), four ecological groups related to water table position are presented (aquatics, wet terrestrial herbs, species of the telmatic belt and of the flooded or waterlogged littoral zone; for the definition of these groups see Chap. 2.8). Through the fluctuations of aquatic and perilacustrine *taxa*, we can recognize changes in the lake-level and in the perilacustrine plant belts along the investigated succession.

The pre-anthropic interval is a limnic phase characterized by high values of aquatic *taxa* (*Potamogeton* and *Najas* species) in the first part (LavMZ1) and by the occurrence and spreading of herbs of the littoral waterlogged belt in the second part (LavMZ2). The exclusive occurrence of aquatic plants indicates an undisturbed deep-water habitat (from 1.5 m up to 3 m deep). Ecological conditions where *Najas flexilis* can live include a range of water pH around neutrality; reproduction is only sexual and occurs only between pH 6 to 9 (Wingfield *et al.* 2004) at a temperature of around 19°C in the second half of June (Haas *et al.* 1998). *Cerathophyllum demersum,* typical of still or slow-moving waters and normally considered to be frequent in more eutrophic communities (Rodwell 2000: p. 40-41), sporadically occurred in these macrofossil zones. Its occurrence is likely linked to the alkalinity of the water, which should be very high due to prevailing carbonatic lithotypes in the glacial deposit of the Garda amphitheatre (see Chap. 1.2.1).

In the subzone LavMZ1b, the ecological conditions of the lake-water slightly change and other aquatic species such as pondweeds become dominant. *Potamogeton natans* has a fairly wide tolerance of different trophic states, from mesotrophic to fairly nutrient-poor waters. It is poorly represented in more eutrophic waters like pools or dykes (Rodwell 2000: p. 53). With its predominance of floating against submerged foliage, it can also survive in fairly turbid conditions. It can penetrate to considerable depth; it commonly grows in 0.5 – 3 m deep water.

The subsequent spreading of the littoral vegetation starting at 345 cm depth, i.e. from 3000 BC onward, could be somehow linked to human impact. Archaeological finds of Copper Age are actually known in the territories of Desenzano del Garda and Lonato (de Marinis 2000: p.77). Furthermore, a weak human impact for this period is also shown in the pollen diagram carried out in the Lavagnone basin (Arpenti *et al.* 2005, see Chap. 1.6.2.5). Different factors like pathways traced to reach the lakeshore, hunting or fishing activities, animals browsing in the area and trampling on the vegetation at the lake's margins could have favoured the propagation of littoral species.

With the onset of the Ist settlement phase (LavMZ3), i.e. the foundation of a pile dwelling in the Lavagnone basin, a strong change of the aquatic habitat took place. This anthropic phase involved the eutrophication of the water, causing an increase of *Ceratophyllum* and helophytes, and a strong decrease of deep, oligotrophic and clear water indicators. Thereafter, the sedimentation turned from alternating carbonatic gyttja / gyttja to a thick accumulation of coarse organic matter and fine organic mud.

The aquatic community recorded in the LavMZ4 reveals standing, mesotrophic to eutrophic waters. The spreading of *Lemna minor* indicates that water habitats are restricted to ponds, or to a reduced open water surface where it can grow as floating vegetation or among the marginal swamps of still waters (Rodwell 2000:

p. 30-31). Furthermore, *Lemna minor,* in congenial conditions, can spread rapidly demonstrating a strong adaptive ability to colonize ephemeral moist habitats. *Ceratophyllum demersum* is still dominant in the aquatic habitat; it grows slowly but can become very luxuriant and dense. It is tolerant to shading by floating vegetation as a continuous mat of *Lemna minor* could do.

A subsequent episode characterized by a rise in water depth took place within LavMZ8, but it was less intensive than the pre-anthropic phases and very short in time. It was detected by a weak increase of *Ranunculus sect. batrachium* and *Myriophyllum*, as well as mollusc shells.

The eulittoral zone vegetation (waterlogged littoral belt, helophytes) dominates the macrofossil zones LavMZ3-4-5; it shows a high peak in LavMZ3 and increases again during a second short episode of water level rising in LavMZ5. During these intervals, the coring point was likely closer to the lakeshore or in an area of low water depth (maximum of 70-80 cm).

Wet terrestrial herbs co-occurred with helophytes. They are present in only low concentrations at the beginning of the anthropic phases and increase upwards towards 180 cm, pointing out a trend to more and more terrestrialization of the area. The abundance of even upland herbs can be interpreted as a strong contribution of material discharged by humans to the natural sedimentation of the lake (in zones LavMZ7 and LavMZ9). The plant macrofossil assemblages reflect a mixture of fruits and seeds produced by local vegetation and those brought in by human activities. This strong contribution is also confirmed by the high accumulation rate calculated for this part of the sequence (Fig. 4.2). On the other hand, if a terrestrialization of the area took place, the inland habitats were closer to the coring point and seeds and fruits produced in these habitats could have reached it easier.

An additional factor to the lake-level lowering could have been the progressive infilling of the lake by natural and anthropogenic sediment supplies characterized by a low compacting degree thus reaching high thickness values in a short time (Fig. 4.2).

Another important aspect to discuss is the record of the telmatic vegetation. It is considered marking the seasonally dried-up shores of closed lakes, mostly composed by short-lived annuals (group 6.2 in Chap. 2.8 and Tab. 2.4). The existence of seasonal dry periods with low lake water levels caused the exposure of bare ground on large surfaces where the spreading of some pioneer species was favoured. At Lavagnone, the abundance of species specific for periodically flooded shores, apparently unrelated to human activities (e.g. *Rumex maritimus*), helps disentangling relationships between natural- and human-driven changes. Significant occurrences of the telmatic vegetation appear in LavMZ2, just before the Ist settlement phase at about 320 cm depth. From this time on, the concentrations of this plant group increase and show two main peaks, just before the beginning of the IInd and IVth phases respectively. Finds prior of this limit are mainly imputable to *Cyperus flavescens* that on the contrary decreases upwards. It is a character species of the alliance *Cyperetum flavescenti* (Nanocyperion), it grows on neutral to alkaline soils, at the riverbanks or lake margins where the water level fluctuates, on bare ground, which should be wet during the time it is germinating (Oberdorfer 2001, Ellenberg 1988: p 608). The submediterranean climate of the Garda region with hot summers as well as changes in mean annual rainfall (see Chap. 1.2.3) could explain strong seasonal lake level oscillations, especially in closed and small lakes fed only by groundwater flow as the Lavagnone basin. During drought periods, large land surfaces could have been completely dried up and colonized by pioneer species, especially those with a short life cycle, requiring high temperature, light and dry soils for germination. The most representative of these species is golden dock, *Rumex maritimus*. Together with *Ranunculus sceleratus*, they are the character and dominant species of the Association *Rumici maritimi-Ranunculetum sceleratii* occurring on the exposed bottom of summer-dried ponds, pools, lakes, and oxbows where they can reach a cover of 100% (Šumberová 2011). They require so highly nutrient-rich soils that they

can even grow well on muddy bed of sewage disposal of farms, intolerable for most plants (Ellenberg 1988: p. 613). Golden dock germinates not only in spring but also in summer and autumn on drying muddy soils. The germination requires high temperatures, thus it is delayed until the soil is warmed up after a lowering of the water table (Van Assche *et al.* 2002).
In the fossil record of Lavagnone *Rumex maritimus* is quite abundant from the LavMZ3 upwards and is well correlated with *Ranunculus sceleratus*, reinforcing the idea of wide distribution of the specific habitat described by the above plant association and important seasonal lake level oscillations.
When broomcorn millet spread in the LavMZ9b, a strong and sudden decrease is observed in both *Rumex maritimus* and *Ranunculus sceleratus*. What changed in the environment? Could this indicate a spatial competition? Broomcorn millet has a short life cycle (3-4 months), requires very dry soils without any water stagnation, and grows in light and sandy soils. Its ecological requirements can be partly satisfied in the unstable habitat occupied by *Rumex maritimus* and *Ranunculus sceleratus*'s alliance.

8.8 The routes of origin of newly appearing plant *taxa* in the Bronze Age of northern Italy and possible far-trade routes

During the Bronze Age, we see the building of a series of far trade contacts, e.g. between the western and the central Asian steppe, the Carpathians, the Aegean and Anatolia. This is the emergence of the so-called Steppe corridor, which connected the Altai Mountains with the Carpathian basin, therefore China with Europe (Kristiansen & Larsson 2005: p. 181 and 249). This will be later – during the Iron Age and the early historical periods – the route along which several major migrations take place. Sherratt (2006) discussed another important route of exchange that he called "the Trans-Eurasian Exchange" and placed the chronological threshold of this exchange in the early second millennium BC. This period is marked by the development of metallurgical techniques that, among other reasons, emphasize the long-distance contacts and exchanges, by trading raw materials or manufactured objects (Harding 2000: p. 185). Actually, the production of metal objects during the Bronze Age played a crucial role in the intensification of exchange of goods and establishing new trade routes, even across Europe. A wide range of other materials was traded along these transport routes although not necessarily covering the complete long-distance. Goods, items, and ideas gradually moved between the two farthest regions (Sherratt 1993).
Other important trade networks were the connections between the Baltic Sea region and the central Mediterranean, well documented by the amber trade (Kristiansen & Larsson 2005: p. 186), and the networks trade between the Eastern Mediterranean and Central as well as northern Europe.
In a recent paper Jones M.K. *et al.* (2011) moved the focus from the material cultural evidence of exchanges to the direct evidence of the crop plants translocation across central Asia as part of the ancient trade networks, a process called 'food globalization' by the authors. Particularly they focused on starchy crops and argued the reasons of "why move starch" to areas that already possess it. They argued that three main factors related to ecological opportunism, economic relations and cultural choice drove these crop exchanges. They emphasize the ecological drivers, such the brevity of growth cycle and ripening period, risk-minimization strategies and multi-cropping systems. Moreover, they suggested that such a crop translocation process began in the second half of the third millennium BC – earlier than the cultural materials outcomes presented by Sherratt (2006). Boivin *et al.* (2012) re-examined the question giving more importance to the social aspects of crop translocations and confirming the earlier dating of such exchanges' evidences from plant remains. They pointed out a strong relationship between prestige, power and the translocation of exotic plants. Numerous examples from the ancient world supported the important roles that plants played in defining

social status, in maintaining memory and identity in new social contexts, and for their medical and magical uses. The controversial issue discussed in the mentioned recent papers highlights the importance of archaeobotanical data to support and integrate the archaeological evidences into the mobility of culture.
In Europe, we see the appearance of new cultivars (spelt, different legumes, millets….) as well as weeds during the Bronze Age; however this is not well enough researched (see e.g. Jacomet 2004; Jacomet *et al.* 1998; Jacomet & Brombacher 2009; Harding, 2000 p.143). Nevertheless, the Bronze Age cultivar spectra seem to point to strong long-distance links. The millets probably originated in China (Lu *et al.* 2009; Hunt *et al.* 2008; Nasu *et al.* 2007) and the pulse spectra remind us on various Bronze Age settlements in Thessaly (e.g. Becker & Kroll 2008).
Our results of the archaeobotanical investigation of two key sites south of the Alps can contribute a lot to the reconstruction of the development of plant economy and plants' translocation during the Bronze Age, within and in the surroundings of the Alps. Until now, archaeobotanical information from the southern side of the Alps were very scarce depicting a palaeoeconomical and palaeoecological research gap. Some plant *taxa* found in both, the Lucone D and Lavagnone sites bear traces of long-distance exchanges. Their significance is discussed below, and for the first time it is possible the shed light on this topic based in plant spectra from northern Italy.

8.8.1. Broomcorn millet (*Panicum miliaceum*) and some open land taxa

Remains of broomcorn millet (*Panicum miliaceum*) were found in large amounts in the MBA samples of Lavagnone (Chap. 3). The plant macroremain analysis of the core LAV37 (Chap. 4 and Chap. 8.7, Fig. 4.1) clearly shows its spread in the time interval corresponding to the IVth settlement phase (macrofossil zone: LavMZ9) at the transition from the EBA to the MBA. Before this time, it was only sporadically recorded. The broomcorn millet concentration peaks around 1500 BC during MBA I.
The domestication history of broomcorn millet is quite significant for an understanding how new crops were acquired in prehistoric societies and which potential drivers for food globalization were involved. Nevertheless, it is subject to an ongoing debate mainly concerning the geographical origins. The earliest broomcorn millet remains are dated to the early Neolithic and come from sites in north China, dated to ca. 8350-6750 cal BC (Lu *et al.* 2009; Barton *et al.* 2009). So far, no finds of Neolithic age have been found in central Asia, while some early Neolithic records are known in Eastern Europe and the Caucasus region (Hunt *et al.* 2008, Zohary *et al.* 2012). This geographical disjunction has been explained by several hypotheses suggesting a single domestication centre followed by a rapid spread across the central Asian steppe or assuming multiple domestication events (Jones M.K. 2004). Recent genetic studies confirmed the division in two main groups in modern millet cultivars but they did not provide a clear explanation (Hunt *et al.* 2011).
The occurrences of *Panicum miliaceum* in earlier Neolithic sites of western Europe are characterized by scattered grains (single or few finds). These are often interpreted as weeds (Kreuz *et al.* 2005, Kohler-Schneider & Caneppele 2009). The first west-european record where broomcorn millet grains were retrieved in larger amount is from eastern Austria and is dated to the Late Neolithic, to ca. 3000 BC (Jevišovice Culture) (Kohler-Schneider & Caneppele 2009). In central Europe the first bulk find of broomcorn millet is from Domica cave (east Slovakia). These finds were dated to Middle Neolithic (ca 5000/4900-4700 cal BC) (Hajnalová *et al.* 2013). Nevertheless, a chronological revision of the earliest millet finds from Slovakia is now in progress and seems to re-consider them younger (Hajnalová *et al.* 2013). From the Bronze Age onwards, broomcorn millet became common and increased remarkably towards the Late Bronze Age, claiming the status of a regular crop (Stika & Heiss 2013). This slow and progressively spreading of broomcorn millet cultivation reflects the

time lag, often observed in crop translocations, between the introduction of a crop into a new environment and its growth on a significant scale (Boivin *et al.* 2012: 455). Boivin *et al.* argued that this long delay clashes with the hypothesis that the goal of long-distance crop translocations was the transformation of native agricultural system through the intentional seeking of new calorie sources. If so, a rapid uptake and large-scale consumption of the novel staple would be expected.

In northern Italy, broomcorn millet remains are quite sporadic and documented by doubtful identifications during the Neolithic period (Rottoli & Castiglioni 2009). Certain identifications are dated to the Chalcolithic period and refer to two sites: Monte Covolo (Pals & Voorrips 1979) and Velturno-Tanzgasse (Castiglioni & Tecchiati 2005). Nevertheless, these finds are represented by single grains. Still sporadic in sites of the Early Bronze Age, *Panicum* shows an increasing trend from Middle Bronze Age onwards when its cultivation is attested (Fiorentino *et al.* 2004). Broomcorn millet cultivation reached its maximal diffusion during the Iron Age and in medieval times (Castelletti *et al.* 2001).

The huge amount of broomcorn millet remains in the Lavagnone MBA layers are of significant importance because they are in stratigraphic continuity with the EBA layers. This allows analysing changes in the plant macroremain spectra that can shed light on the acquisition of new crops at the transition from the Early to the Middle BA. This change corresponds to the transition from the IIIrd to the IVth settlement phase, outlined in the analysis of the core LAV37 (Chap. 4) and discussed in chapter 8.7.1. At this transition, a higher biodiversity in the plant fossil assemblage with an increase and diversification of the terrestrial herbs has been observed (Chap. 8.7.1, Fig. 4.2, Tab. 4.1). The occurrences of a high number of new *taxa*, not recorded before account for a diversified and wider open land. Most of these newly introduced *taxa* (e.g. *Agropyron* cf *repens*, *Medicago minima*, *Cichorium intybus*, *Onopordum acanthum*, *Pastinaca sativa*, *Silene otites*, *Verbascum* sp.) favour dry and warm habitats. In this scenario, broomcorn millet started to be intensely cultivated. The ecological tolerances of broomcorn millet should be also considered in order to explain its adoption in a multiple cropping system – the crop plant spectra of Lavagnone and Lucone D are indeed characterized by a high diversity of cereal crops (Chap. 8.2). *Panicum miliaceum* is a summer crop, sown very late in spring, as it does not bear frost during germination. It grows well in regions characterized by warm climate with a short rainy season, on poor soils and under severe droughts. The Garda region reflects very well all these environmental features. In such ecological conditions, broomcorn millet is quite advantaged by the brevity of growth and ripening period (completed in 60-90 days) (Zohary *et al.* 2012). Under these circumstances, the lowering of the lake level supported the human works for draining the area (see the LavMZ9b dated to 1620-1450 cal BC described in Chap. 4.1 and Fig. 4.2). We can argue that the 'bonifica' (land reclamation) of a part of the Lavagnone basin may relate to one of the centennial climate-warming phases characterizing the Middle Bronze Age period (Magny 2004, Magny *et al.* 2009, Furlanetto *et al.* in prep.), but clearly preceding the phase of low lake levels called "Bronze Age optimum" and dated to 1350 – 1200 cal BC on the base of dendrochronology of trees affected by glacier advances in the Alps (Le Roy *et al*. 2015). These hypotheses require further multidisciplinary investigations in order to find out clear evidences of it.

All in all, ecological drivers seem to have a significant role in spreading the cultivation of broomcorn millet in the Garda region. However, social processes and economic relations cannot be excluded in the general improvement of crop husbandry practices. We can conclude that the introduction of new cultivars (broomcorn millet), an intensification of pulse cultivation (horsebean) and a diffusion of rotation systems characterizes the Middle Bronze Age of northern Italy.

*8.8.2. Safflower (***Carthamus tinctorius***)*

The second example of exotic plant translocation concerns finds of *Carthamus tinctorius* (safflower) (Fig. 8.8.1). Remains of this species were found in both, Lucone D and Lavagnone (Chap. 3.3.4, 6.3.4). Safflower is an herbaceous annual species of the Asteraceae family, possessing several branches each terminating with a head of 20-80 florets. Each floret produces one seed. It is highly tolerant to drought stress. Thus, it is well adapted to arid and semiarid environments, with low relative humidity especially during the latter part of its growing season – these are essential conditions for a good development of a high oil content of the seeds (Claassen 1949). *Carthamus tinctorius* is a plant used for dyeing (from the immature flowers for yellow or red colour) and for oil extraction (seeds). Today the crop is of minor economic importance; different varieties are known. The wild progenitor species of safflower is *Carthamus palaestinus* (invalid species name for *C. persicus* Willd.), which has a wide distribution including Syria, Turkey and the Levant where safflower was first cultivated (Knowles & Ashri 1995, Chapman *et al.* 2010).

The remains found in Lucone D and Lavagnone are very remarkable. On the basis of a recent compilation of safflower fossil finds (Marinova & Riehl 2009), they are together with finds from Tell Karanovo (Bulgaria), which are dated to EBA (2800-2600 cal BC) (Marinova 2004), the oldest finds of this species in Europe. So far, in Europe safflower achenes have been retrieved only in Bronze Age contexts, in the Balkans (Bulgaria and Serbia) and in Hungary, and in a military camp of Roman Age in Alsace (France) (Vandorpe 2010) (Fig. 8.8.2). Earlier finds are known from a number of EBA sites in northern and central Syria (ca. 3400 BC). From this center of origin it later spread to Egypt, the Aegean and south-eastern Europe (Marinova & Riehl 2009). Bronze Age finds in the Near East are usually interpreted as being related to dyeing because of the well-known Egyptian finds of the second millennium BC whose chemical analysis of textiles confirmed the use of safflower as dye plant. From the Iron Age and the Roman period, the plant is supposed to be cultivated mainly for oil extraction. However, the highly fragmented finds of *Carthamus* fruits from Early Bronze Age Tell Karanovo could be already interpreted as residues produced by an oil extraction technique (Marinova & Riehl 2009).

The finds of *Carthamus* in the EBA layers of northern Italy can be considered as an element testifying long-distance trade-links from the Near East to south-eastern Europe through the Balkan region.

*8.8.3. Bladdernut (***Staphylea pinnata***)*

Another noteworthy species whose occurrence needs to be discussed is *Staphylea pinnata*, bladdernut, a deciduous shrub or small tree, from 1.5 to 5 meters high, with nice white flowers in dropping terminale panicules (Fig. 8.8.3). Indeed, nowadays this shrub is widely cultivated for ornamental purposes. It produces inflated and bladder-like capsule fruits, with 1-few large, nutlike seeds per carpel. The seeds almost spherical, ca 10 mm in diameter, glabrous and shiny, and have extremely hard seed coats. They are suitable for ornamental objects. The Celts used them as ornamentals and after the introduction of Christianity, they were used as rosary beads (see Heiss *et al.* 2014 for an overview on the ethnobotanical interest of bladdernut).

The modern distribution of bladdernut extends mainly in south-eastern Europe (Fig. 8.8.4). It covers a wide area from the easternmost countries of Moldova, Romania, Bulgaria where it reaches the Black Sea coasts, to the middle Danubian basin (Croatia, Slovenia, lower Austria) and the northern Alpine margin, westwards till the mountains of Jura, the Vosges and Ardennes (NE France and Belgium). Northwards, bladdernut reaches the Bohemian foothills (Czech Republic) and southern Poland. The southernmost records occur in Calabria, southern Italy. A unique population known from Greece is currently considered to be extinct (Raus

2006). Outside Europe, there are a number of sporadic occurrences in Turkey, in western Anatolia and along the southern coasts of the Black Sea.

The biogeographic interpretation of *Staphylea pinnata* has been widely discussed in the last century, and it still arouses interest in the botanical and palaeobotanical research. One main question is concerned with its dispersal by man in Central Europe (see below). On the other hand, bladdernut is considered a representative element of the submediterranean nemoral flora whose boundaries are controlled by climatic conditions (Meusel & Jäger 1989).

A comprehensive bladdernut distribution map was drawn by Meusel & Jäger in two versions (1978 and 1992). The most recent version distinguishes (i) a main continuous range where the species occurs in stable populations, (ii) several isolated spots representing doubtful native stands, and (iii) a few localities (stated as synanthropic) where the species was definitely introduced by man (gardens, yards, etc.). Several authors were concerned with critical areas where *Staphylea pinnata* may have been introduced. For instance, the occurrence of this plant in southern Poland was widely and controversially discussed by Gostinska (1961 and 1962) and Kornas & Wrobel (1972). The former author favoured the hypothesis of an anthropogenic origin; the latter on the other hand suggested a natural establishment during the current interglacial. Parent (2000 and 2006) listed several stands of bladdernut found at its western distribution limit (NE France, Belgium, Luxembourg, and W Germany). He pointed out that some monastic communities may have introduced the species during the Middle Age. Likewise, Hendrych (1980) asserted the secondary origin of *Staphylea pinnata* in Bohemia (Czech Republic) based on phytogeographical and historical evidence. Finally Meusel & Jäger (1992) did not clearly define the range of the species in N Italy (on their map a broken line delimited the range in this region). Some updating notes on the distribution of the bladdernut shrub in this region will be given in a forthcoming paper (Perego *et al.*, in prep.). A significant progress to the debate on the controversially discussed present-day distribution of bladdernut will become possible from enlarging our palaeobotanical knowledge on this species (Latalowa 1994). Thus, in this prospective, the new finds from the Garda region are particularly remarkable.

Bladdernut fossil remains found in the EBA layers of Lucone D consist of seeds included in two necklaces (Fig. 8.8.5), and two isolated seed finds: one charred and perforated, retrieved from a surface sample (Tab 6.3b and Tab. 6.4b); the second one uncharred and entire, collected during the excavation in the Stratigraphic Unit SU250 as judgment sample. The first necklace is made of 13 bladdernut seeds and 13 marble beads, both the stones and the seeds being perforated. The second one is a necklace made of 61 elements including just one bladdernut seed. These records are the oldest finds of this plant in an archaeological context. Considering the rare and sporadic distribution of bladdernut in northern Italy (see above), these findings arose the question whether they do represent early imported artefacts – introducing bladdernut in the Central Alps, or, instead, if they originate from local native stands. Actually, the prehistoric lacustrine village of Lucone D lies five kilometres away from a living spot at Rocca di Manerba (very close to the Garda lakeshore, see Fig. 1.2.2), where the bladdernut grows in the understory of *Ostrya-Carpinus betulus* woodlands on limestone scree slopes facing North. This is one of the best established populations of *Staphylea pinnata* in northern Italy: there are numerous individuals, all of them flowering in April and producing a discrete quantity of fruits. Three wooden artefacts – two containers and one club-stick – from the EBA pile dwelling of Barche di Solferino (situated more than 20 km southwards from Lucone) were doubtfully identified by Follieri (1974) as cf *Staphylea pinnata*. Finds of bladdernut wood remains speak for a local growth of the species. Considering the importance of these woody finds, a new identification is requested to remove any doubtful identity (unfortunately the two containers are not anymore traceable at the Civic Museum of natural History of Verona). So far, records in the Garda region are missing any evidence

of fossil pollen. In the light of these data, the hypothesis of a local gathering is to be put forward which is strengthen by the find of an intact seed in the pile dwelling sediment but unrelated to the necklaces contexts. Otherwise, trading of 'raw material' for assembling ornamental objects has to be supposed.
In the hypothesis of trading bladdernut seeds, an eastern provenance should be envisaged, most probably from Croatia, Slovenia, or lower Austria. In these regions, the species has a continuous and extensive distribution. Questions concerning bladdernut distribution and its Holocene history will be further discussed in a forthcoming paper Perego *et al.* (in prep.). There, the Alpine pollen record and species pollen production will be dealt with.
So far, a definitive evidence did not emerge either for species human introduction or for its native status in the Garda area. On the other hand, in the light of our new fossil records, the bladdernut biogeographical history appeares to be strongly influenced by human activities since the prehistoric time. The interest for such a decorative plant should be further investigated, tracing the influence of man in its spreading.

8.8.4. The 'new glume wheat' type

The last species we want to focus is the 'new glume wheat' type (denominated '*Triticum* nn' in our carpological spectra). The new glume wheat was first described by Jones *et al* (2000) at three Neolithic and one Bronze Age sites in northern Greece. It is a new type of glume wheat morphologically distinct from typical einkorn, emmer and spelt. It has morphological features, which are in between emmer and einkorn (detailed morphological descriptions are given in the catalogue of the main species, App. 7). Its origin and exact identity still remain uncertain, but it seems likely that it is a tetraploid wheat with morphological features in common with *Triticum timopheevi*, cultivated only in Georgia. This glume wheat was largely grown, both in Lucone D and Lavagnone where a huge amount of remains have been found (Chap. 3.3.1 and 6.3.1) in both archaeological phases of the Early and the Middle BA. It is one of the most important crops together with emmer, barley and einkorn (Chap. 8.2). In Lucone D, the fire event separating the two settlement phases, allowed the preservation of complete ears that revealed new morphological features of the species not yet known (Perego & Jacomet 2013, and the catalogue of the species App. 7).
Since the first description by Jones *et al.* (2000), several finds of this morphologically distinct tetraploid wheat have been announced in more than 30 Neolithic and Bronze Age sites across central and south-eastern Europe, as well as in Turkey, where the oldest evidences of this crop species (Early Neolithic, 7200-5800 BC) are recorded (Fiorentino & Ulas 2010). An updated state of the art on the new glume wheat finds is given in a recent paper by Kenez *et al.* (2014). A distribution of fossil finds of the new glume wheat is given in Fig. 8.8.6. So far, in northern Italy, the new type was found in five Neolithic and five Bronze Age sites. Up till now we don't have any occurrences of it in Central or Southern Italy. The distribution of its finds highlights the moving of the novel crops along the trade networks connecting the Near East to Europe, crossing the Balkan Peninsula, the Pannonian region, the Po Plain and finally the regions north of the Alps. Thus, this distribution reinforced the idea of important trade routes from the Near East to southern Europe. Based on the current knowledge the cultivation of the new glume wheat was anyway not much widespread and appears to drop in the Iron Age – the last occurrence is dated to Late Iron Age/La Téne 250 - 50 BC, in Austria (Kohler-Schneider & Heiss 2010). The reason of the limited success of the new glume wheat is still to be unravelled.

8.9. Comparison with the site of Fiavè-Carera (TN)

At the beginning of the Bronze Age, the pile dwelling sites became widely scattered on the southern fringe of the Alps (see Chap. 1.3). Until now, only a few of them have been comprehensively investigated (see Chap. 1.5.3). We can mention the lake dwellings of Fiavè-Carera (Trento, located at 648 m a.s.l.) (Perini 1984; 1987a; 1987b) and Canàr di San Pietro Polesine (Rovigo, 7 m asl) (Accorsi *et al.*, 1998; Castiglioni *et al.*, 1998). A detailed comparison can be attempted with the Fiavé deposits, at least for the Middle Bronze Age period. Here a complete outline of the crop remains record was given thanks to the systematic sampling and analysis of the cultural layers. Actually, the Bronze Age layers of site of Fiavé are the only pile dwellings in northern Italy where multidisciplinary archaeobotanical investigations were performed (Greig 1984, 1985; Jones & Rowley-Conwy 1984, 1985; Karg 1998).
The oldest human occupation at Fiavé dates back to the Late Neolithic-Copper Age and is parallel with the North Alpine phase of the Pfyn tradition. The settlement in this phase was built on the ground encroaching on the Carera island. The very beginning of the Bronze Age (i.e. the culture of Polada, which is well represented at Lavagnone, see Chap. 1.3) is not documented at Fiavé. During the MBA a large, water-type lake-dwelling developed, with a structural typology characterized by wooden floor supported by long isolated posts driven into the lake bottom. Later (late MBA), the settlement layout became more complex with habitation modules arranged in three concentric bands from the shore to the lake centre. As regards pollen analysis, Fiavè is still one of the few cases where both on-site and off-site pollen records have been obtained. In addition, a comparison between these pollen records and the seed spectrum has been produced.
Macroremains analysis provided evidence of the utilisation of a wide range of species including fruits, nuts, cereals, flax and a pulse.
Within cereals, a high diversity of species was cultivated as in Lavagnone and Lucone D sites, testifying the important role of cereal crop cultivation for the economy of the Fiavè settlement as well. Cereals consisted of charred fragments of ears, whole spikelets, spikelet forks, glume bases and free grains. There were barley and four wheats crops. Both one- and two-seeded einkorn varieties (*Triticum monococcum*) were found. Remains of a tetraploid wheat characterized by morphologically different forms were recovered and described as *T. dicoccum / turgidum / durum*. The uncertain identification of these remains would deserve a revision in the light of the new evidences and wide distribution of the 'New Glume Wheat' type remains (NGW) (see Chap. 8.8.4). At least part of these intermediate forms might be attributed to the NGW (Glynis Jones pers. com.). Most of hexaploid wheat spikelets belonged to spelt type (*T. spelta*), whereas spikelets of bread wheat type (*T.* cf *aestivum*) were few in number. All the ear fragments of barley were of six-row hulled type (*Hordeum vulgare*), although the presence of two-row species and the naked variety cannot be definitely excluded.
Overall, the cereal crop spectrum is similar to that of the MBA recorded in the Lavagnone site, particularly concerning the abundance of einkorn (solely one-seeded einkorn was found in the Lavagnone assemblage) and the tetraploid wheat. The latter in Lavagnone MBA layers is largely represented by the NGW type. The major differences are the abundance of hexaploid wheat (particularly *Triticum spelta*) at Fiavé, while it is a secondary crop in either EBA or MBA at Lavagnone, and the presence of broomcorn millet (*Panicum miliaceum*) at Lavagnone already in the MBA, while in Fiavè it appears in LBA and is represented by a few carbonised seeds.
Pulses were rarely recorded in both sites. The only species of pulse found at Fiavé was the field pea (*Pisum sativum*). At Lavagnone, only seeds of broad bean (*Vicia faba* var. *minor*) found in the MBA, documented pulses occurrence.

Concerning nuts and fruits, Cornelian cherry (*Cornus mas*) was the most common fruit and found in large quantities in Fiavè. In Lucone D and Lavagnone (both Early and Middle BA layers), it was abundant as well, but the largest amounts of remains are those of small fruits like strawberry (*Fragaria vesca*) or blackberry (*Rubus* gr. *fruticosus*). This recall to the large extent of slope limestone bedrock in Fiavé, i.e. one of the optimal habitats for Cornus mas. Limestone bedrock is missing in the lower Garda amphitheatre.
The cereal processing sequence proposed at Fiavè consisted of harvesting the cereal crop by plucking, leaving the straw and most weeds in the field. The ears were stored unthreshed and grains cleaned piecemeal during the year. On the contrary, in Lavagnone and Lucone D sites, weeds evidence, ear finds and harvesting tools suggest cereals were more likely harvested cutting straw and ear together (see Chap. 8.2.2.6).
Overall, there are some analogies between our sites and Fiavè. They reinforce the idea that crop cultivation was an important component of the subsistence economy during the Bronze Age over a wide range of different environments, even in an inner valley of the southern Alps. Besides, the high diversity of cereals grown in both situations is consistent with the spreading of a more generalized agriculture at the southern fringe of the Alps. This could represent an adaptive strategy helping to face climate and other type of yearly events.
The observed dissimilarities might be ascribable to the different environmental conditions characterizing the alpine foothills and the internal prealpine valleys.

9. CONCLUSIONS AND PERSPECTIVES

The plant macroremains analysis carried out in the two Bronze Age lake-dwelling sites of Lavagnone and Lucone D (Lake Garda area, northern Italy) contributed in a substantial way to the reconstruction of the development of the plant economy during the Bronze Age, within and in the surroundings of the Alps. For the first time representative archaeobotanical information from the southern side of the Alps become available.

The analysis of samples from both Early and Middle Bronze Age cultural layers allowed documenting significant changes at this transition concerning the crop spectrum, i.e. the introduction of new cultivars, the exploitation of natural sources, as well as changes in the landscape.
A large variety of cereal crops have been detected in both age periods. Emmer, the 'new' glume wheat type (NGW), barley and einkorn resulted to be the most important cereals, while spelt and naked wheat (both, 4n and 6n) were secondary crops. The abundance of the NGW remains is particularly noteworthy. The exceptional preservation of complete ears in the burnt layer of Lucone D allowed a description of morphological traits not known so far for this species. The spread of broomcorn millet cultivation and the record of pulses (mainly horsebean) in the MBA layers of Lavagnone could have been investigated, considering also the coeval palaeoenvironmental changes involving the surrounding landscape. The comparison between the plant assemblages of Lavagnone and Fiavè stressed the high diversification of crop spectra in regions south of the Alps during the Bronze Age. Moreover, the similarities between the two sites suggest a transfer of the lowland farming economic system into the mountain region and a consequent adaptation to the different climatic condition. At Fiavè, the spreading of crops requiring warmer climate such as broomcorn millet, occurred only in LBA, i.e. later than in the lowland (see Chap. 3.3.1 and Chap. 8.9). We can argue a climatic change to explain this shifting in the agricultural system. Actually, the so-called 'Bronze Age optimum' occurred in the later BA (1350 and 1250 (± 100) BC, Holzhauser *et al.* 2005).
Other crop species in addition to cereals were flax and oil or dyeing species such as *Carthamus tinctorius* and maybe *Camelina sativa*.
The rich weed spectra and the archaeological finds such as farming tools (e.g. a plough, several reaping knifes and jaw-sickles) were used to reconstruct crop husbandry practices, although we did not deal with samples from 'closed contexts'. Based on soil features and the distribution in the surroundings of the two settlements, plots more suitable for cultivation have been recognized. The crop field's potential surface has been estimated in an area of 1 km radius around the lakes. Apparently, in the Lavagnone basin a larger fertile and flat surface (more than 200 ha) was available close to the settlement than in the Lucone basin (ca 124 ha). These areas were partly cultivated, partly covered by woodland. Most likely extensive winter crop fields were located on the flat area surrounding the basin. On the other hand, summer crops were grown in small plots close to the lakeshore and to the settlement, here the soil features better fitted with the ecological requirements of crops sowing in late spring/summer.
The finds of a conspicuous amount of wild edible plants testifies a large contribution of gathered species in food supply. Among these, a large quantity of acorns (charred or as waterlogged pericarp fragments) have been found. Heaps of charred acorns were retrieved in the burnt layers of Lucone D. These remains stress the controversial question about acorns edibility by man. Moreover, the abundance of wild plant remains such as *Portulaca oleracea* and *Chenopodium album* let suppose a use of these species for food purpose during MBA.
Thanks to the excellent preservation of plant remains in both sites, palaeoenvironmental reconstructions

above all concerning open land, the perilacustrine belt and aquatic habitats were carried out. The high number of open vegetation plant *taxa* recorded in the plant assemblages from Lucone D and Lavagnone was likely due to human activities or animal vehicles (through fleece or excrements). The fallow land and dry meadows appeared to be largely distributed in the surroundings of the settlements. In these habitats, new species could spread e.g. *Orlaya grandiflora,* which presents a strong increase in the region since the MBA as documented by pollen and carpological data in Lucone D and Lavagnone deposits.

The importance of the open environments was also detected by the analysis of ruminants (goats and sheep) coprolites recovered from sediment samples. Pollen and plant macroremain content of the coprolites gave information about animal husbandry and habitats grazed by the animals. Indeed, in Lavagnone and Lucone, goats and sheep seem to browse mainly in dry meadows and fallows. Probably they browsed by themselves in the surroundings of the settlements even during wintertime; thanks to the mild climate of the region, snow should have been uncommon and not persisting. Furthermore, a detailed comparison analysis between an off-site (almost 60 m) and an on-site sequence in the Lavagnone site integrating pollen and carpological data from sediments and coprolites, showed how important coprolites as transport vehicles responsible for the accumulation of pollen and macroremains into anthropogenic sediments are. The high percentage of some pollen types could be explained only by the coprolites pollen influx.

The fossil plant assemblages include rare wetland *taxa*, today extinct or very rare in the modern flora of the Po plain, such as *Caldesia parnassifolia, Najas flexilis, Rumex maritimus.* These species are normally linked to specific habitats thus they are very important for the characterization of the past ecosystems. Their disappearance or modern reduced distribution are likely due to the strong disturbance against the original pre-anthropic habitats. However, the final extinction of a number of wetland species is related to the final reclamation of these wetlands in the 20^{th} century.

All this testified the importance of the archaeobotanical investigations in reconstructing the wild plant history and the potential use of the results for ecological services and the modern landscape management.

The plant macroremain analysis of the long depositional sequence of Lavagnone, extending over a long time interval encompassing all the Bronze Age settlements phases, allowed tracing the progressive local environmental changes at the foundation of the first pile dwelling and during the subsequent settlement displacements that took place all over the area according to the archaeological investigation. Changes are observed in the anthropogenic *taxa*, as well as in the aquatic and perilacustrine *taxa*.

Finally, the occurrences of novel crops or cultivars not so common in the European scenario (broomcorn millet, safflower, the new glume wheat type), examined on a large scale, might be considered as stages of moving economic plants along trade networks connecting the Near East to Europe. From this point of view, northern Italy – particularly the sub-mediterranean region of Lake Garda – is placed at the boundary of a region where ecological and climatic conditions allowed growing some *taxa* that could not be favoured in the regions north of the Alps.

Different research questions were investigated within the present thesis, however the plant material preserved in the two sites has a huge potential and its analysis is far from being exhausted. Further analysis could definitively add information to what has already been studied, thus it is of great importance to enlarge the number of samples so far analysed, e.g. additional samples from the first settlement phase of Lucone D are needed. Other approaches for the data elaboration are required. For example, a detailed statistical analysis of the samples using a multivariate approach could help interpreting the differences observed between Early and Middle BA, as well as the environmental predictors of differences between the two sites; it would equally allow a good comparison of deposits within and between structures. In addition, a detailed comparison between the results of plant macro remain analysis from Lavagnone and Lucone D and other sites inside and north of the Alps would be very interesting.

The samples from the burnt layers of Lucone D deserve a detailed and exhaustive investigation, particularly those from 'closed' contexts that might give important results concerning weed spectra and crop husbandry, as well as the well-preserved remains of the largely enigmatic 'new glume wheat' type retrieved from these layers. So far, they allowed for the first time describing unambiguously the grains of this *taxon* and the complete ear. However, with morphological and biometrical means alone, it is not possible to surely identify the biological species; this requires aDNA studies. As there are also only partly carbonised finds of ear fragments, there is a good possibility for tracing aDNA and proving the taxonomic status of the "new glume wheat". This would be of crucial interest for the whole research community.

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PART 2

List of Figures

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List of abbreviations used in the text

AD	Anno Domini
AP	Arboreal Pollen
App.	Appendix
BA	Bronze Age
BC	Before Christ
bienne	biennial
BP	Before Present
c	charred
ca.	about
caesp	caespitose plant
cal	calibrated
CH	Chamaephytes (life-form category)
EBA	Early Bronze Age
FQA	Full Quantitative Analysis
frg	fragment
frut	fruticose plant
G	Geophytes (life-form category)
H	Hemicryptophytes (life-form category)
I	Hydrophytes (life-form category)
Kyr	Kiloyear
L	Length
LAV	Lavagnone
LBA	Late Bronze Age
lian	liane
LGM	Last Glacial Maximum
LUC	Lucone
LS	Length of stalk
MBA	Middle Bronze Age
MNI	Minimum Number of Individuals
NAP	Non Arboreal Pollen
n.c.	not counted
NISP	Number of Identifiable Specimens
P	Phanerophytes (life-form category)
PCH	Position of the Chalaza
ph	phase
pulv	cushion plant
rad	rooting
rept	reptant, procumbent plant
rhiz	rhizomatous plant
ros	rosette plant
RS	Rapid Scanning
scap	scape
Smpl	sample
SU	Stratigraphic Unit
suffr	subshrub
T	Therophytes (life-form category)
ubiq	ubiquity
unc	uncharred
VBQ	Vaso a Bocca Quadrata
W	Width
yr	year

FIGURES

Fig. 1.2.1 – Geographic position of the Garda Lake, with the location of the Lucone and Lavagnone sites near its southern shore.

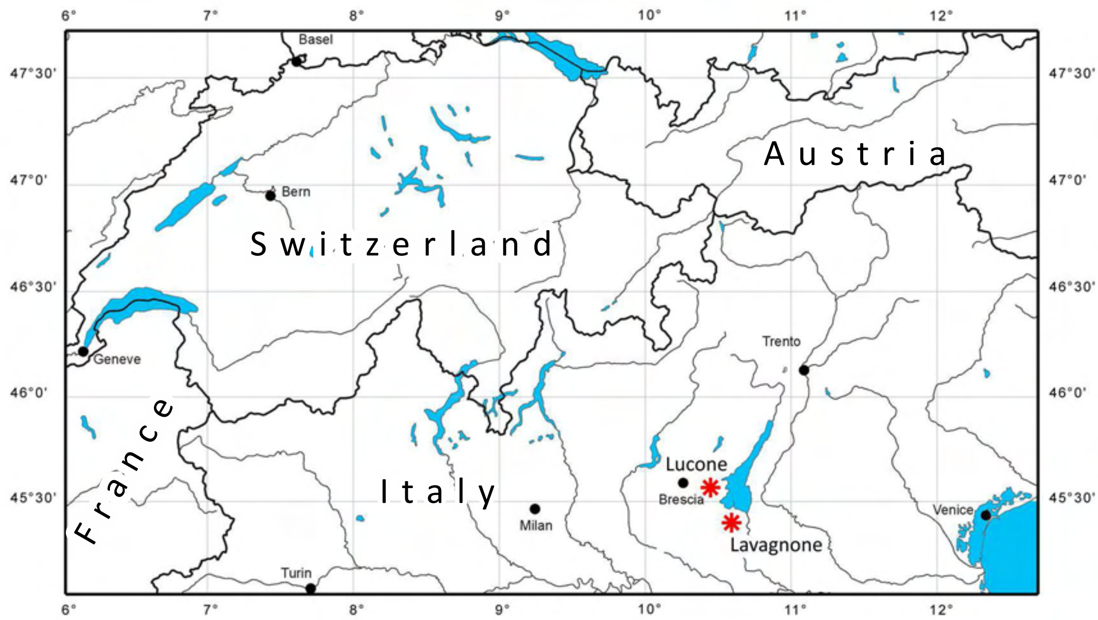


Fig. 1.2.2 – Digital terrain model of the region surrounding the Garda lake. The colour scale represents the elevation belts (green 0-100 m asl; yellow 100-200 m asl; brown above 200 m asl). The highlighted sites belong to three different landscape types: (a) lower morainic belt (include the site of Lavagnone); (b) upper morainic belt resting over the alpine bedrock hills (Lucone site); (c) typical prealpine landscape with glacial lakes (Ledro and Fiavè sites, the latter northwards out the figure limit).

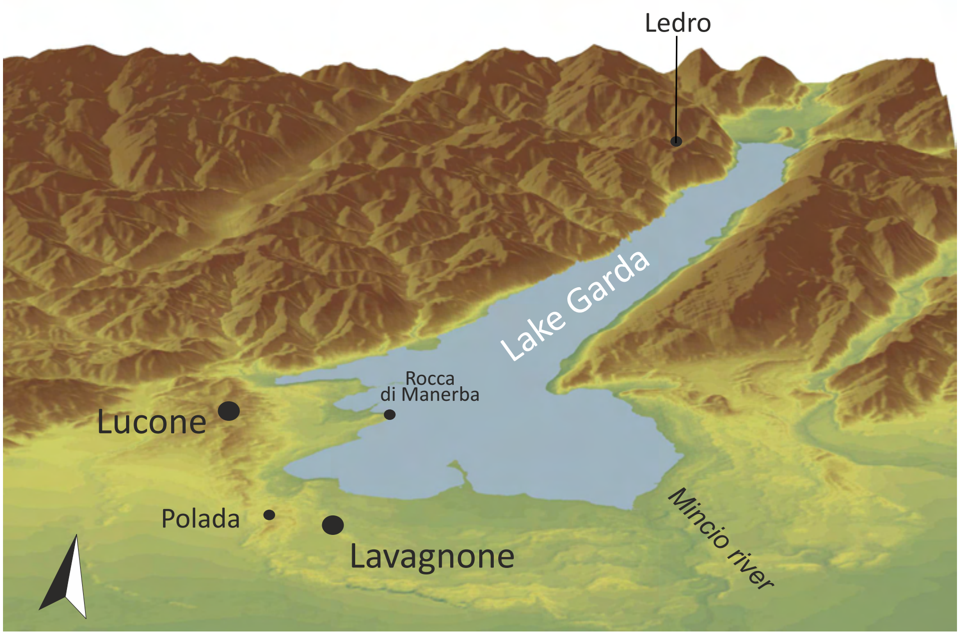


Fig. 1.2.3 – A view of the Garda Lake from Rivoli (eastern lakeshore). The rocky promontory, in the background, along the lakeshore is the Rocca di Manerba hill.

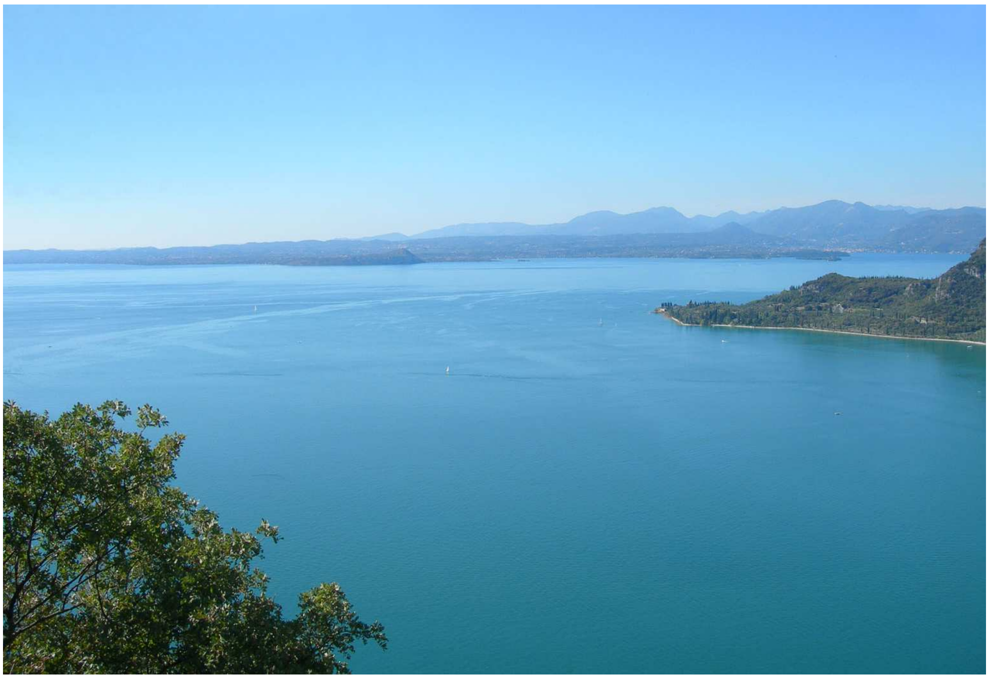


Fig. 1.2.4 – Morainic amphitheatres of the Garda region and geographic position of Lavagnone, Lucone and Polada sites. Red dots are Bronze Age sites according to de Marinis 2000 (map redrawn and modified by Venzo 1969).

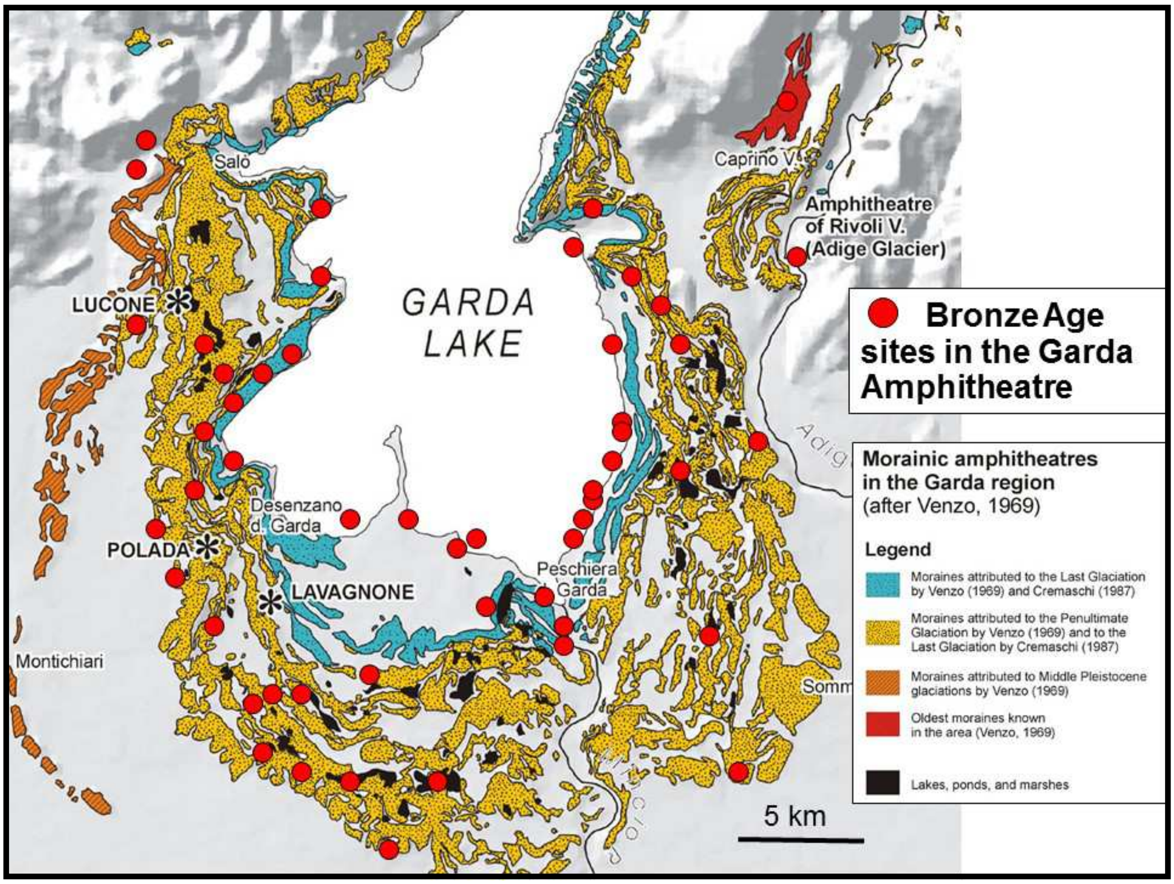


Fig. 1.2.5 – Map of modern soils in the area surrounding the Lake Lavagnone. Information derived from the ERSAL soil survey (Minnelli, 1997) modified and simplified.

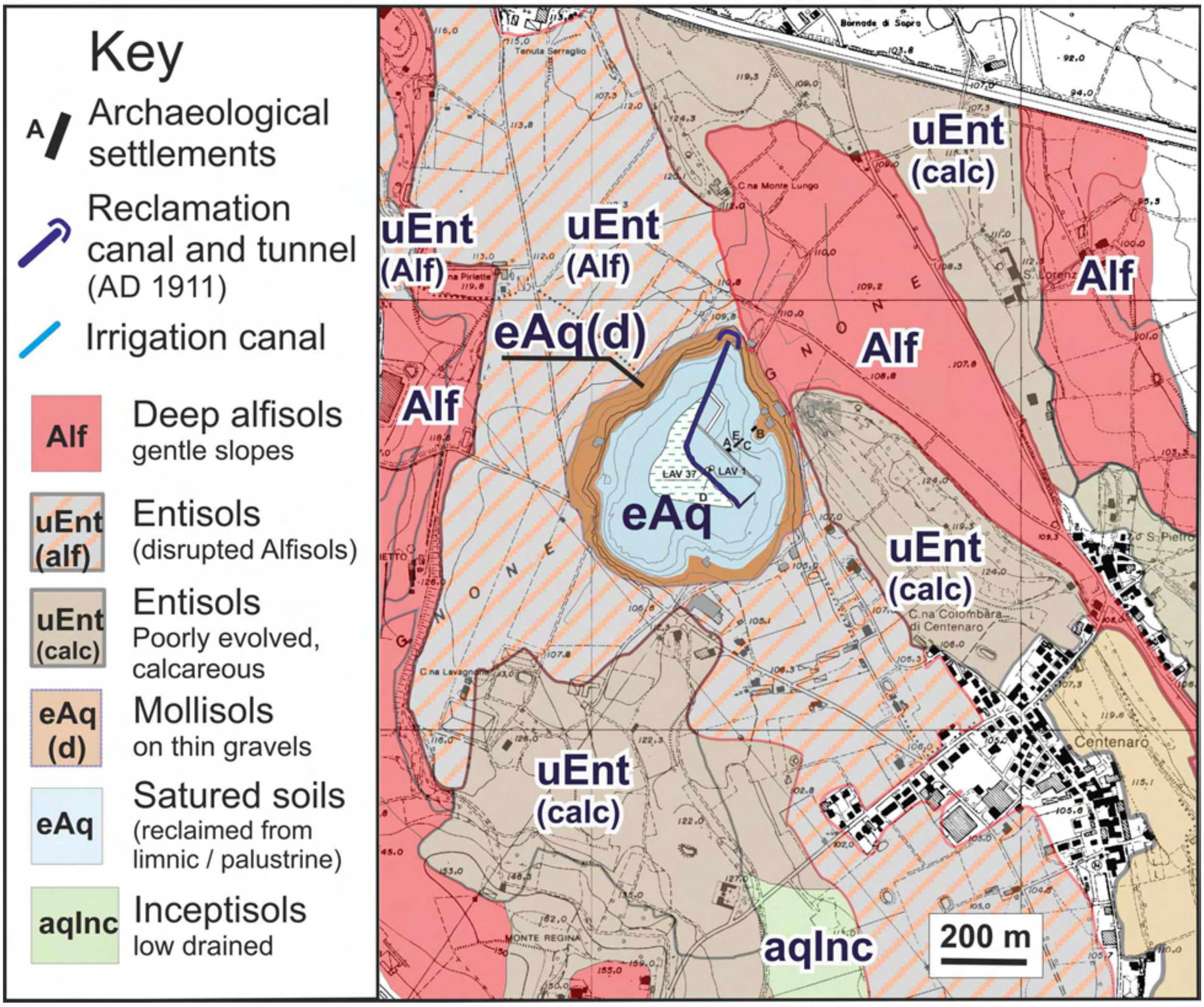


Fig. 1.2.6 – Map of modern soils in the area surrounding the Lake Lucone. Neolithic and Bronze Age settlement are shown. The pile dwelling Lucone D has been considered in this study. Information derived from the ERSAL soil survey (Minnelli, 1997) revised and simplified.

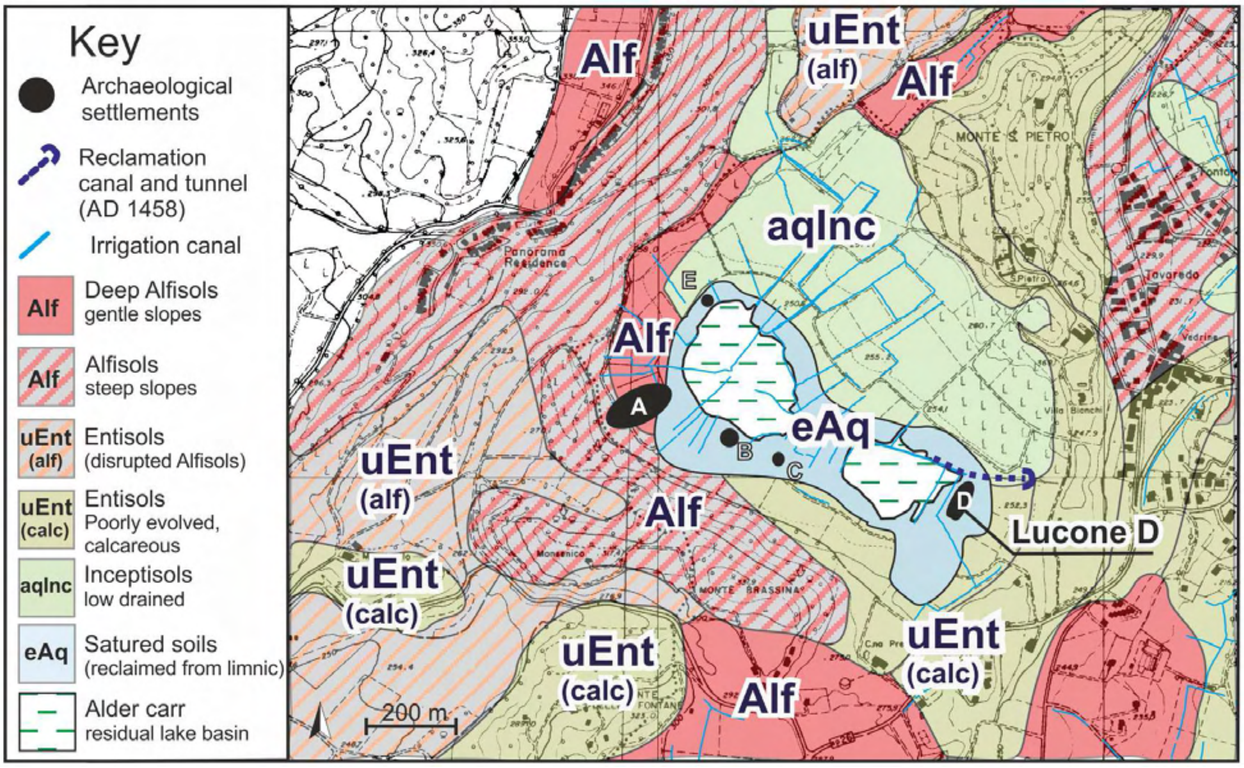


Fig. 1.2.7 – Walter (1973) climate-diagrams referring to the Lower Garda Region relative to the 2002-2011 decade (Agrometeorological Centre of the Brescia Province) (after Furlanetto 2013). The semi-drought period is marked by a broken line.

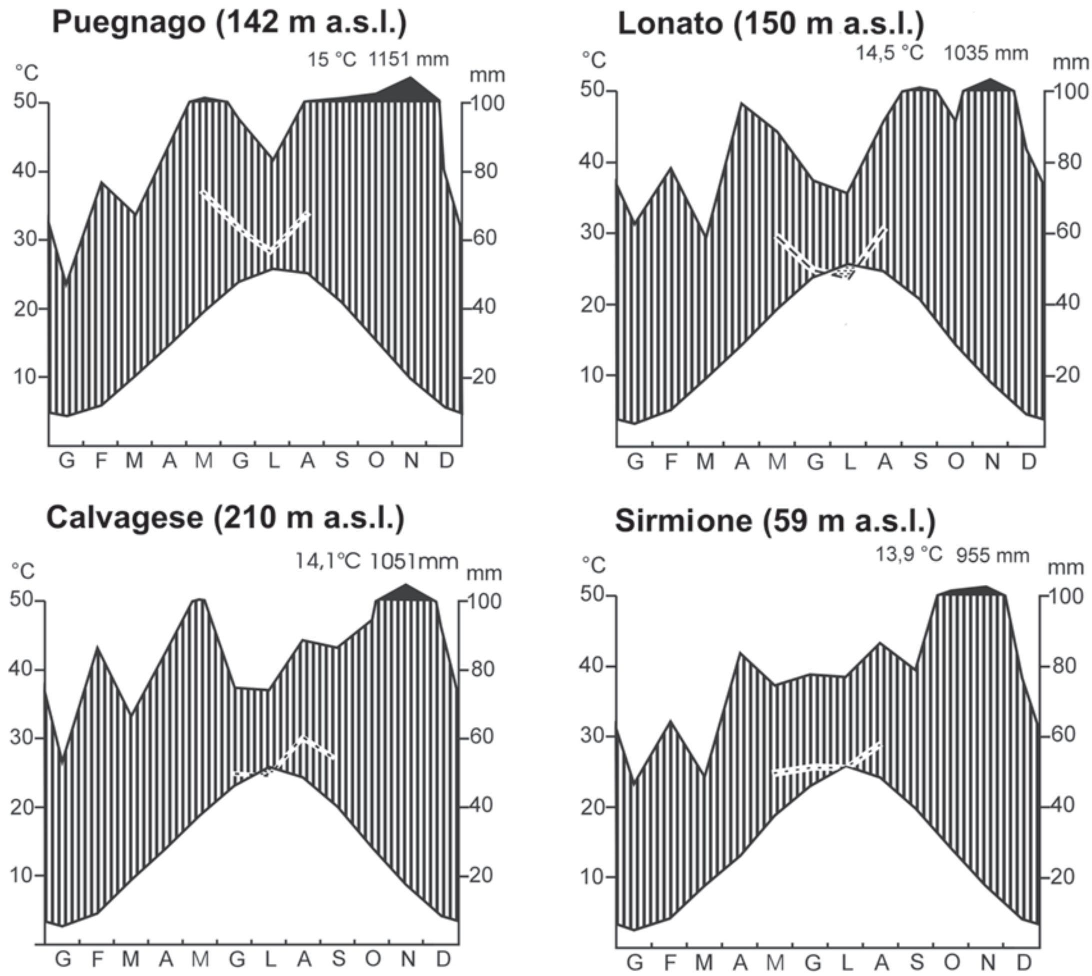


Fig. 1.2.8 – Above, mesophilous woodland of *Ostrya carpinifolia* and *Quercus pubescens*, with a rich understory of *Ruscus aculeatus* and *Hedera helix*, near Rivoli (December 2007). Below, *Quercus cerris* woodland on the morainic hills close to Polecra, Le Crosere di Lonato (a few km from Lavagnone).

Fig. 1.2.9 – Dry meadows intensely grazed by sheep on morainic hills close to Lavagnone. Above, Corno Gerardi (3 km from Lavagnone); below Monte Nuvolo, Polecra (© photos C. Ravazzi).

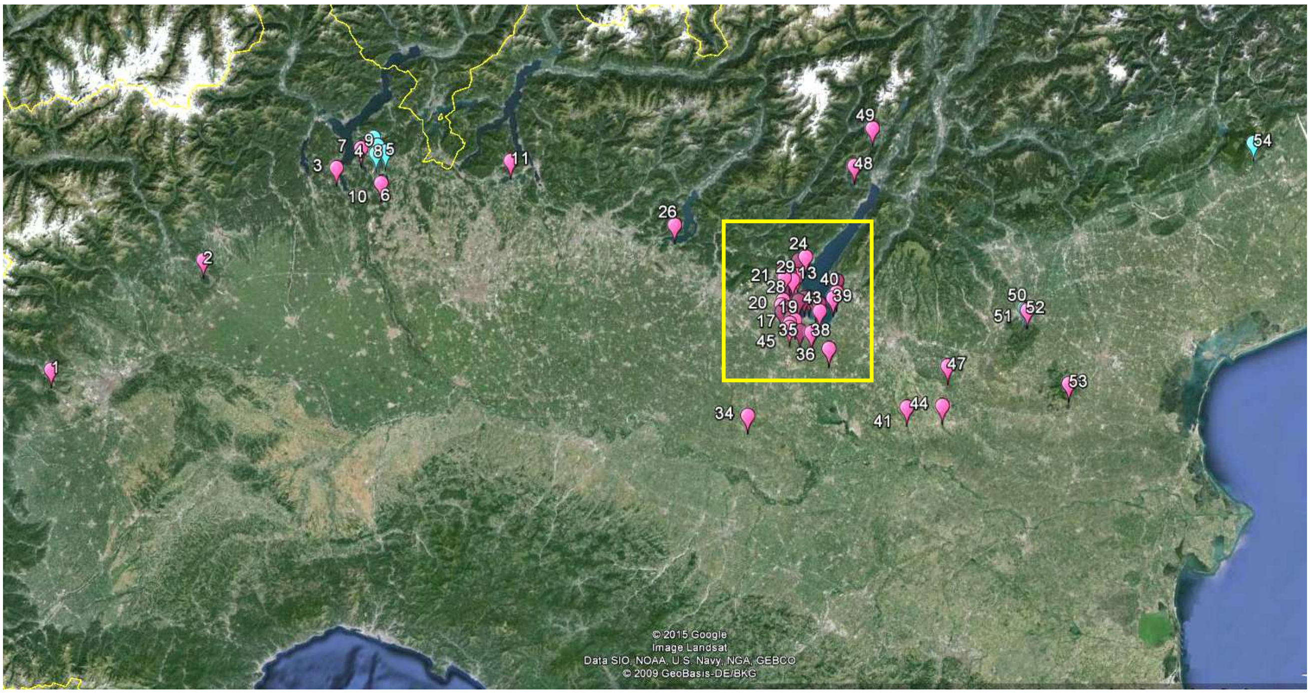
Fig. 1.3.1 – Comparative chronological scheme for the periodization of the Bronze Age in Italy and Central Europe (after de Marinis 2002).

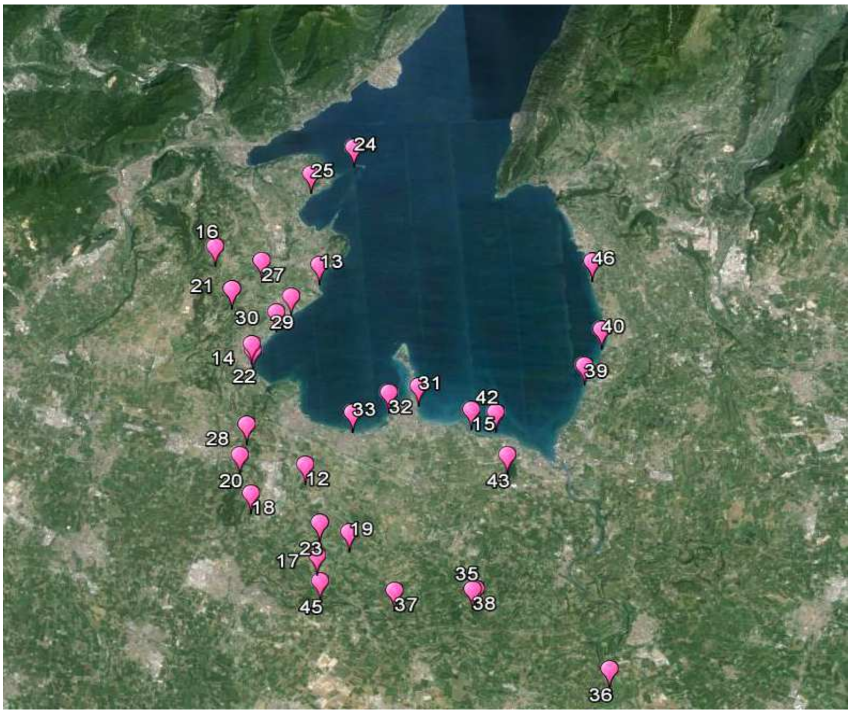
Italy	Central Europe	Reinecke System
BRONZO ANTICO	FRŰHE BRONZEZEIT	A 1 A 2a A 2b
BRONZO MEDIO	MITTLE BRONZEZEIT	*Hügelgräberzeit* B (B 1) C 1 (B 2) C 2 (C)
BRONZO RECENTE		*End Bronzezeit* D 1 D 2
BRONZO FINALE	SPÄT BRONZEZEIT	*Hallstattzeit* Ha A 1 Ha A 2 Ha B 1 Ha B 2 Ha B 3
FERRO I		

Fig. 1.3.2 – Comparative chronological scheme for Early Bronze Age in northern Italy and Central Europe (US= Stratigraphic Units) (after de Marinis 2002).

years BC		Northern Italy		Central Europe		
		main assemblages and dendrodates			dendrodated sites	
2200 2100 2000	EBA I A	Polada (Rambotti pile dwelling) Lavagnone 2 Lucone area D, layer E Lavagnone 2 Bande di Cavriana Lavagnone 2	 2077 2048 2033-2031 2010-2008 2005, 1998 1994-1992	EBA A 1		
1900	EBA I B	Lucone area D, layer D Lavagnone 3 Bande di Cavriana Lavagnone 3 La Quercia VI Lavagnone 3	1985-1979 1984 1980, 1959 1957 1939-1912 1926, 1916	EBA A 2a		Leubingen 1942
1800	EBA I C	Lavagnone area B, us 658-810 Canàr I, structure 4 La Quercia	 1869, 1859 1852-1844			Helmsdorf 1840
1700 1600	EBA II	Fiavè 3 Lavagnone 4 Frassino La Quercia layer IV Frassino	 1709, 1695 1690 1656, 1646 1637	EBA A 2b	Concise sur Colachoz 1801 1773 Forschner 1767, 1759 1737, 1730 Meilen Schellen Zurich-Bauschanze Bodman-S. I B	

Fig. 1.5.1 – Distribution map of pile dwelling sites in Northern Italy, pink icons = Bronze Age, light blue icons = Neolithic (© 2015 Google image Landsat, data SIO, NOAA, U.S. Navy, NGA, GEBCO © 2009 GeoBasis-DE/BKG)





1 Trana (TO)
2 Viverone (BI)/Azeglio (TO) VI.1-Emissario
3 Mercurago, Arona (NO)
4 Isolino Virginia-Camilla-Isola di SanBiagio, Biandronno (VA)
5 Bodio centrale o delle Monete, Bodio Lomnago (VA)
6 Lagozza, Besnate (VA)
7 Il Sabbione o settentrionale, Cadrezzate (VA)
8 Bardello (VA)
9 Ponti o Cazzago - Palude Brabbia (VA)
10 Lagozzetta VA)
11 Bosisio Parini (LC)
12 Lavagnone, Desenzano del Garda (BS)
13 San Sivino Gabbiano, Manerba del Garda (BS)
14 La Fabbrica , Padenghe sul Garda (BS)
15 La Maraschina-Tafella , Sirmione (BS)/Peschiera del Garda (VR)
16 Lucone, Polpenazze del Garda (BS)
17 Torbiera Spade, Lonato del Garda, BS)
18 Palude Lunga, Brodena (Lonato del Garda, BS)
19 Cattaragna, Lonato del Garda (BS)
20 Case Vecchie, Lonato del Garda (BS)
21 Chizzoline Torbiera, Soiano del Lago (BS)
22 Villa Garuti, Padenghe sul Garda (BS)
23 Fenil Vecchio, Castel Venzago (Lonato del Garda, BS)
24 Isola di Garda (ex Lechi), San Felice del Benaco (BS)
25 Casone o Scovolo, Fornella (?), San Felice del Benaco (BS)
26 Torbiera Iseo (BS)
27 Corno di Sotto, Desenzano del Garda, BS)
28 Polada, Lonato del Garda (BS)
29 Porto, Moniga del Garda, BS)
30 La Ca', Padenghe sul Garda, BS)
31 Porto Galeazzi, Sirmione (BS)
32 San Francesco, Sirmione (BS)
33 Arriga, Rivoltella (Desenzano del Garda, BS)
34 Lagazzi del Vho, Piadena (CR)
35 Generali Pezzalunga, Castellaro Lagusello (Mozambano, MN)
36 Isolone del Mincio, Volta Mantovana (MN)
37 Bande - Corte Carpani , Cavriana (MN)
38 Castellaro Lagusello - Fondo Tacoli, Monzambano (MN)
39 Bor di Pacengo, Lazise (VR)
40 La Quercia, Lazise (VR)
41 Dossetto, Nogara (VR)
42 Belvedere, Peschiera del Garda (VR)
43 Frassino, Peschiera del Garda (VR)
44 Tombola, Cerea (VR)
45 Barche, Solferino (VR)
46 Cisano (VR)
47 Feniletto, Oppiano Veronese (VR)
48 Molina di Ledro (TN)
49 Fiavè-Lago Carera, Fiavè (TN)
50 Fimon-Molino Casarotto (VC)
51 Fimon-Fondo Tomellero (VC)
52 Fimon-Le Fratte (VC)
53 Laghetto della Costa , Arquà Petrarca (PD)
54 Palu di Livenza – Santissima, Caneva/Polcenigo (PN)

Fig. 1.5.2 – Distribution map of the Bronze Age sites with archaeobotanical data (fruits and seeds) in northern Italy (© 2015 Google Image Landsat, data SIO, NOAA, U.S. Navy, NGA, GEBCO © 2009 GeoBasis-DE/BKG). Number refer to sites listed in the Tab.1.5.1.

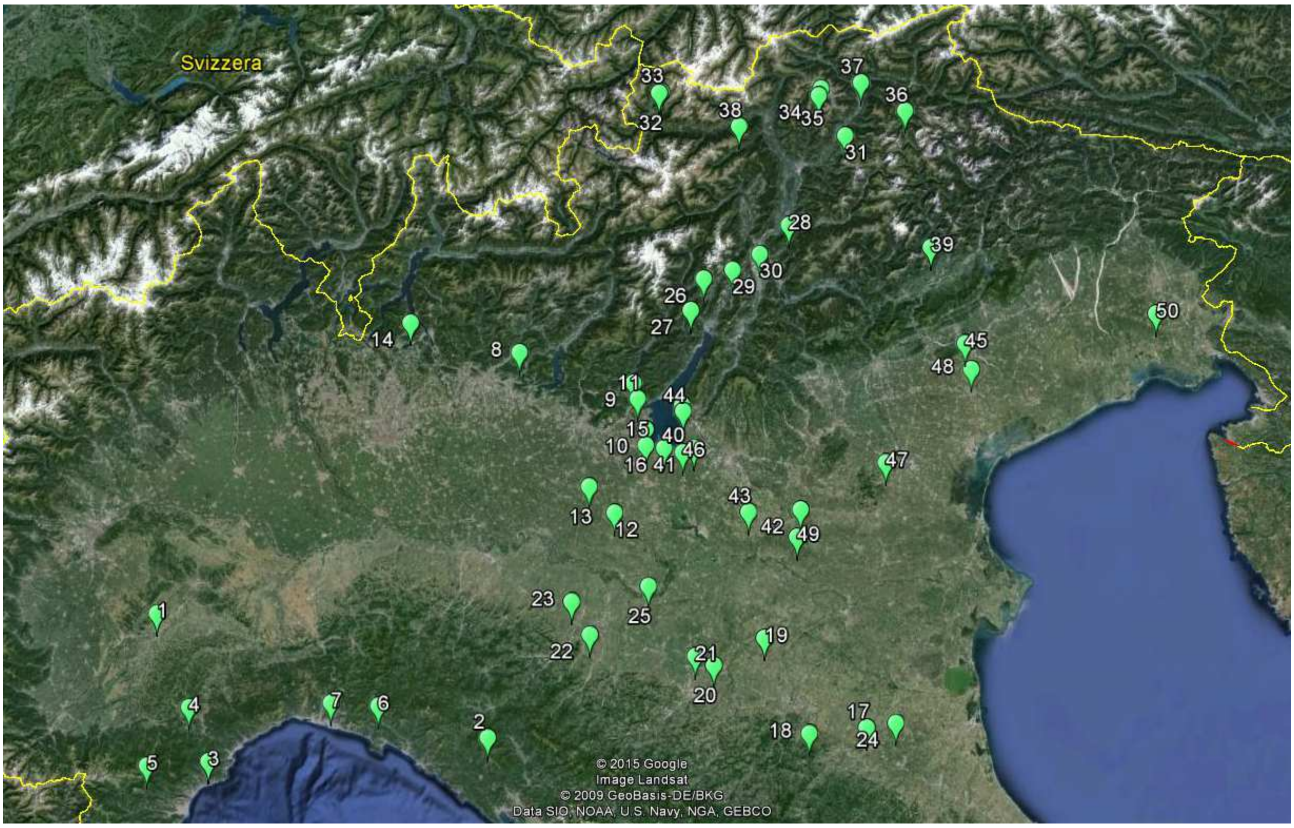


Fig. 1.6.1.1 – Topographic map of the basin of Lucone. The archaeological sites Lucone A-D are marked in blue colour.

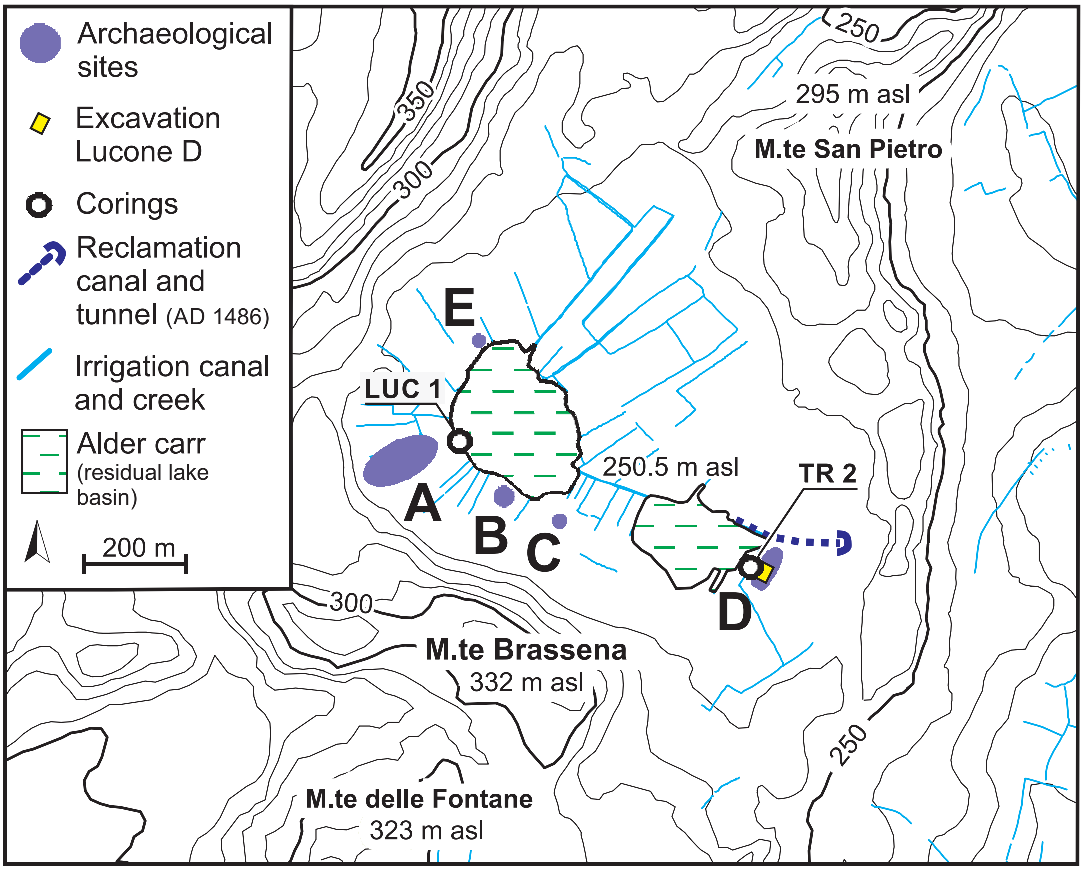


Fig. 1.6.1.2 – Above, a view of the Lucone basin from the western side (© photo C. Ravazzi). In the center, a detailed view of the Lucone A area. Below, a view from the eastern side.

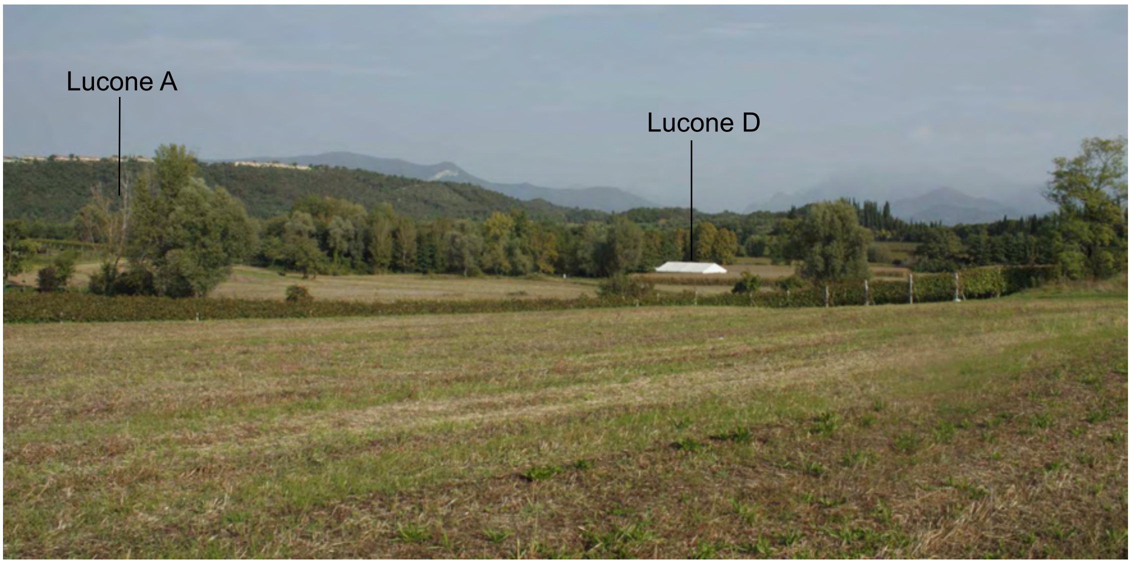


Fig. 1.6.1.3 – The archaeological area of Lucone D. Above, the area during the 2012 excavation when the burnt layer separating the two settlement phases was visible. Below, details of '*cumulus*'88 (on the left) and '*cumulus*' 84 (on the right, © photo S. Jacomet), both belong to layers of the 2nd settlement phase (photos reproduced with permission by M. Baioni, Museo Archeologico della Val Sabbia).

Fig. 1.6.1.4 – Plan showing cores and trenches position carried out in the area of Lucone D site.

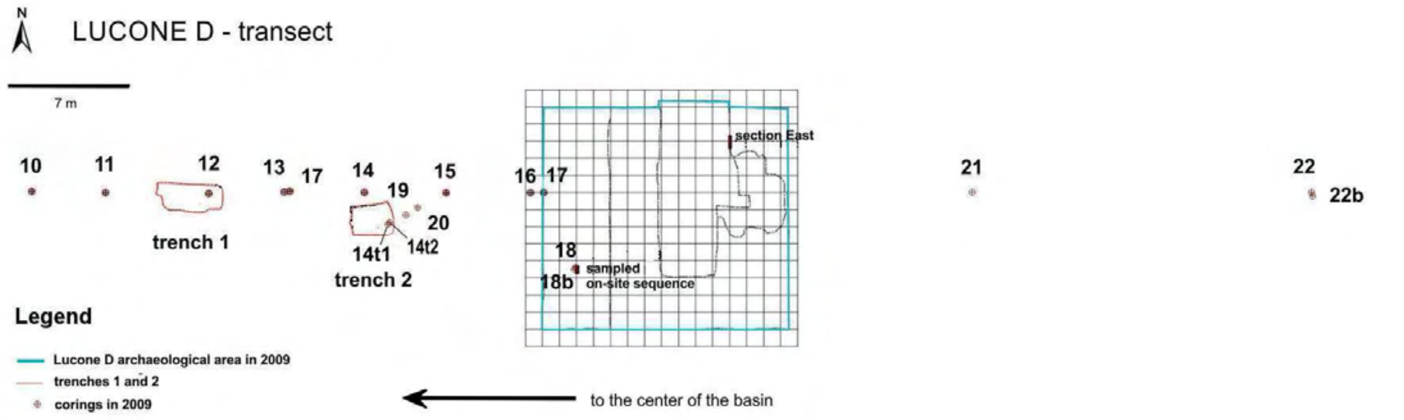


Fig. 1.6.1.5 – The middle to late Holocene sequence infilling the Lucone basin has been exposed in two trenches and several cores close to the archaeological area of Lucone D. The sequence is shown in four panels (from left to right): left picture, uppermost sequence Bronze Age to Middle Ages – note normal faults of modern age due to agricultural practices; central picture Bronze Age to Iron Age; right core segments LUCDT14 Neolithic to Copper age and LUCDT13b Late Glacial to Middle Holocene. Acronyms marked the main stratigraphic units, see text for explanation (© photos F. Badino)

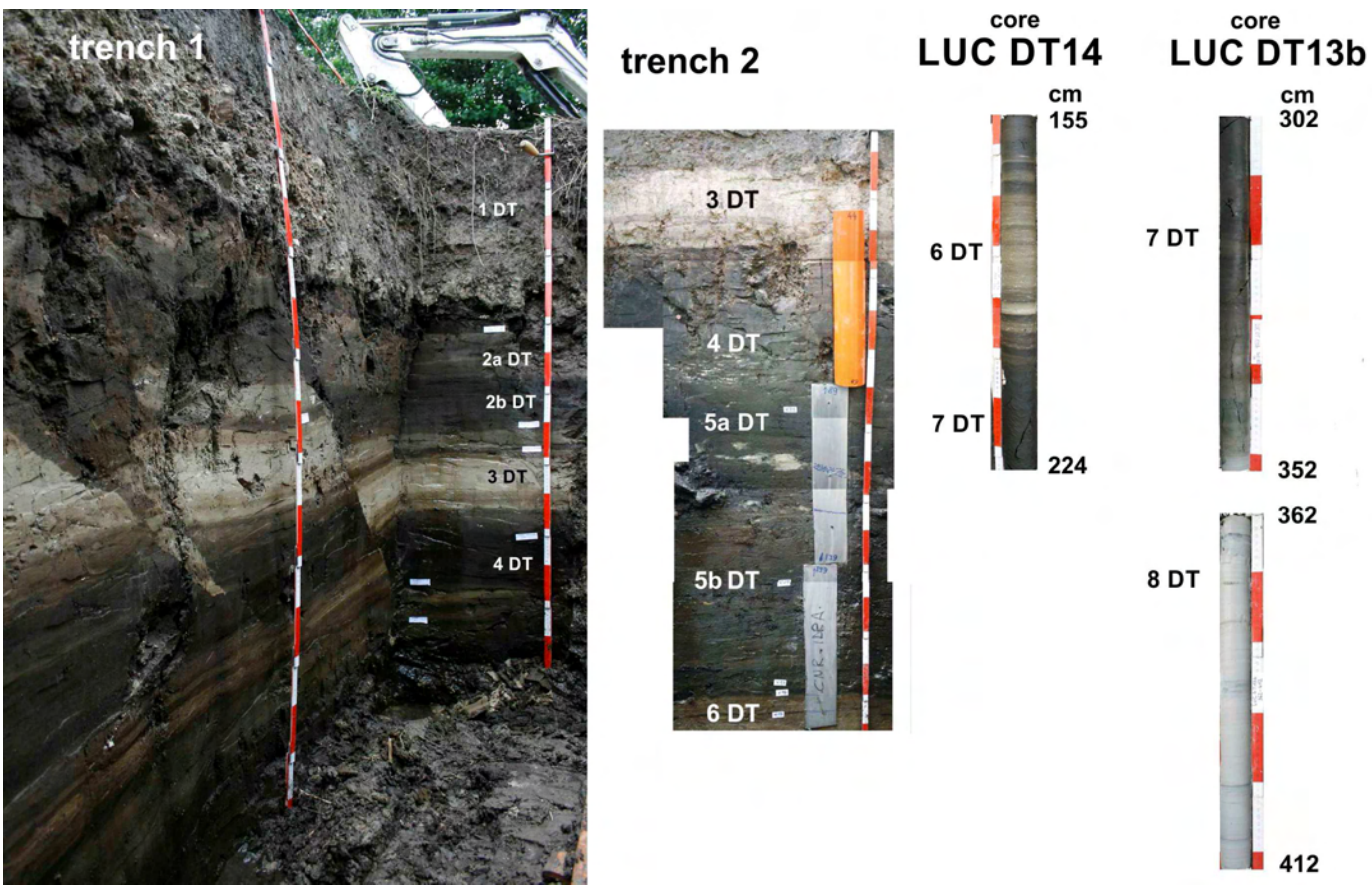


Fig. 1.6.1.6 – The age-depth model of the Lucone sequence (elaborated by G. Furlanetto © CNR IDPA Milano).

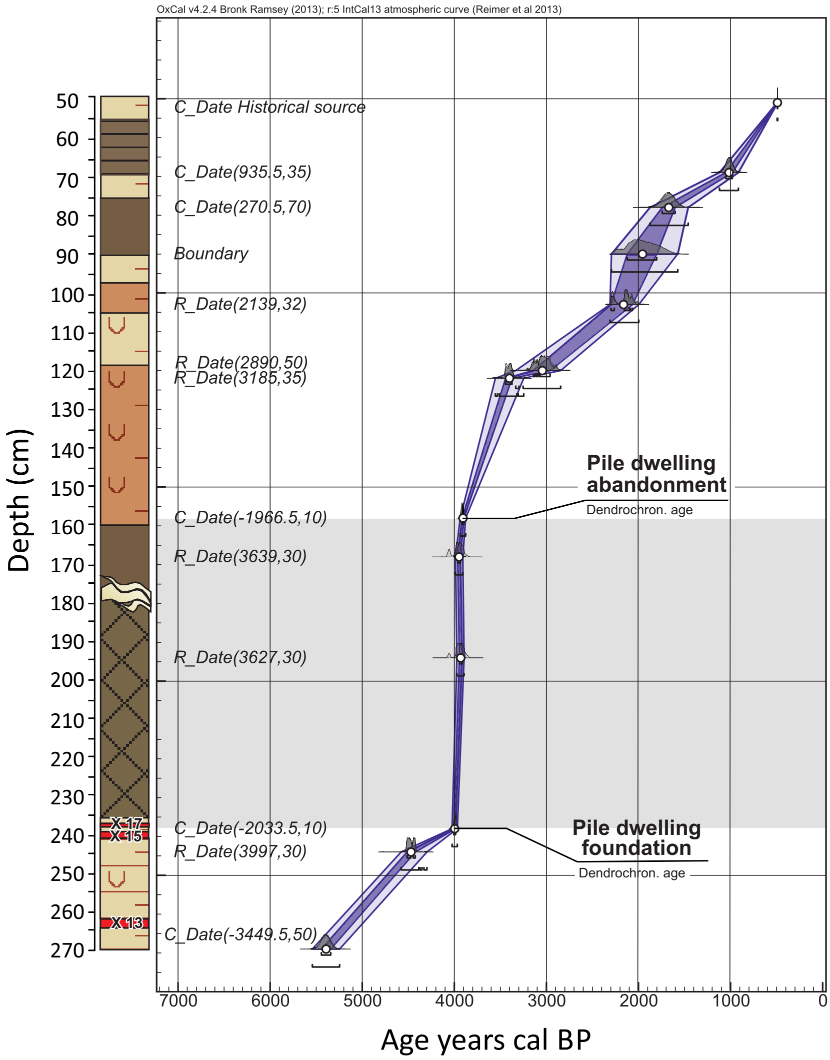
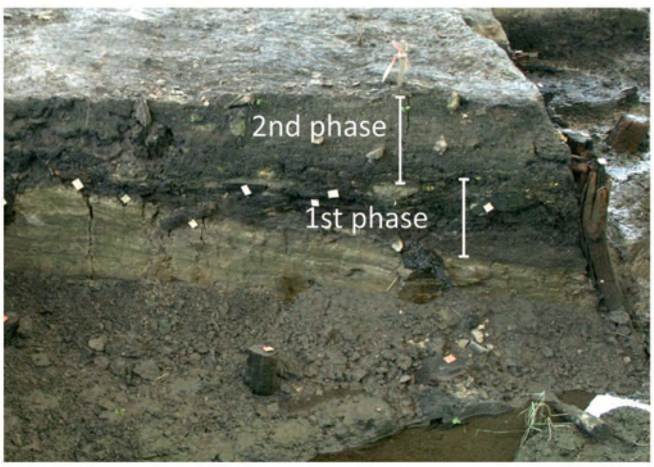


Fig. 1.6.1.7 – The archaeological sequence of the site of Lucone D. On the left, section of the archaeological deposit as exposed on the eastern side of the area (photo C. Ravazzi). On the right, a detailed sight of the stratigraphic sequence with recognized Stratigraphic Units (© photo Museo Archaeologico della Val Sabbia).



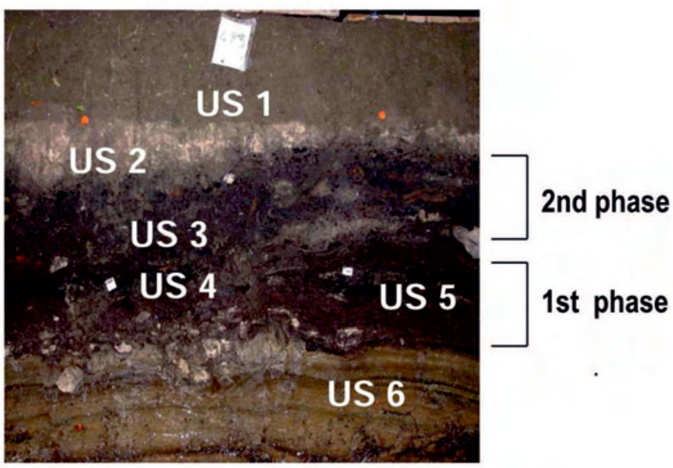


Fig 1.6.1.8 – Pollen diagram of Lucone, selected curves (pollen analysis and diagram by Badino F. and Furlanetto G., © CNR IDPA Milano, reproduced with permission).

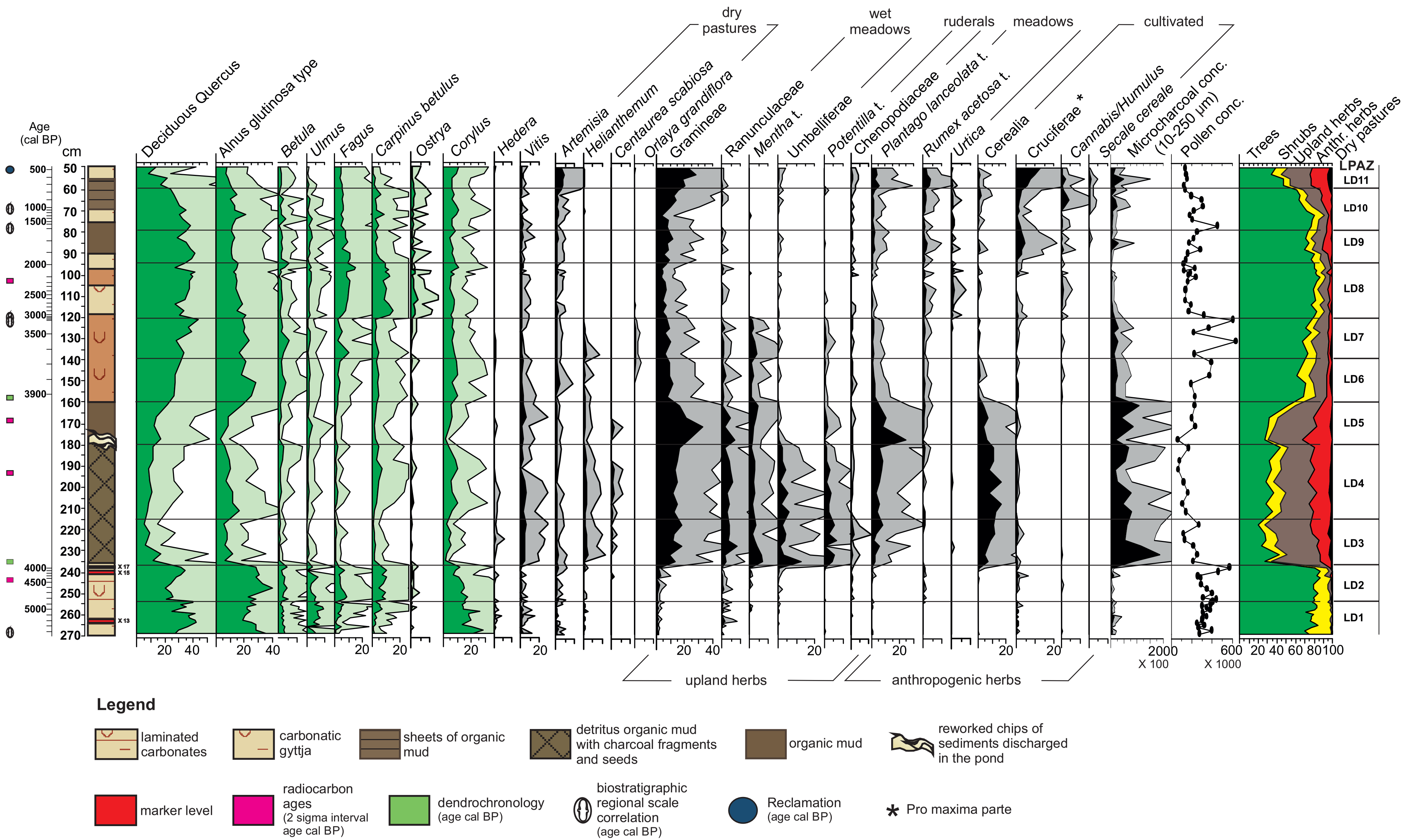


Fig. 1.6.2.1 – View of the Lavagnone basin from the north-eastern side and the location of the archaeological Sectors A-E.

Fig. 1.6.2.2 – Topographic map of the Lavagnone basin showing the location of the different excavation trenches (Sectors A-E) and core drillings sites (LAV1 and LAV37) (topography by University of Milano, Dept. Cultural Heritage and Environment, modified).

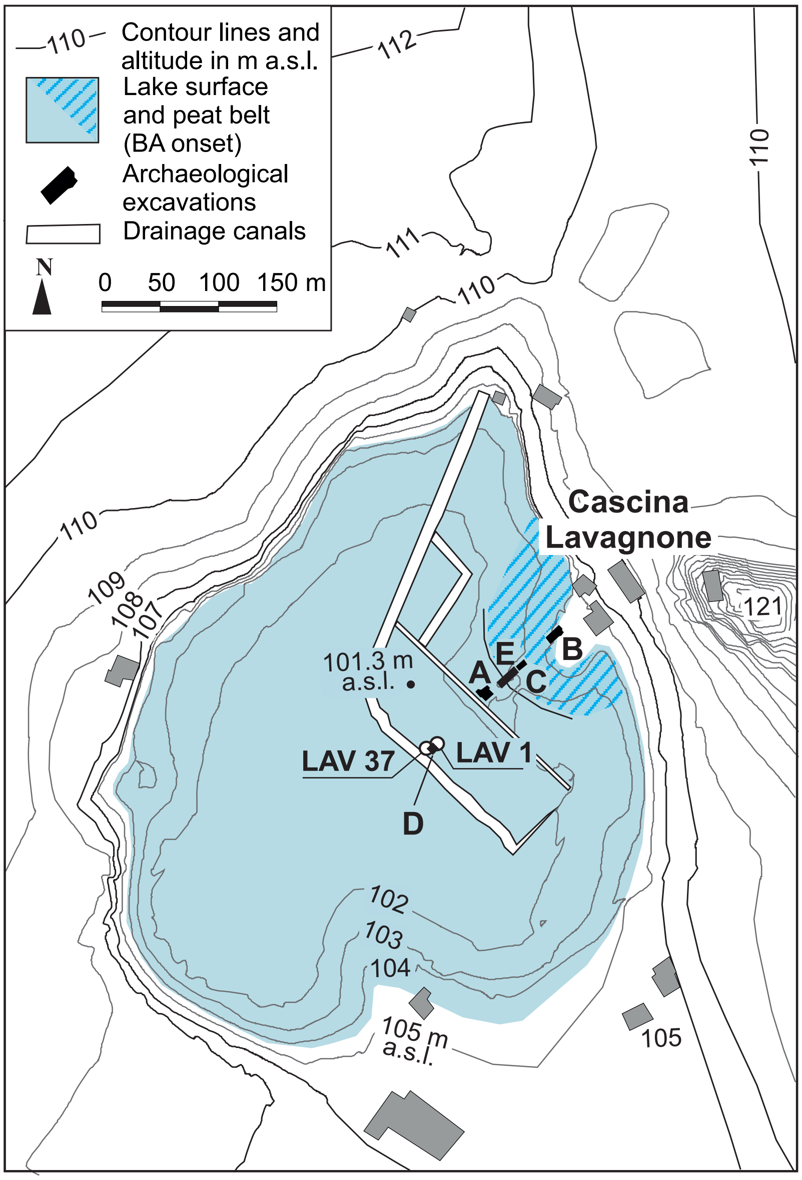


Fig. 1.6.2.3 – The plough found in the site of Lavagnone, dated to EBA I (1900-1800 ca BC). Museo G. Rambotti di Desenzano del Garda, Brescia (© photo Museo Rambotti, reproduced with permission by C. Mangani).

Fig. 1.6.2.4 – Transect through the basin of Lavagnone with the main stratigraphic units recognized by several corings.

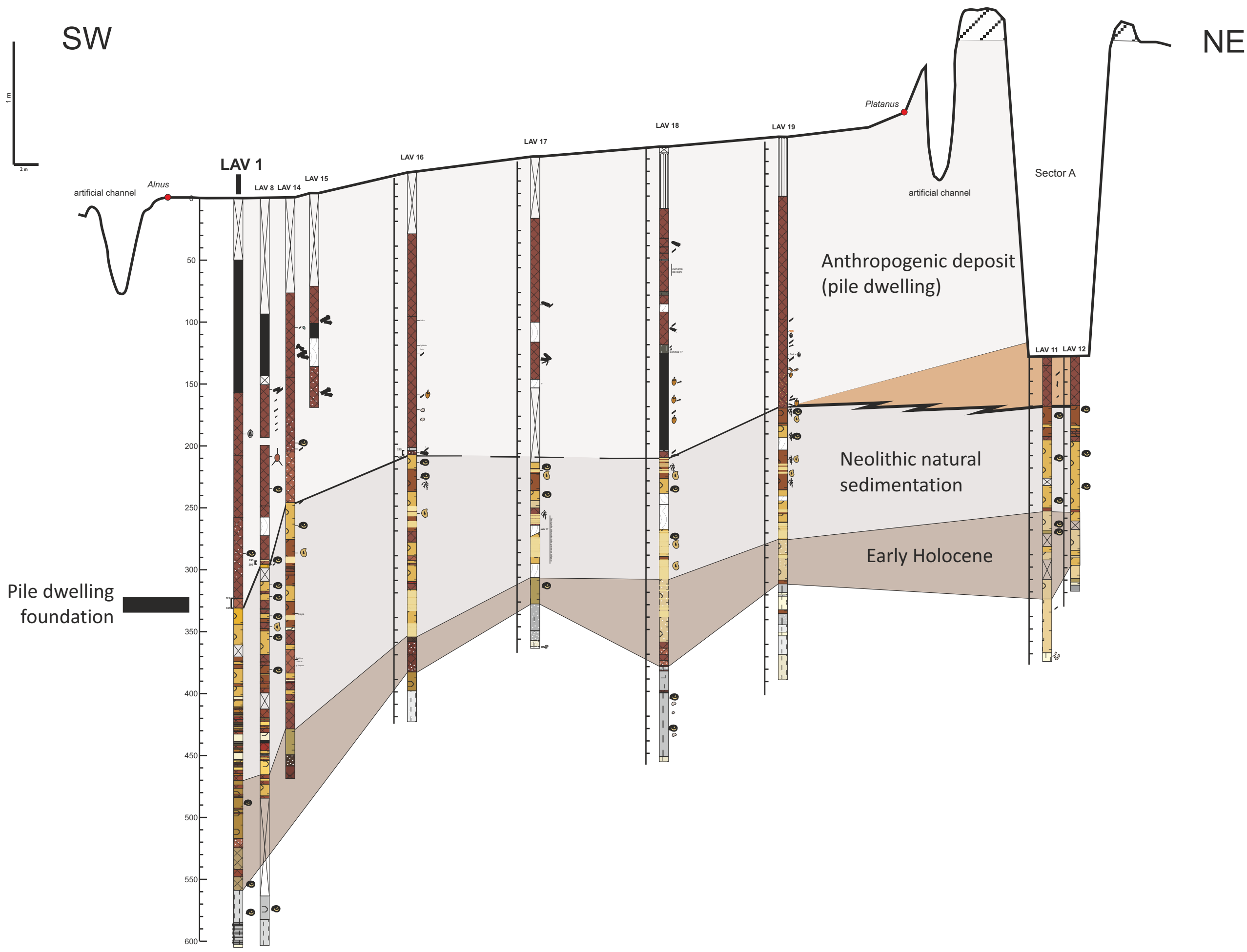


Fig. 1.6.2.5– The lithostratigraphic sequence of the mastercore LAV1 (corings in Sector D), in the SW of the basin (©photos CNR IDPA Milano) (see text for the description and Fig. 1.6.2.2 for location).

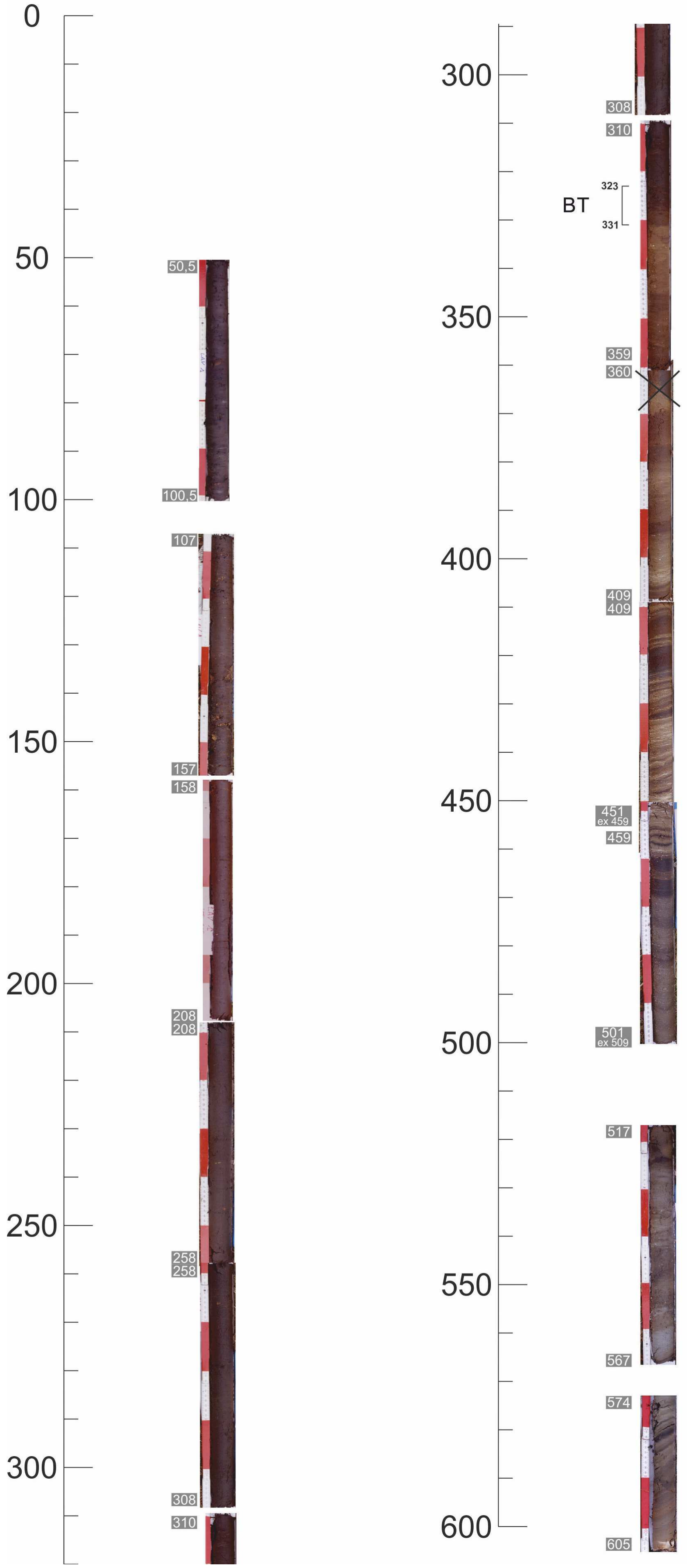


Fig. 1.6.2.6 – The age-depth model of the Lavagnone sequence (elaborated by C. Ravazzi CNR IDPA Milano).

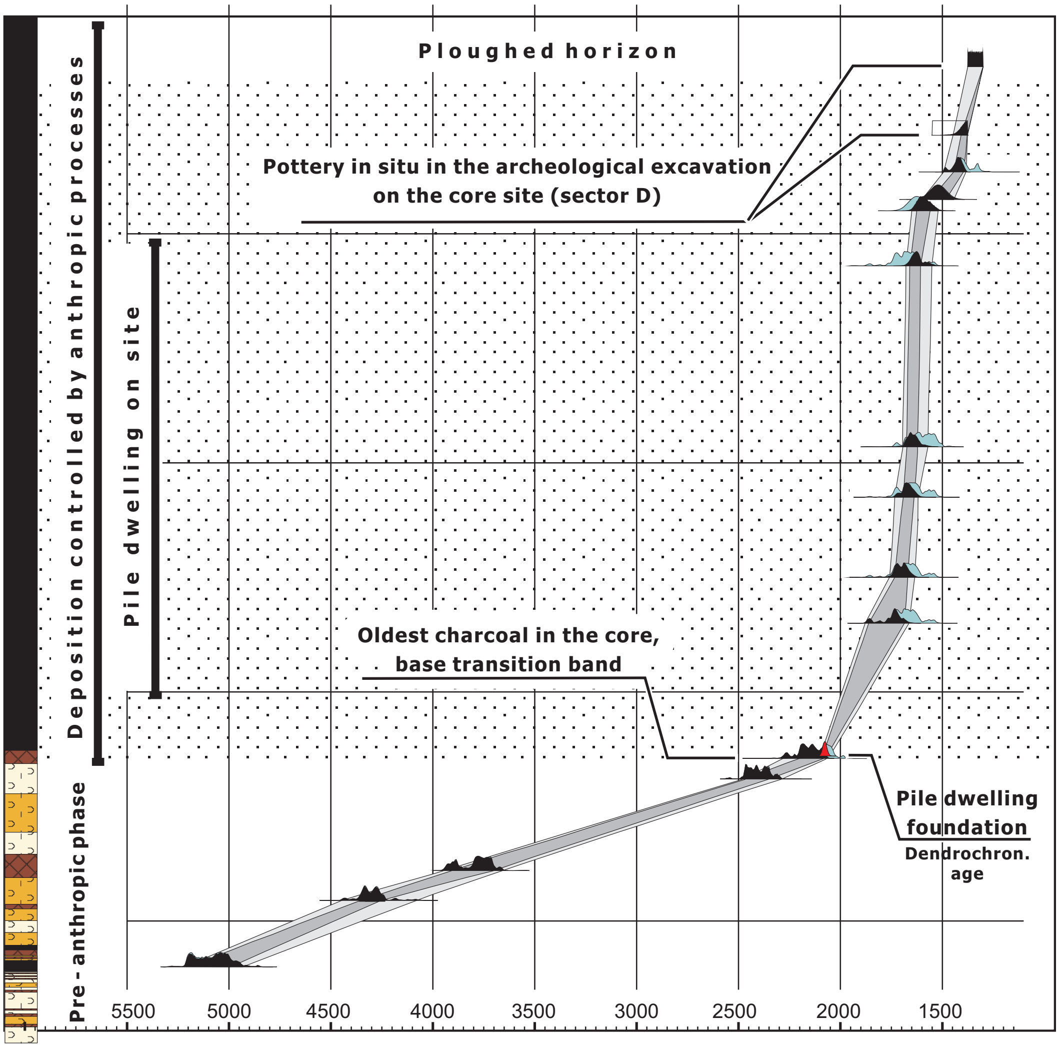
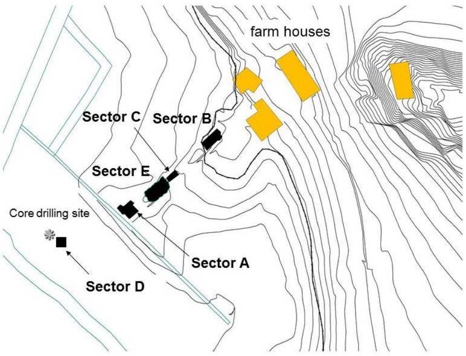


Fig. 1.6.2.7– Archaeological Sectors from A to E of Lavagnone site. The detailed map in the center shows the position of each sector (photos reproduced with permission).



Sector D (year 2013)

Sector A (year 2002)

Fig. 1.6.2.8 – Comparative scheme of the archaeological sequences identified in sectors A, B, C, and D of Lavagnone (after de Marinis *et al.* 2005).

	absolute chronology (±10 BC)	*cultural horizon*	Sector A	Sector B	Sector C	Sector D
LBA			abandonment	dwelling	abandonment	abandonment
MBA II B		*Lavagnone 7*	abandonment	dwelling (ground house)	abandonment	dwelling (structures to define)
MBA II A			abandonment	dwelling (ground house)	abandonment	dwelling (structures to define)
MBA I		*Lavagnone 5-6*	dwelling (houses on dry land)	bonifica layers	dwelling (structures to define)	*not yet excavated*
EBA II		*Lavagnone 4 late Polada*	dwelling (houses on bonifica layers)	dwelling (structures to define)	dwelling (structures to define)	*not yet excavated*
EBA I C		*Canar and Dossetto horizon*	temporary abandonment	dwelling (structures to define)	*not yet excavated*	*not yet excavated*
EBA I B	1916 1984	*Lavagnone 3*	pile dwellings	timber trackway	fence	*not yet excavated*
EBA I A	1994-1991 2010-2008 2077-2048	*Lavagnone 2*	pile dwellings	timber trackway	fence	pile dwellings

Fig. 1.6.2.9 – Pollen diagram of Lavagnone core LAV1 (corings in Sector D), selected curves and ecological groups (pollen analysis and diagram by Arpenti E., Deaddis M., Banino R., © CNR IDPA Milano , reproduced with permission).

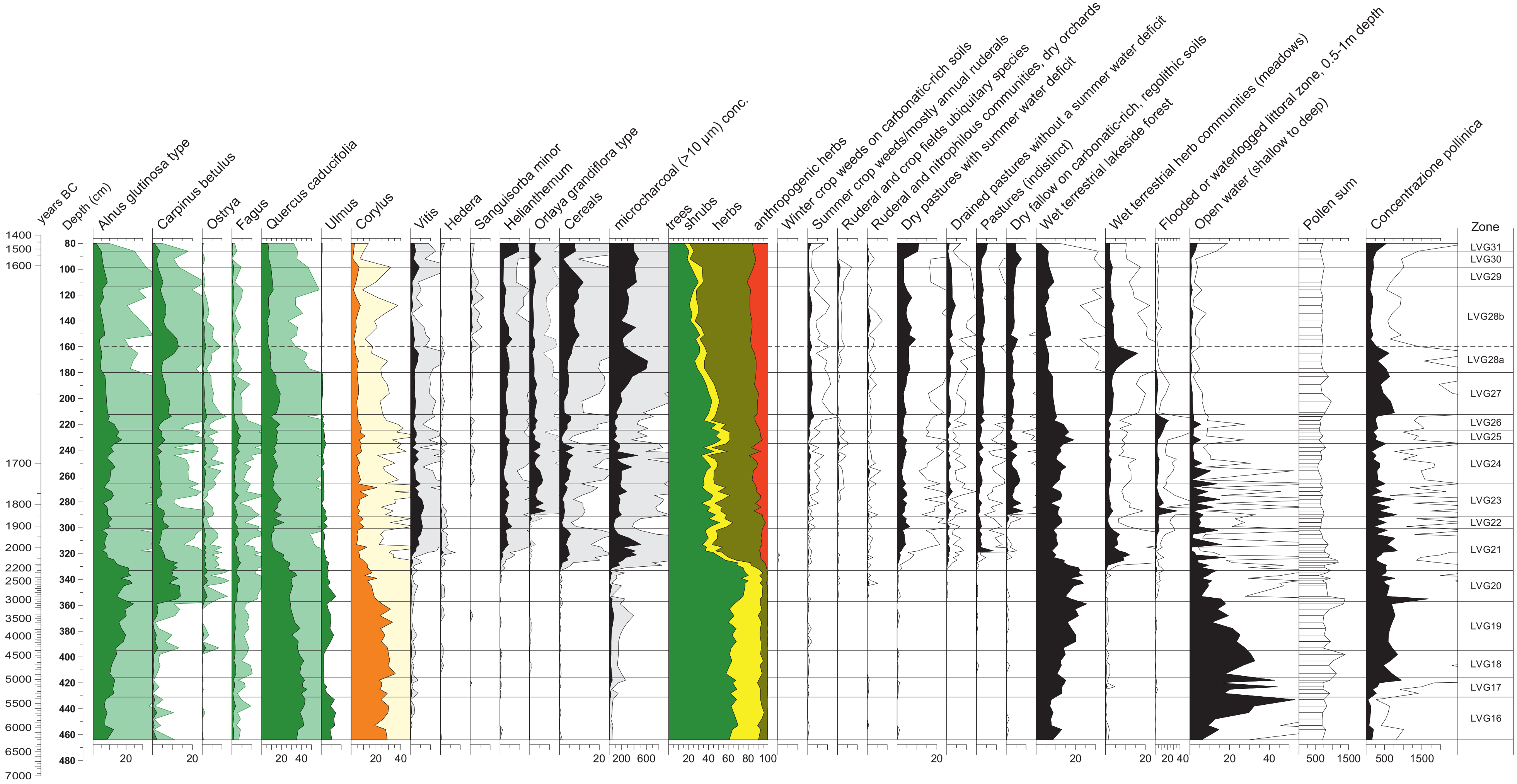


Fig. 2.1 – Distribution of analysed samples in sector A, Lavagnone. Circle's labels refer to samples name. White-bordered circles indicate fully quantified samples. The samples refer to different archaeological stratigraphic units (SU), see the legend in the figure. The grey area delimits the deepest dug surface of the sector and approximately corresponds with the area occupied by a stratified dump of discharged material ('cumulus') described for this sector by the excavators. This also includes the SU338 (corresponding to EBA IA; phase Lavagnone 2). The dotted area refers to stratigraphic units of EBA IB (Lavagnone 3). For more details, see the text.

Fig. 2.2 – Distribution of the analysed samples in sector D of Lavagnone site, excavation 2011. Triangle's labels refer to samples name. The extensions of the stratigraphic units are drawn with different patterns. Most of the samples are from MBA stratigraphic units (SU) 4006, 4009, 4010. Grey triangles indicate samples collected from the overlaying stratigraphic unit (SU4004), also belonging to the MBA. LAV-D-04 is the preliminary sondage excavated in 2004 (and not sampled).

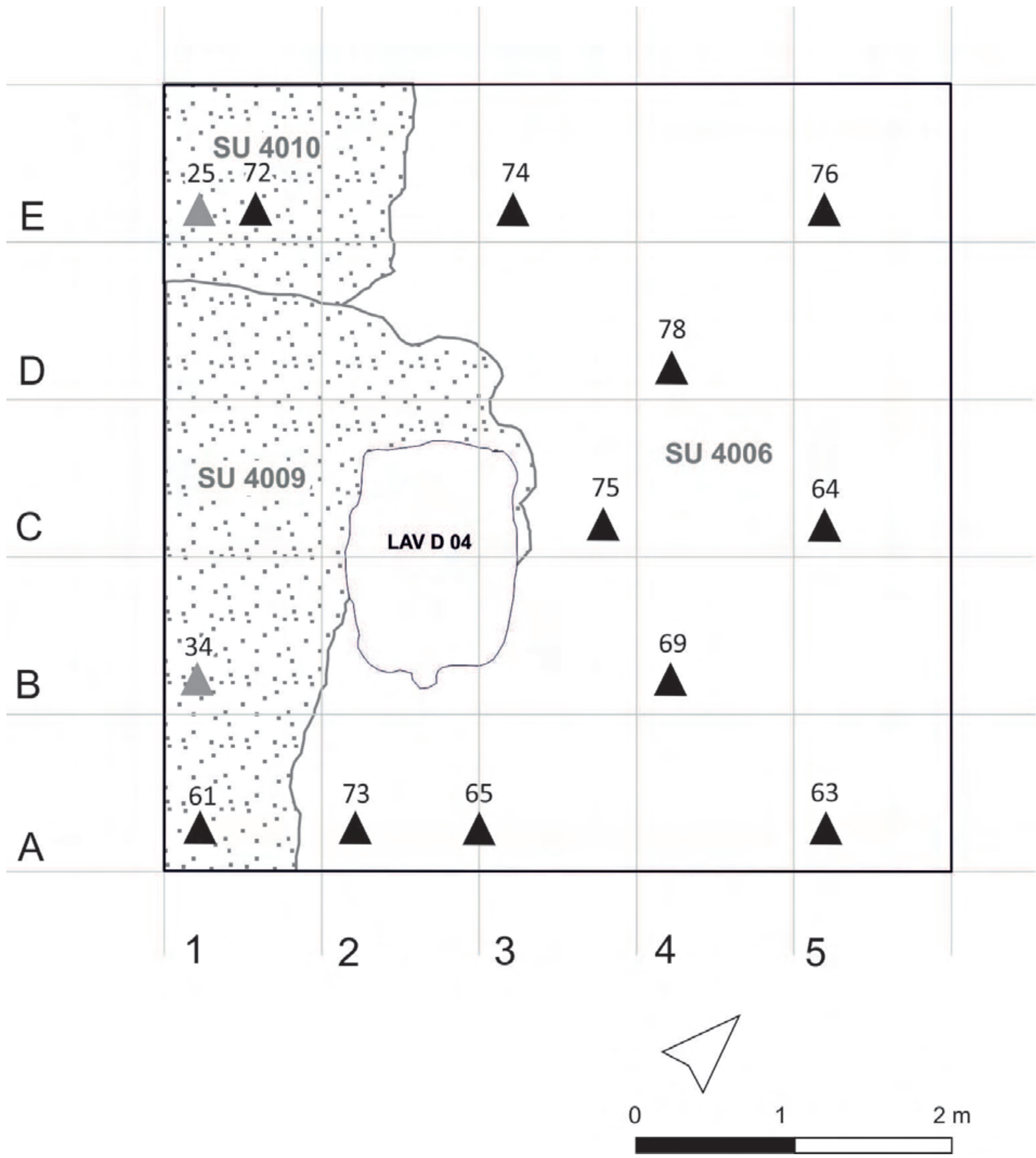


Fig. 2.3 – Distribution of analysed samples of 1st and 2nd EBA-settlement phases at Lucone D. Rectangle's labels refer to samples name. Bordered rectangles indicate fully quantified samples. The dark grey area delimits the originally dug surface (sondage 1986). The light grey area is the first excavated area (2007), enlarged in 2009 to the actual surface (white area). The three circles delimit approximately the waste disposal areas ('cumulus') defined in the second settlement phase.

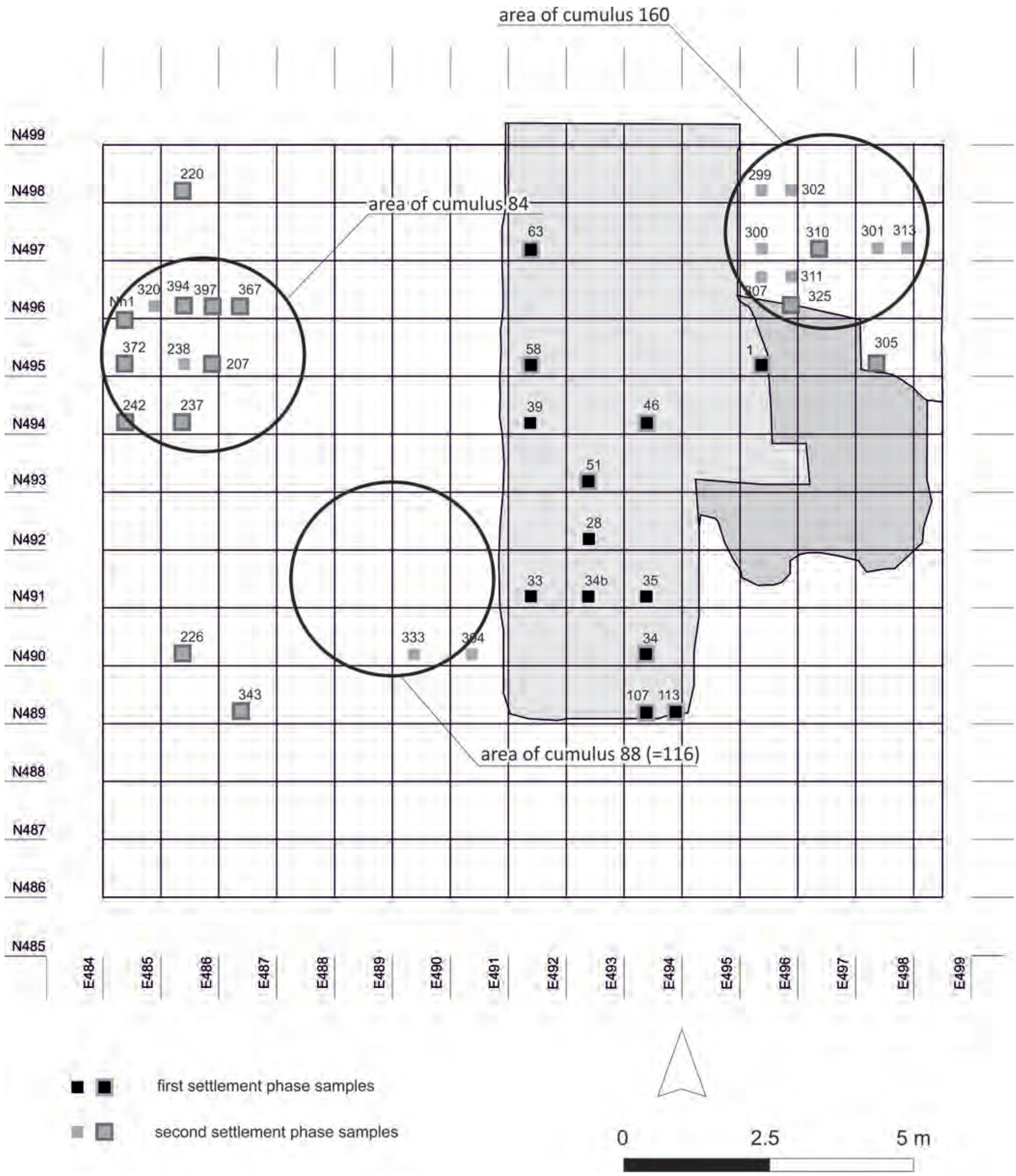


Fig. 2.4 – The wet-sieving facility on the Lucone D site. It was developed at IPAS, Basel University, and allows applying different sieving methods including wash-over.

Fig. 2.5 – Part of the Lavagnone basin transect crossing the archaeological Sectors C, E, A and D, and the southern section of Sector A (section 98) (photo taken in 2002 by © University of Milano, Dept. Cultural Heritage and Environment, reproduced with permission). The southern section of Sector A shows the position of studied samples (red rectangles for macroremains analysis, blue dots for pollen analysis) and of the archaeological Stratigraphic Units (white broken lines).

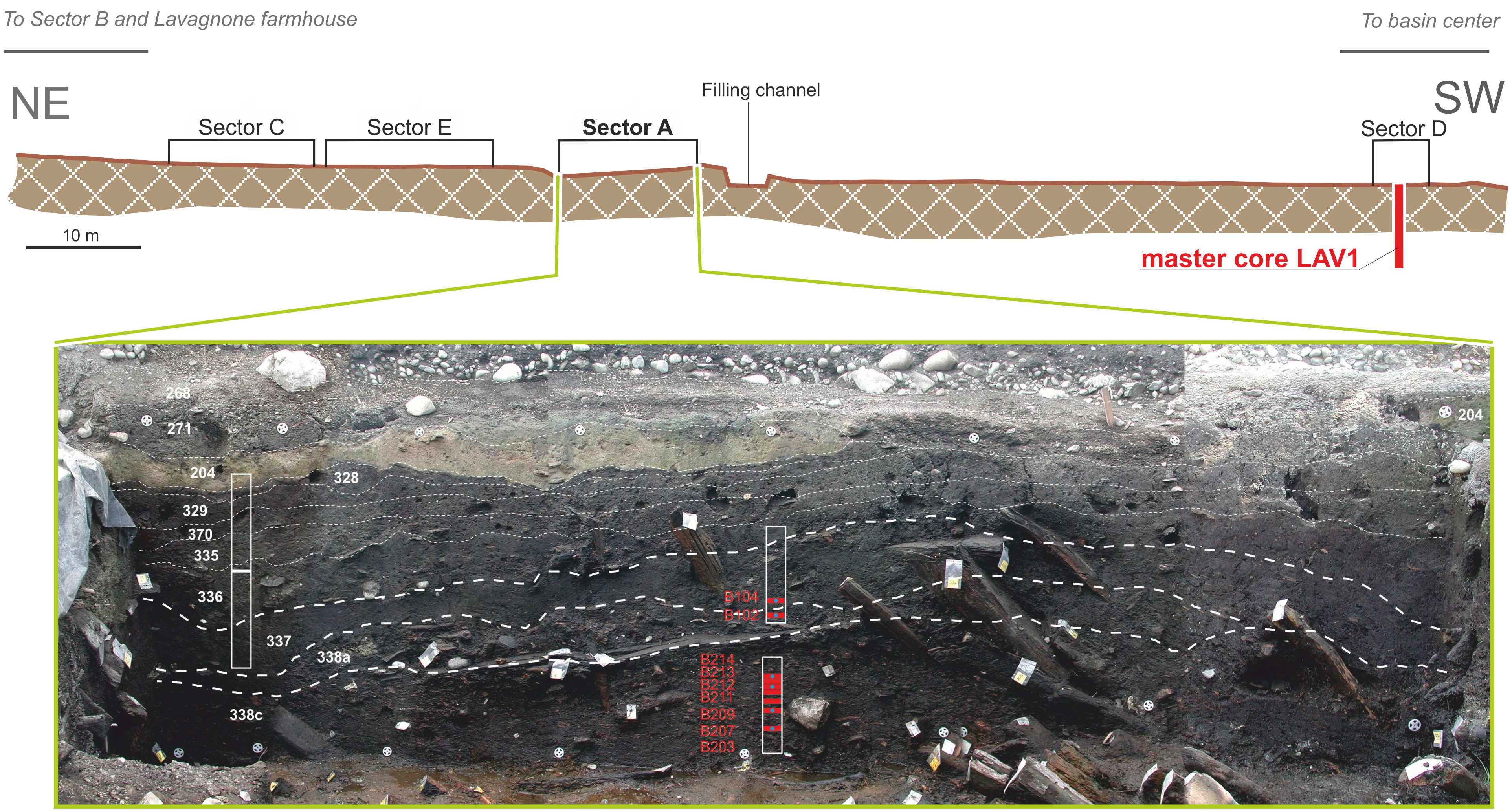


Fig. 2.6 – Column profile Box1 from section 98 (Sector A, Lavagnone).

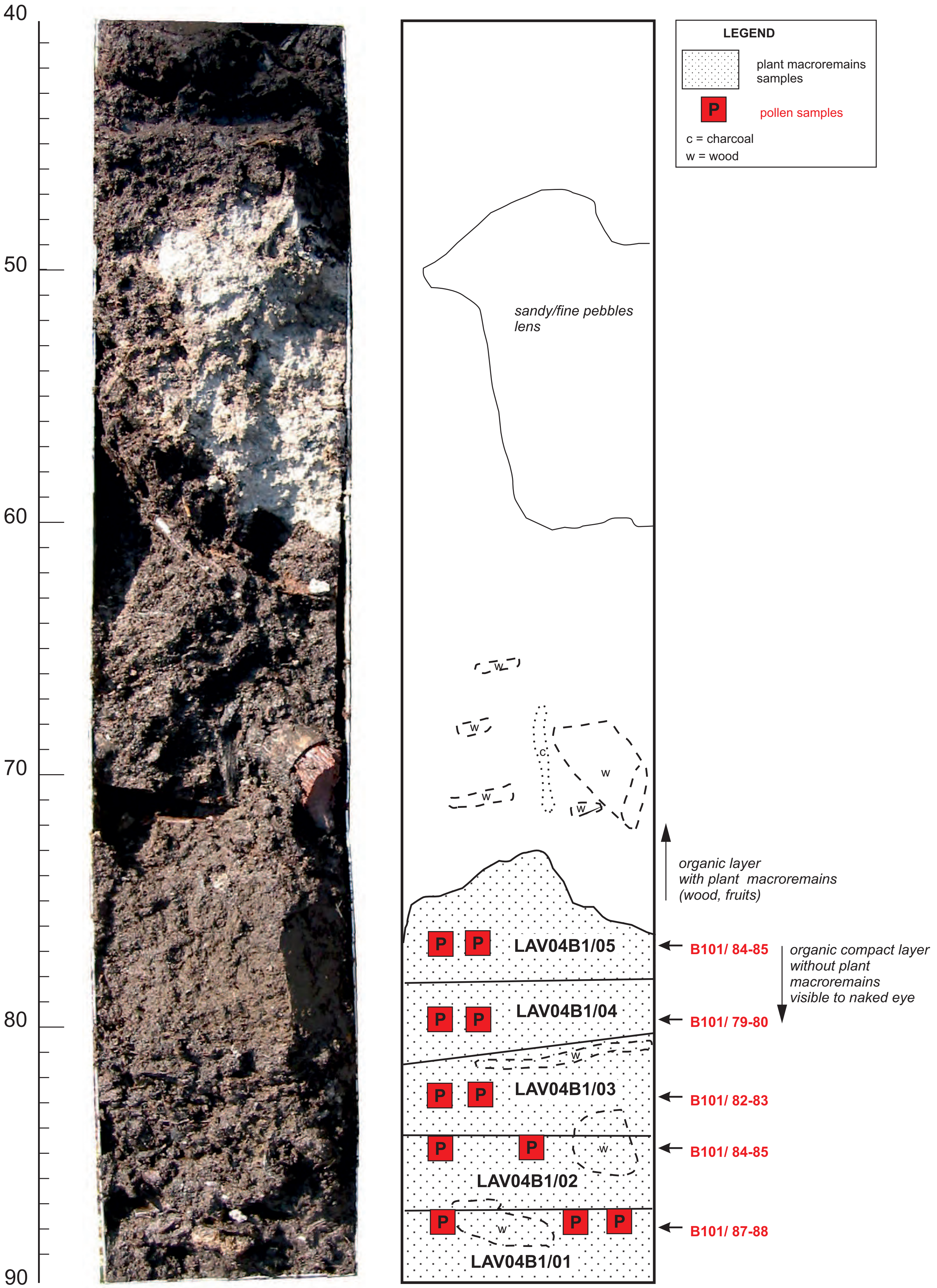


Fig. 2.7 – Column profile Box2 from section 98 (Sector A, Lavagnone).

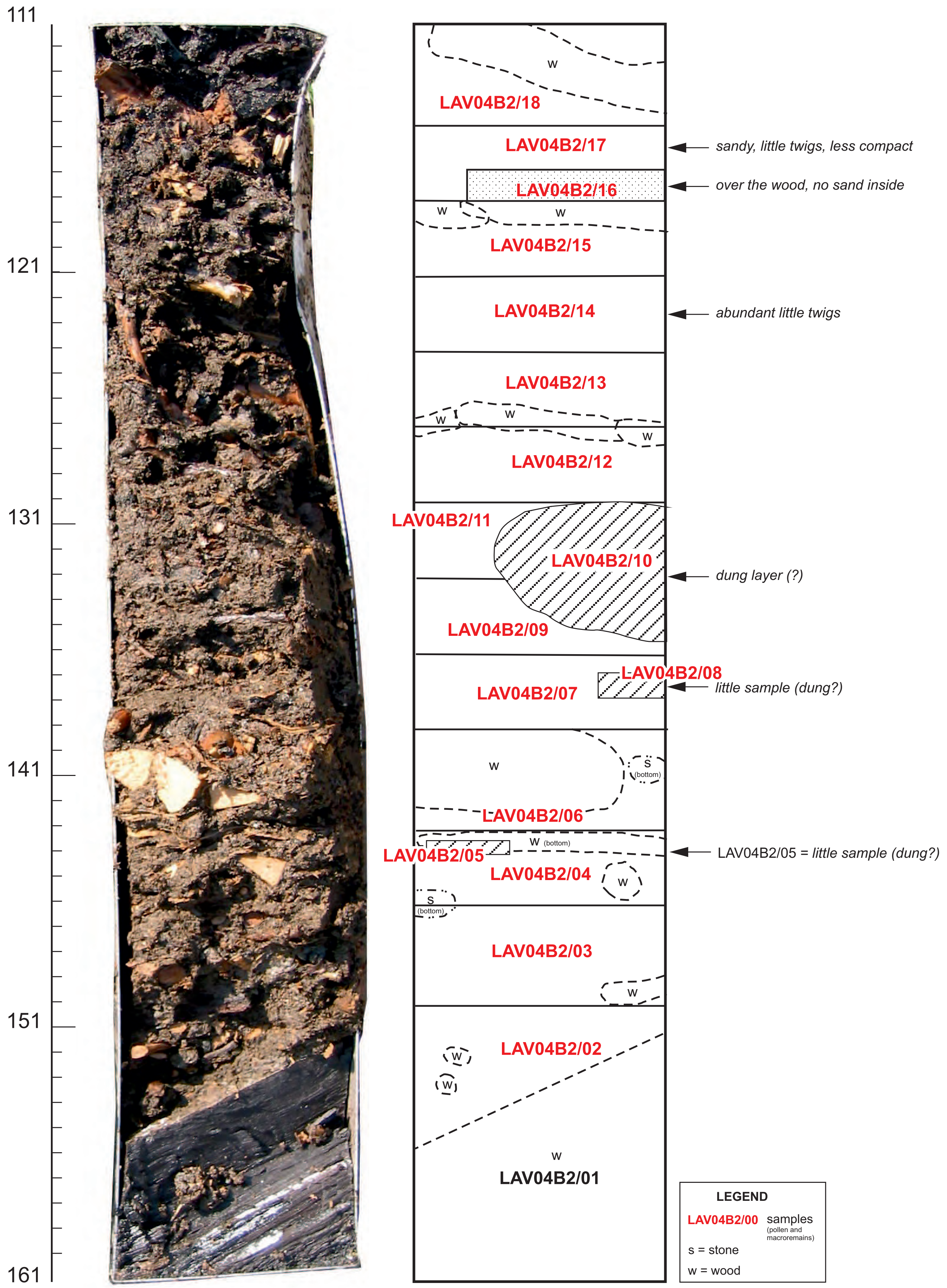


Fig. 2.8 – Lithostratigraphy of LAV37 core from Sector D (Lavagnone).

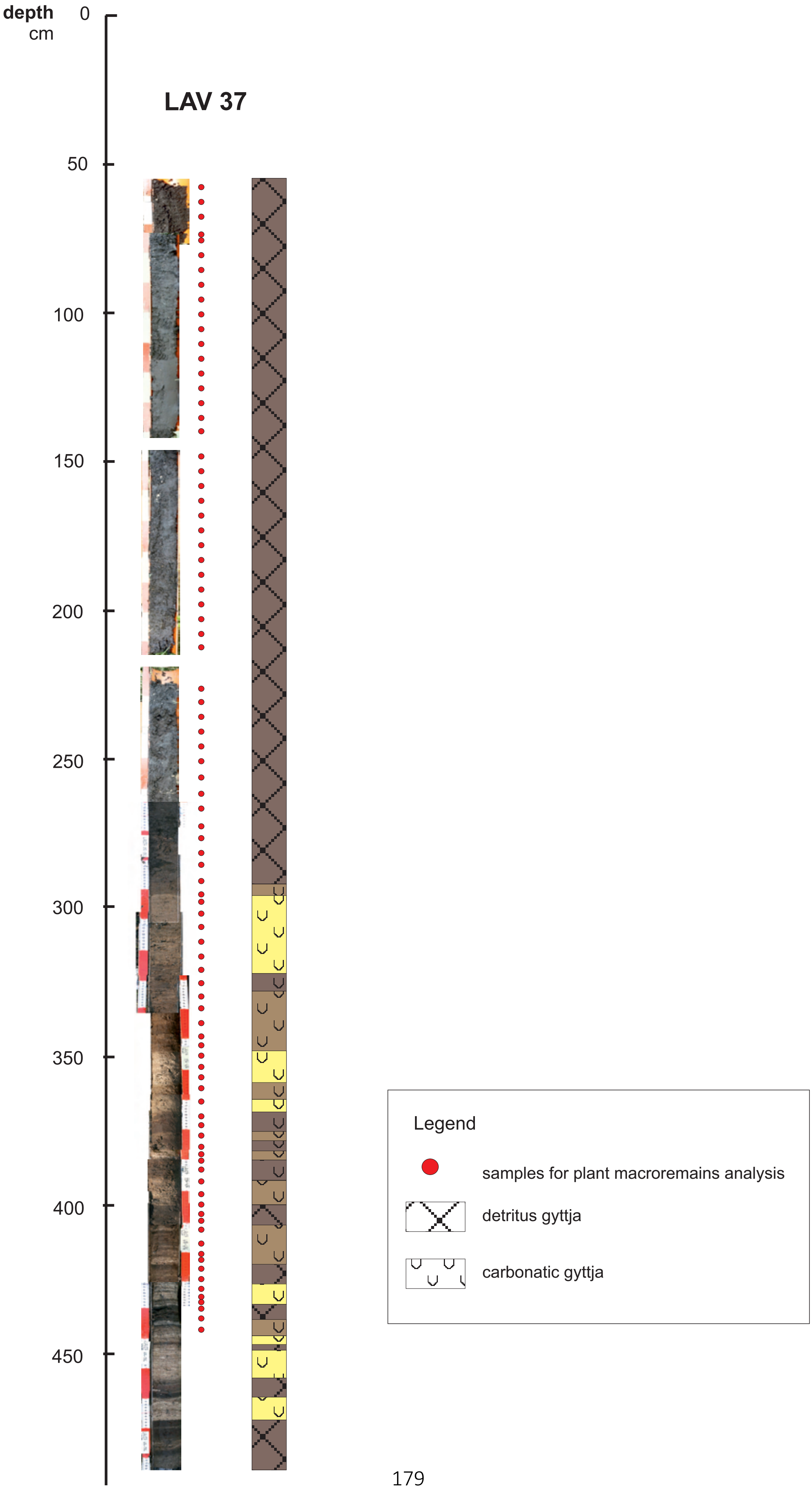
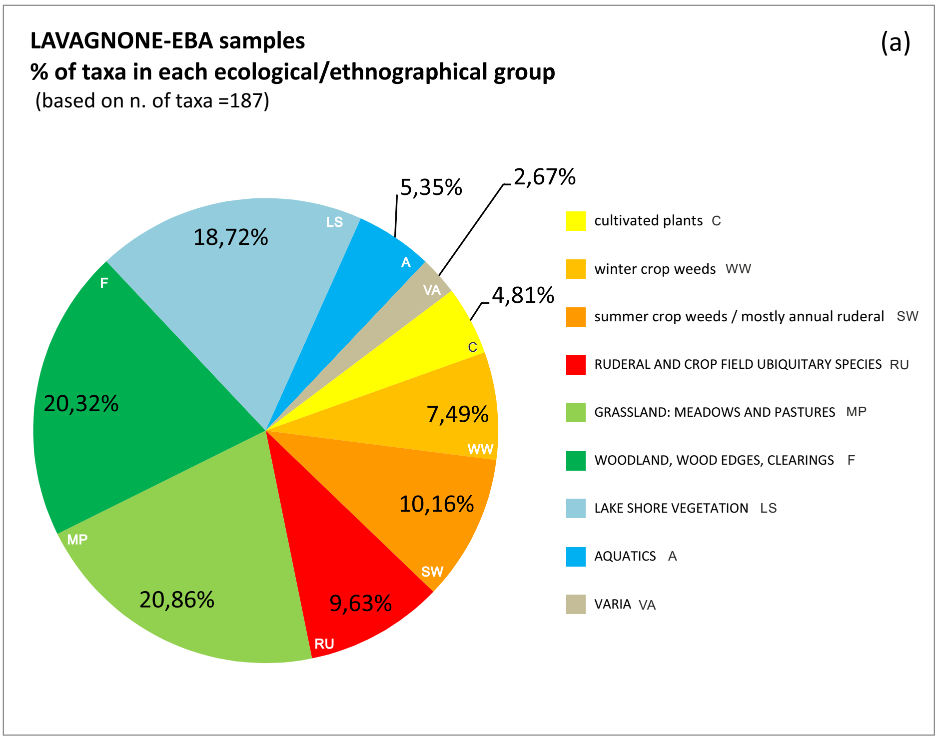


Fig. 3.1 – Proportions of taxa in each ecological/ethnographical group in a) EBA samples and b) MBA samples.



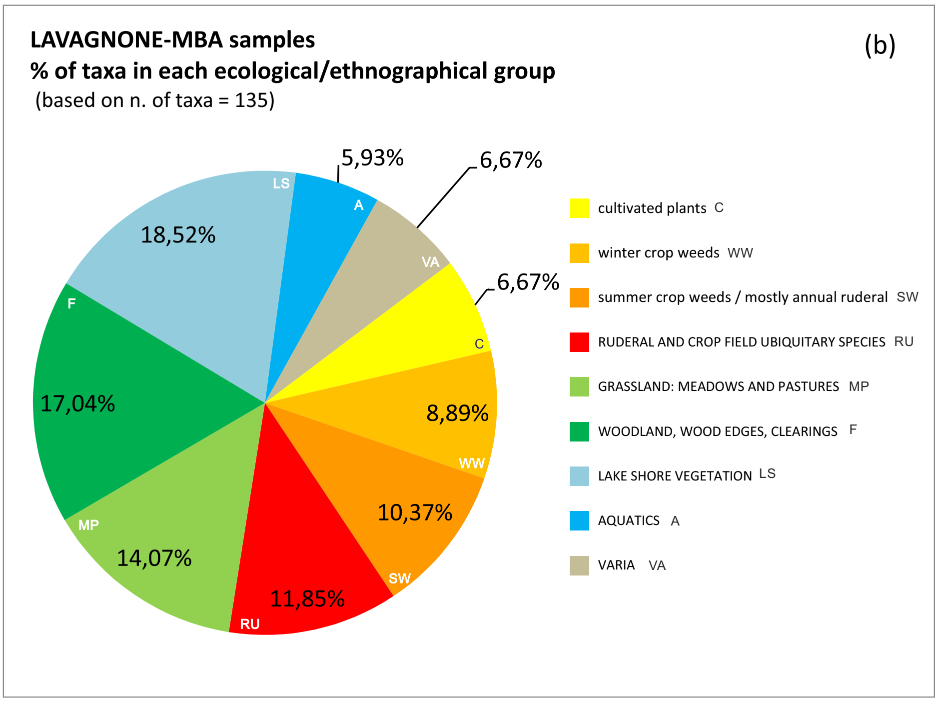
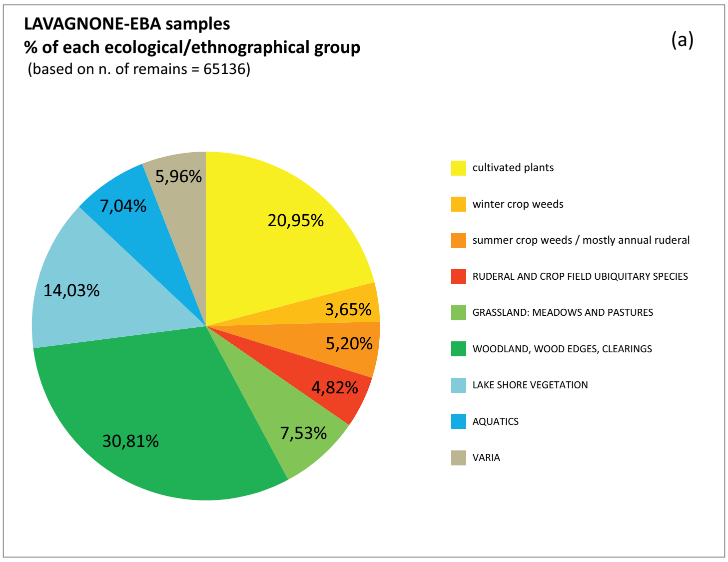
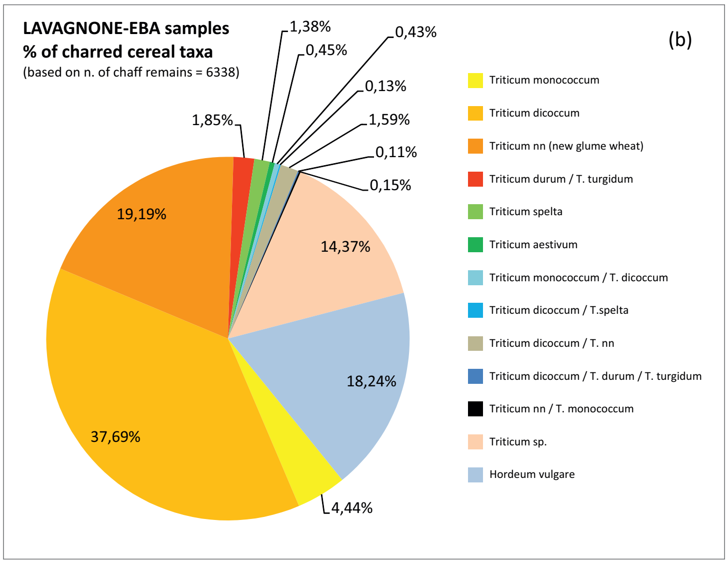


Fig. 3.2 – Lavagnone EBA samples: a) proportions of number of remains in each ecological/ethnographical group; b) proportions of charred chaff remains of cereal taxa (including intermediate morphotypes); c) proportions of charred grains of cereal taxa.





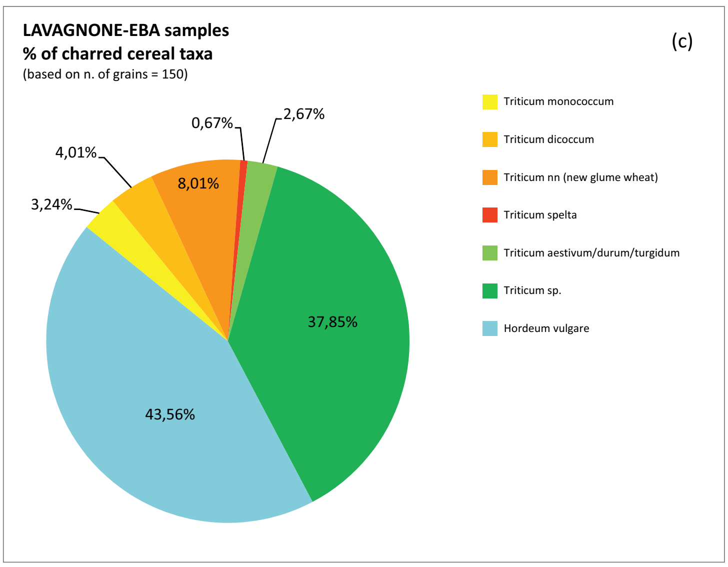
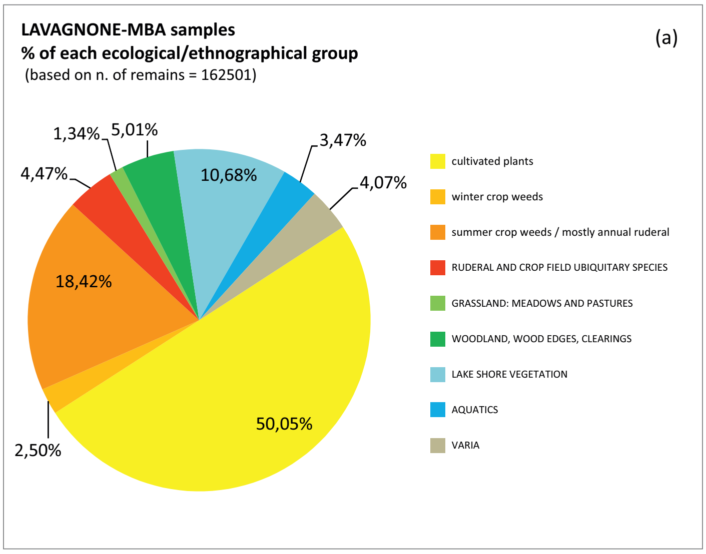
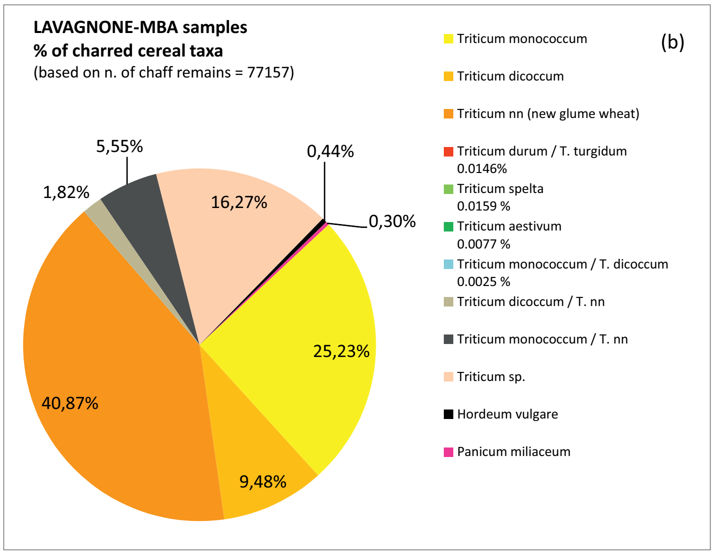


Fig. 3.3 – Lavagnone MBA samples: a) proportions of number of remains in each ecological/ethnographical group; b) percentages of charred chaff remains of cereal taxa (including intermediate morphotypes); c) percentages of charred grains of cereal taxa.





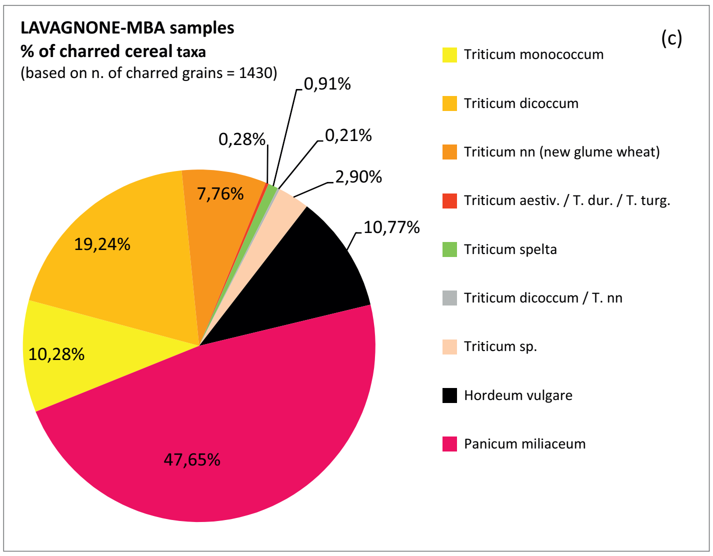


Fig. 3.4 – Comparison between the concentrations of plant remains in the analyzed samples. Each sample is represented by two paired bars, reflecting the different preservation state of remains (charred and waterlogged remains). Samples are ordered according to their depth. The age context is marked by different patterns of the bars.

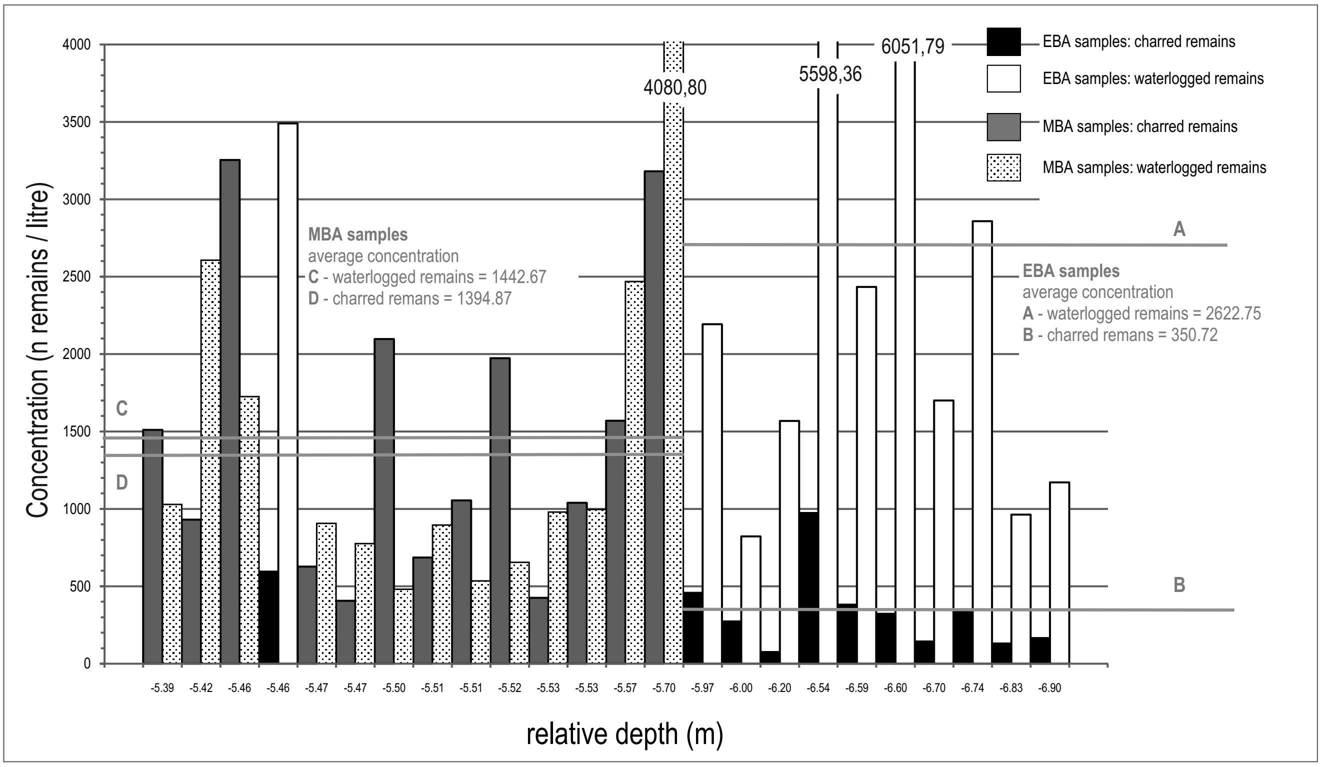


Fig. 4.1 – Plant macrofossil concentration diagram for LAV37: charcoal remains (retrieved in the two sieved fractions), sums for ethnographic and terrestrial ecological groups, and individual bars for a few selected taxa. Values refer to numbers per sediment volume of 100 ml. Sedimentation rate is calculated as cm/year. On the left of the main diagram, the cumulative pollen diagram from the mastercore LAV1 (analysis by Laboratorio di Palinologia e Paleoecologia CNR IDPA Milano). Four main groups are considered here: trees, shrubs, herbs (terrestrial herbaceous plants from natural habitats), and anthropogenic taxa (cultivated plants and anthropogenic indicators e.g. *Rumex*, *Plantago lanceolata* type, *Verbena*, etc).

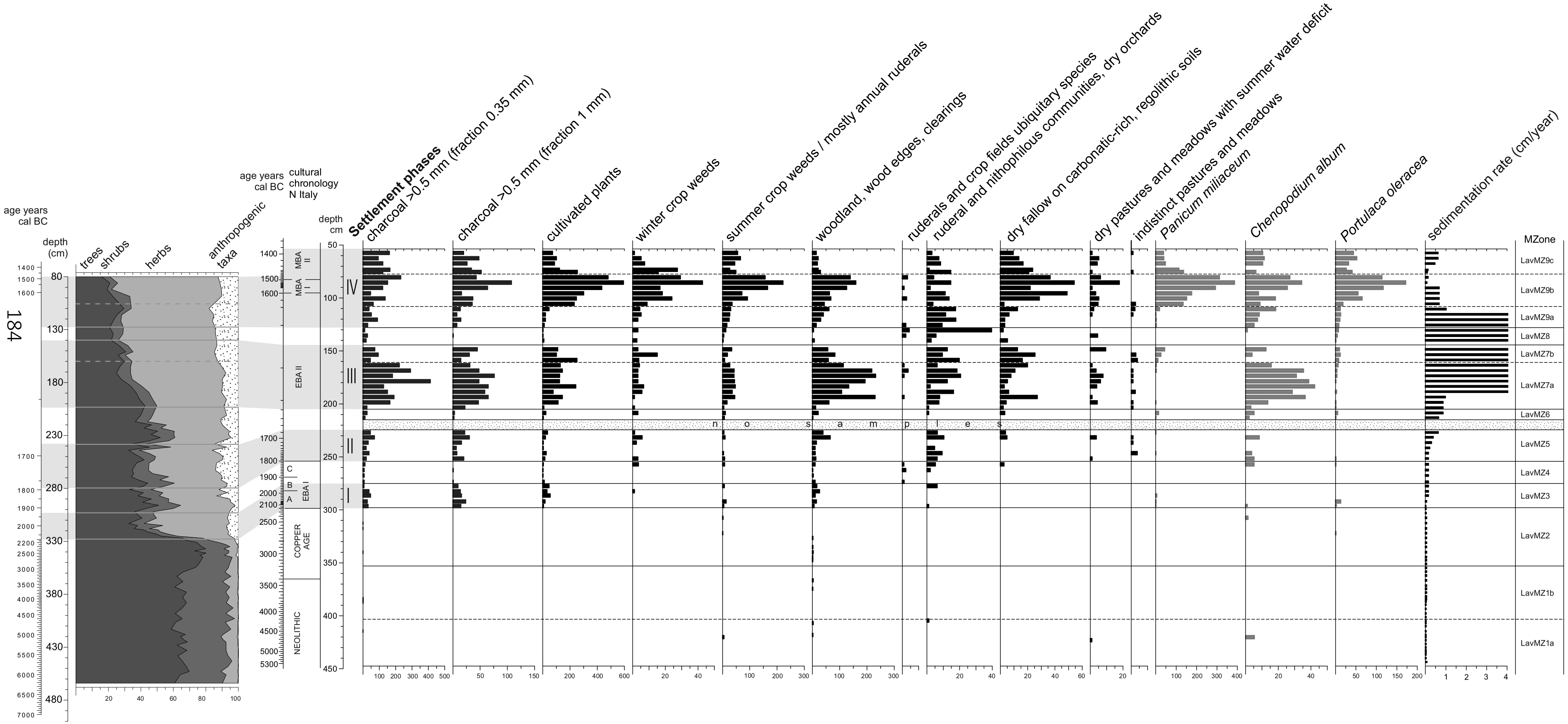


Fig. 4.2 – Plant macrofossil concentration diagram for LAV37: charcoal remains, sums for wet habitat groups and molluscs. Values refer to numbers per sediment volume of 100 ml. S1-S4 curves are wet habitat groups data normalized to 1, plotted for a proper comparison of the abundance trends. On the right, a visual schematic evaluation of each habitat representation in the fossil assemblages related to the water table's position is shown. Three representation degrees have been considered in this evaluation: uniform colour – great amount of fossil remains, the habitat is well represented in the palaeoenvironment; dotted pattern – moderate amount of fossil remains, the habitat is present but not dominant; empty space – no remains or very few, the habitat is not significantly represented in the local vegetation.

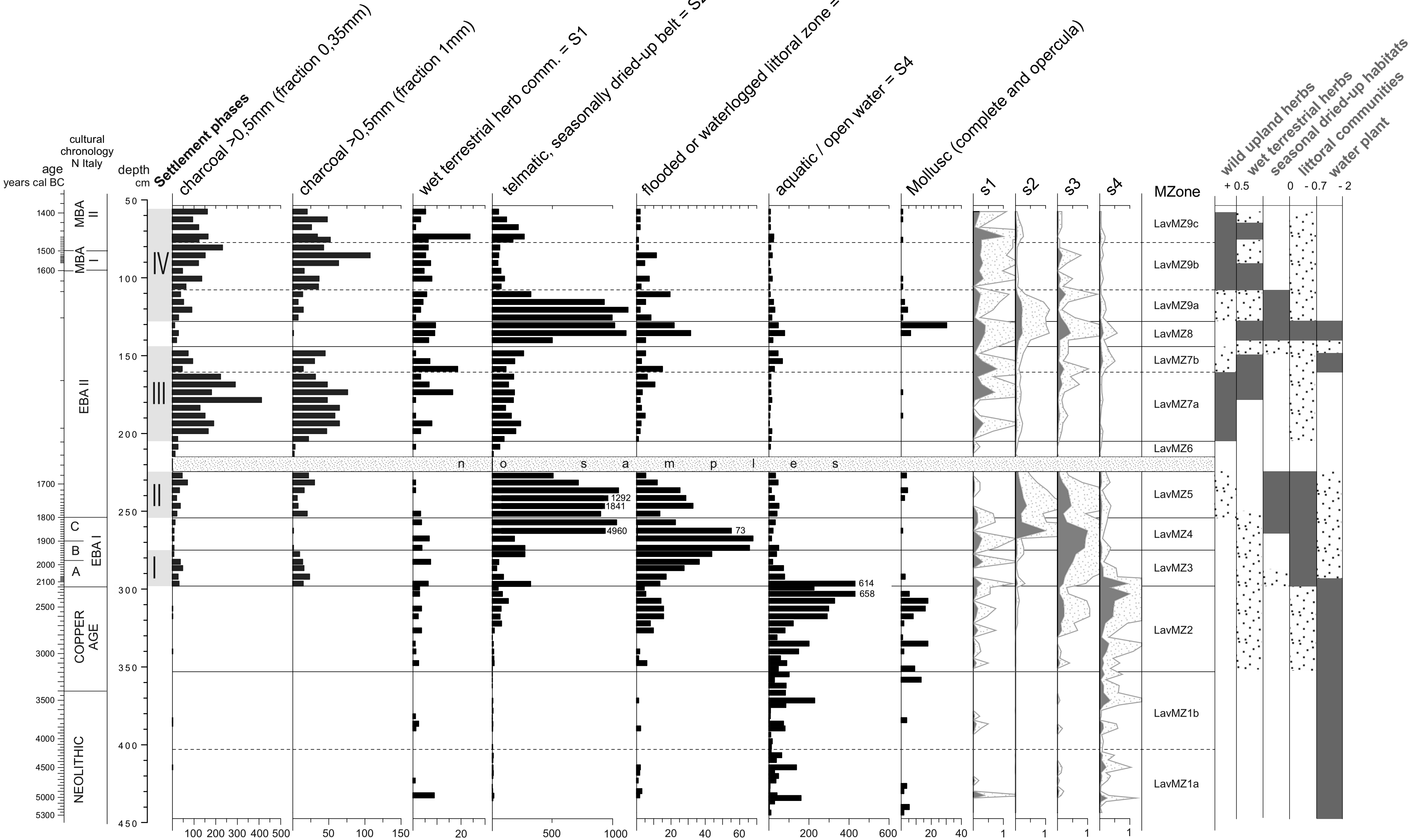
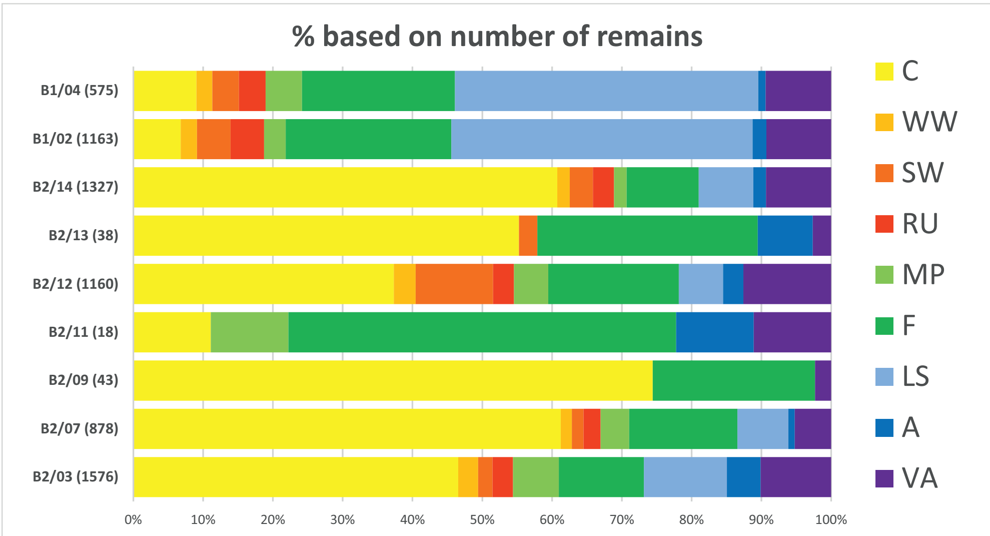
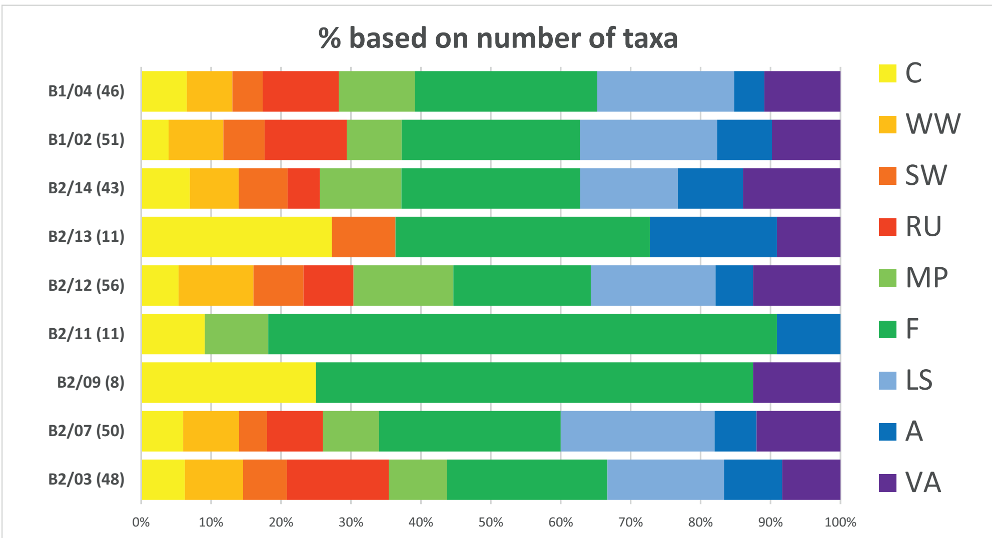


Fig. 5.1 – Graphs of macroremains analyses of samples from section 98 – Sector A.
a) the proportions of ecological groups per sample, based on the total number of remains in each sample (indicated in brackets);
b) the proportions of ecological groups per sample, based on the number of taxa (indicated in brackets). The ecological groups are: C = cultivated plants; WW = winter crop weeds; SW = summer crop weeds; RU = ruderals; MP = meadow and pastures; F = Woodland, wood edges, and clearings; LS = lake shore vegetation; A = aquatic plants, VA = varia (for a detailed definition of the groups see Chap. 2.8).



(a)



(b)

Fig. 5.2 – Pollen diagram of selected taxa and groups of six samples from section 98 - sector A (analysis by M. Zanon, Laboratorio di Palinologia e Paleoecologia CNR IDPA Milano).

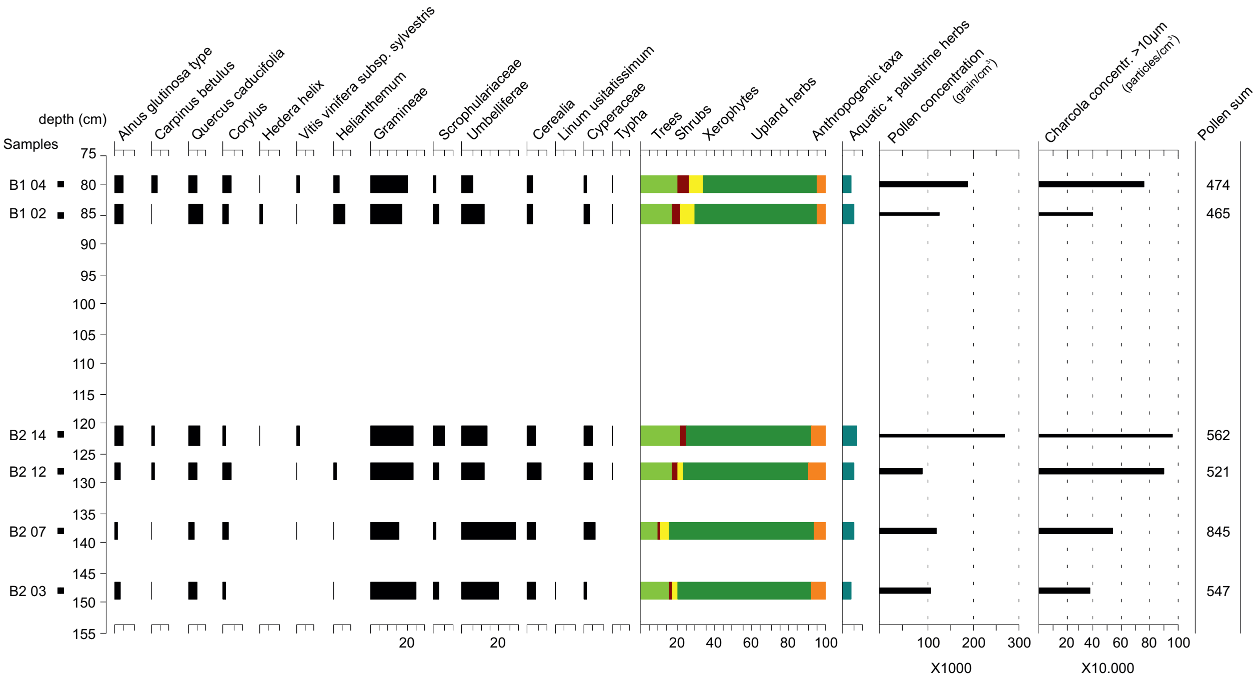


Fig. 5.3 – Correlation between the samples of section 98 – Sector A (SU338; left side) and the pollen diagram of the mastercore LAV1 from Sector D (right side; ecological groups, synthetic diagram, and Local Pollen Zones). For details about the off-site pollen diagram see Chap. 1.6.2.5; for the location of the diagram see Fig. 2.5).

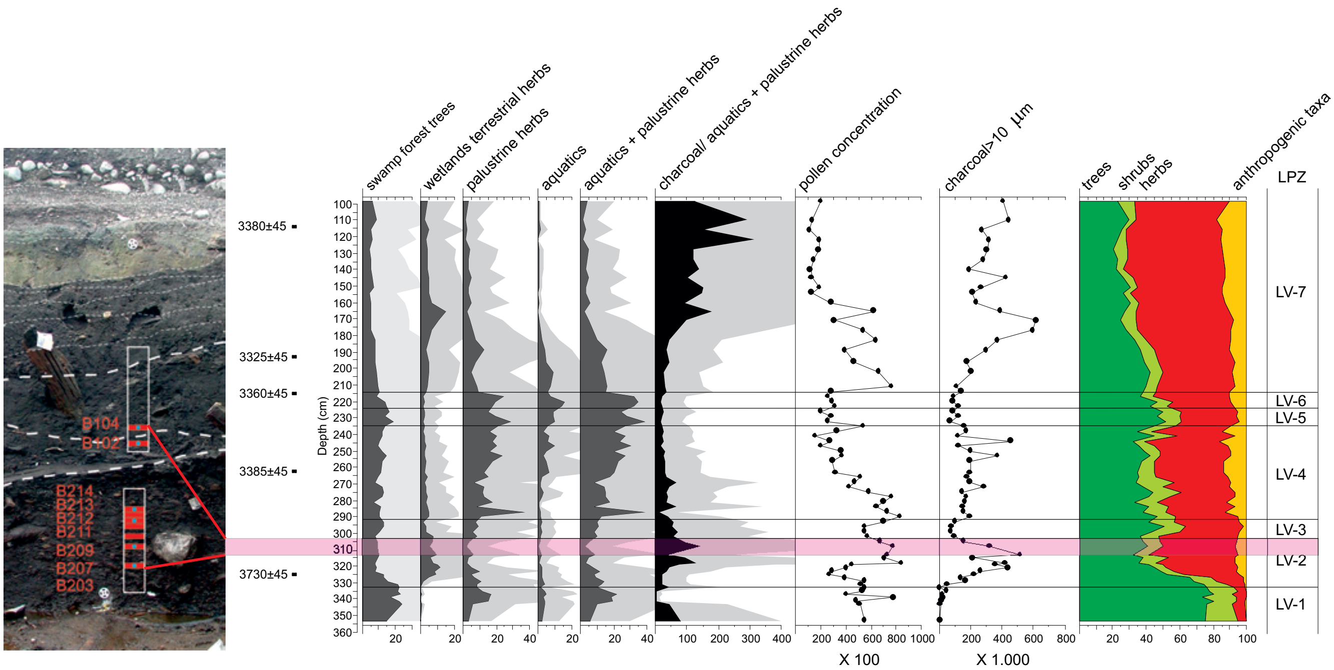


Fig. 5.4 – Results of the analysis of the small ruminant coprolites from the stratigraphic samples of section 98 – Sector A: pollen diagram of selected taxa (analysis and diagram by L. Wick, IPNA Basel). The dark colour area highlights the coprolites with a high percentage of Arboreal Pollen, the light colour area those where Non Arboreal Pollen is dominant.

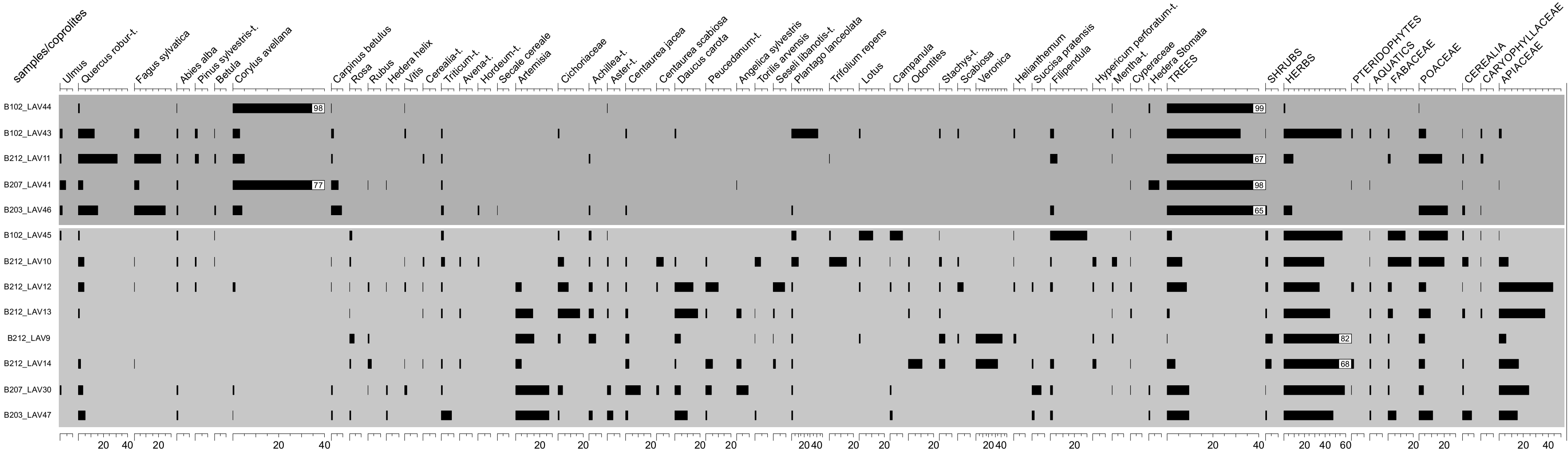


Fig. 5.5 – Pollen and macroremain percentage diagram of the six samples from section 98 – Sector A of which pollen and macroremains were analysed. In red = pollen percentages based on the pollen sum of each samples, in black macroremain percentages based on number of remains found in each sample (for a complete list Tab. 5.1).

Fig. 5.6 –Comparison of pollen % from coprolites, off-site and on-site sequences. Averages and standard deviation of pollen % of selected taxa in samples from the master core LAV1 (black symbols), in sediment samples from the cultural layers in section 98 in Sector A (green symbols), and in the small ruminants coprolites from the same cultural layers (red symbols). On the right side, the contexts in which the taxa abundance and occurrence are most significant.

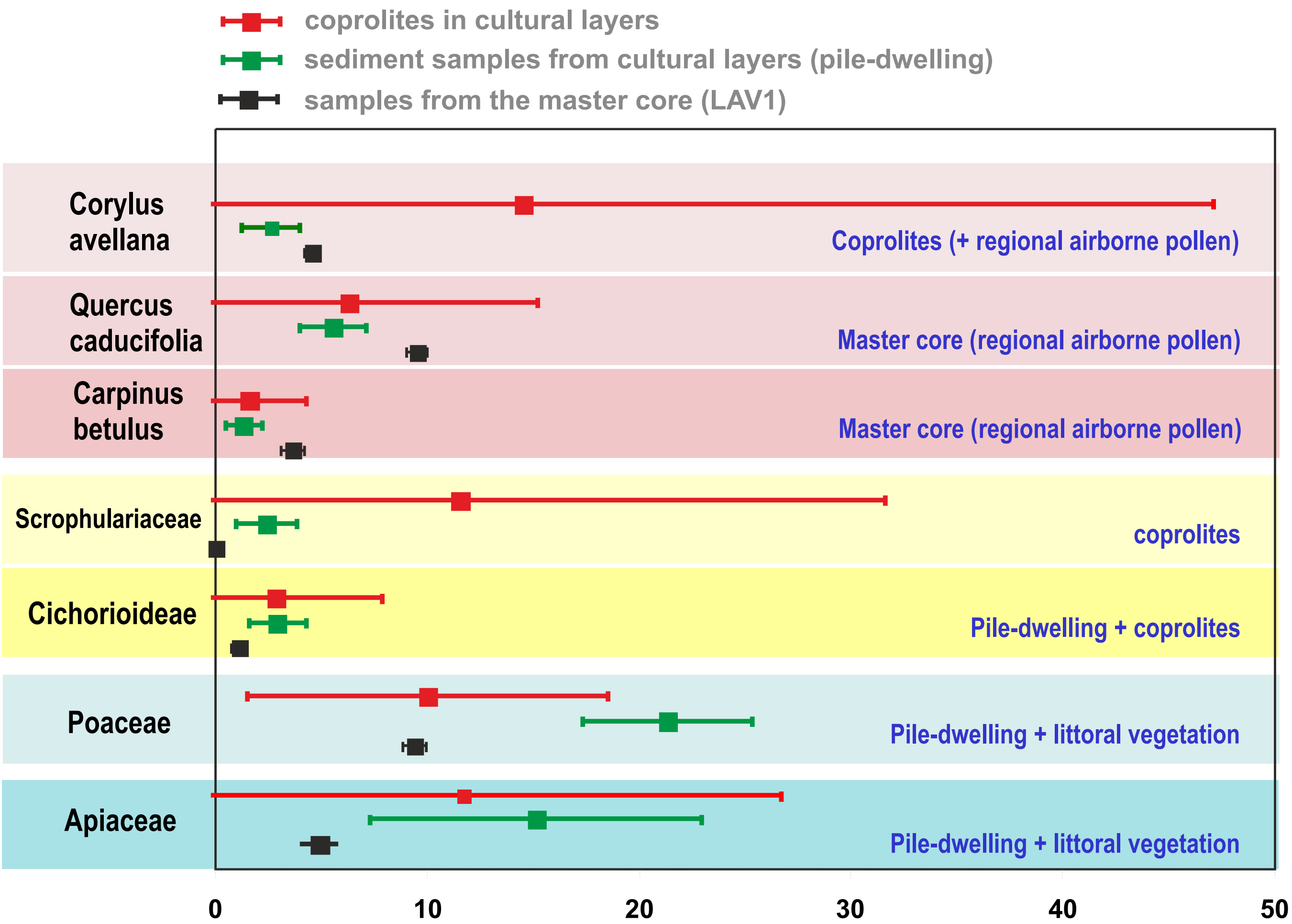


Fig. 6.1 – Proportions of the taxa in each ecological/ethnographical group in a) the first settlement phase samples; b) the second settlement phase samples; c) all samples. For dating of the settlement phases and other archaeological details see chapter 1.6.1.

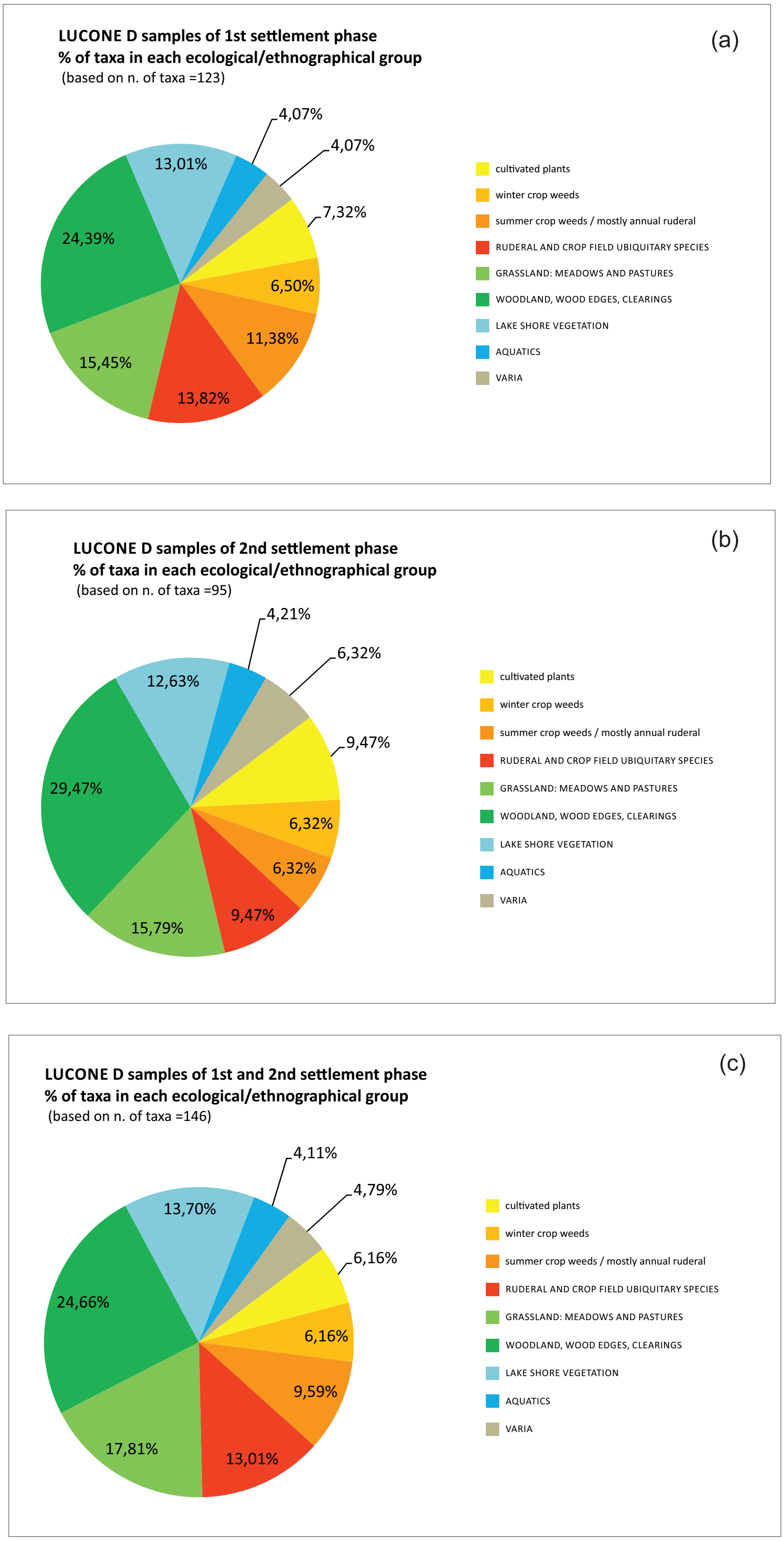
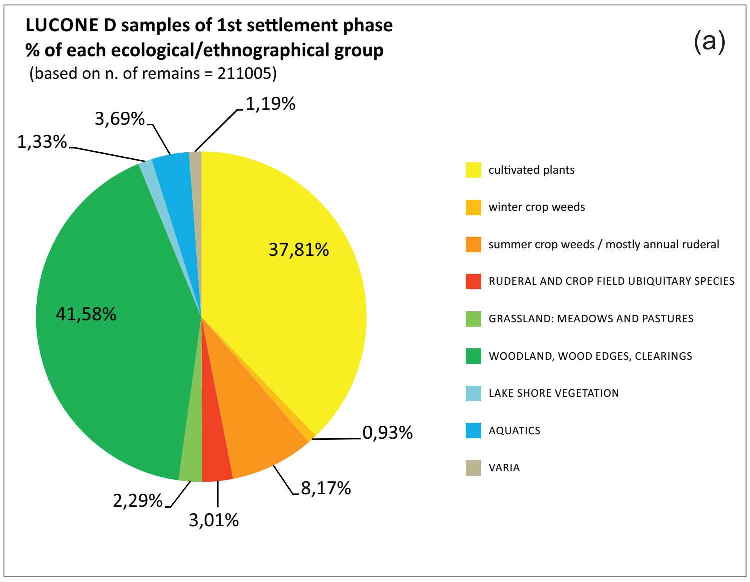
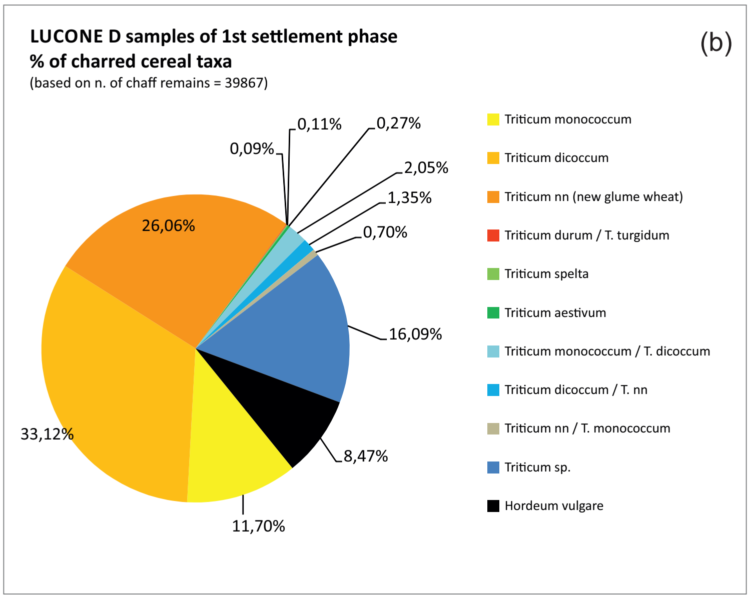


Fig. 6.2 – Lucone D first settlement phase samples: a) proportions of number of remains in each ecological/ethnographical group; b) proportions of charred chaff remains of cereal taxa; c) proportions of charred grains of cereal taxa.





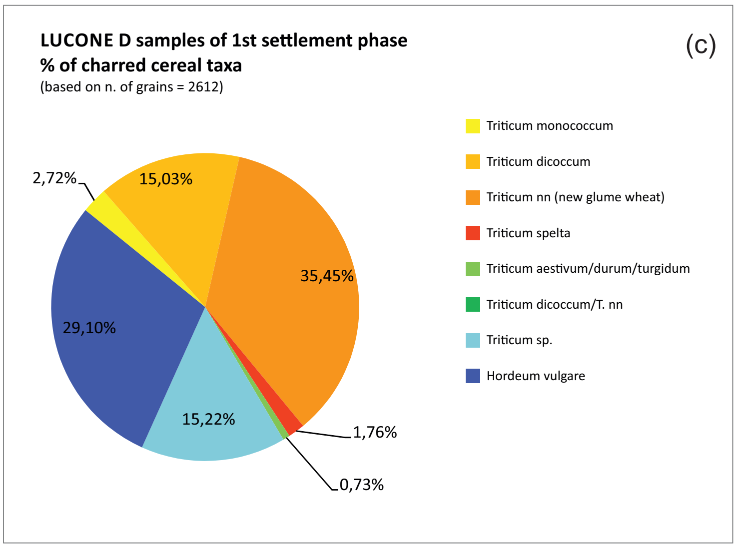
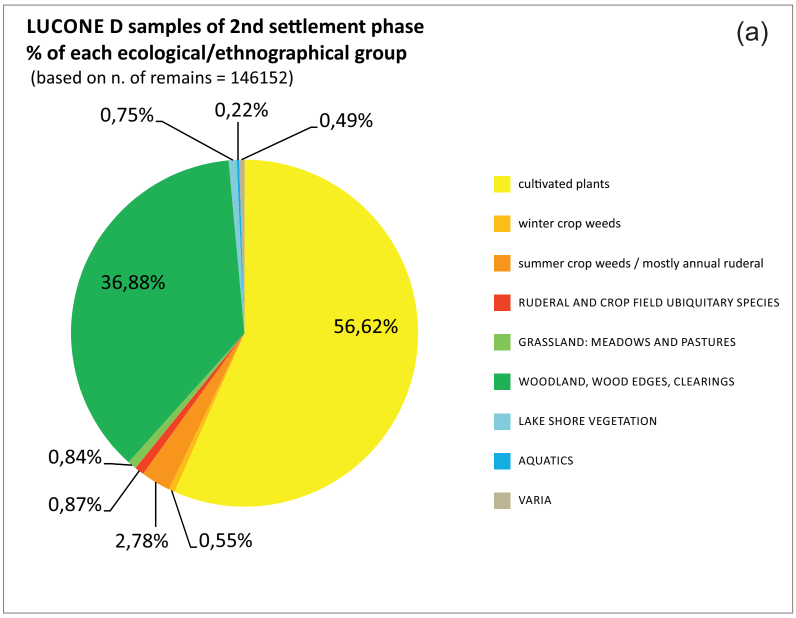
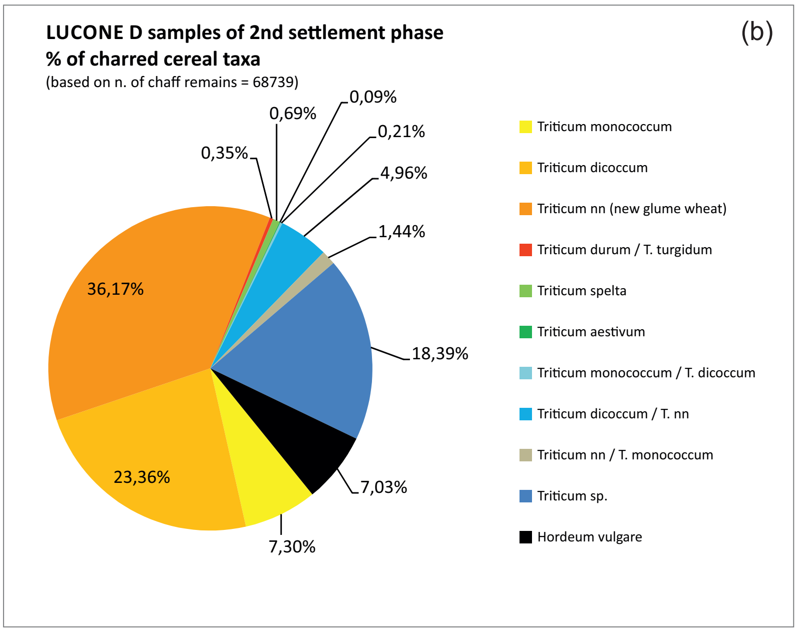


Fig. 6.3 – Lucone D second settlement phase samples: a) proportions of number of remains in each ecological/ethnographical group; b) proportions of charred chaff remains of cereal taxa; c) proportions of charred grains of cereal taxa.





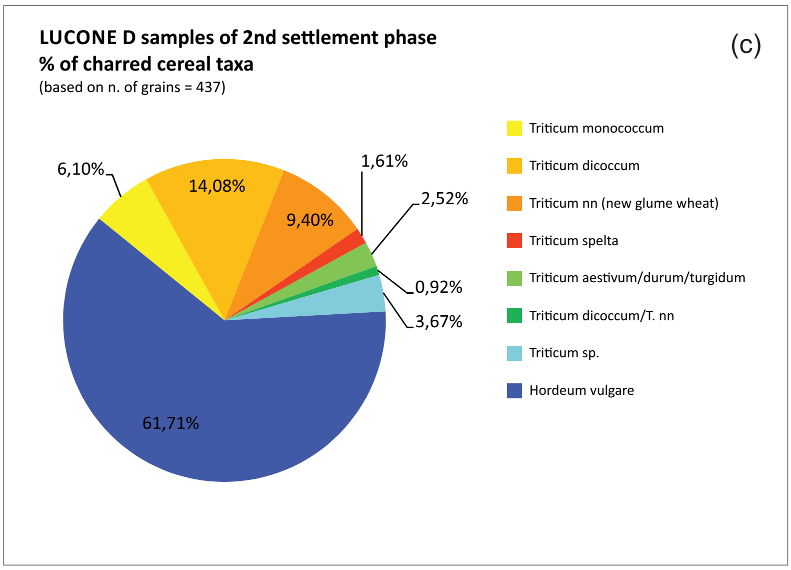


Fig. 6.4 – Lucone D all samples: a) proportions of number of remains in each ecological/ethnographical group; b) proportions of charred chaff remains of cereal taxa; c) proportions of charred grains of cereal taxa.

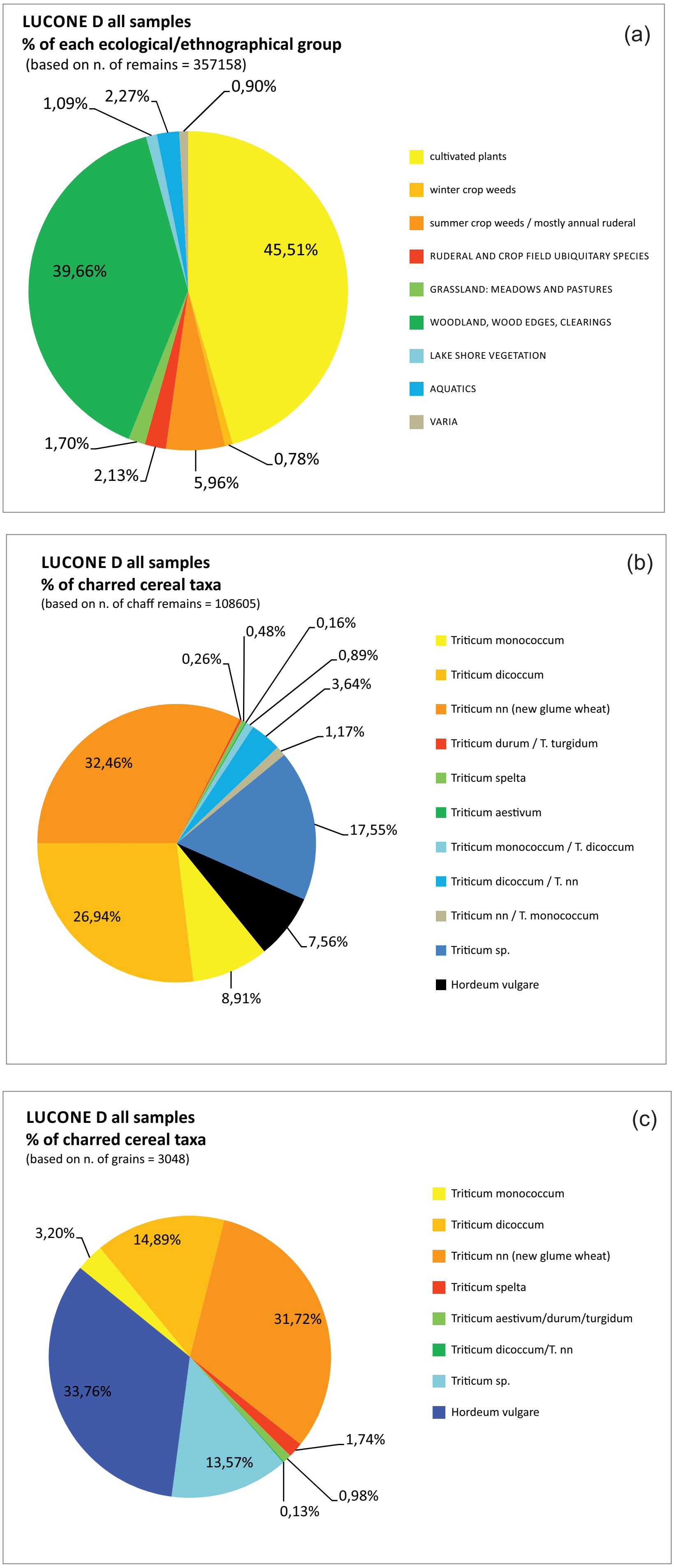


Fig. 7.1 – Plate of Lavagnone analysed coprolites.

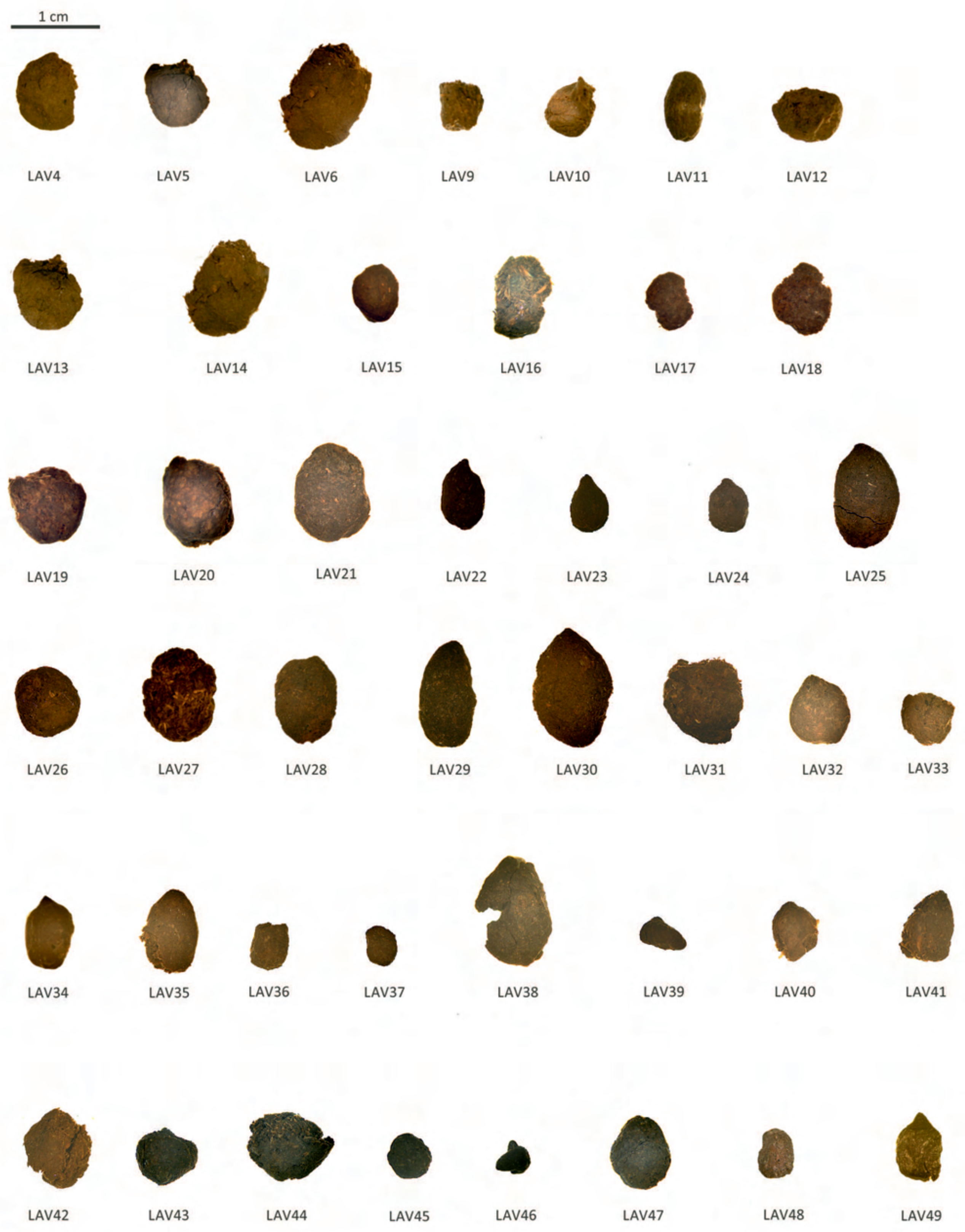


Fig. 7.2 – Pollen diagram of Lavagnone analysed coprolites (analysis and diagram by L. Wick, IPNA Basel University).

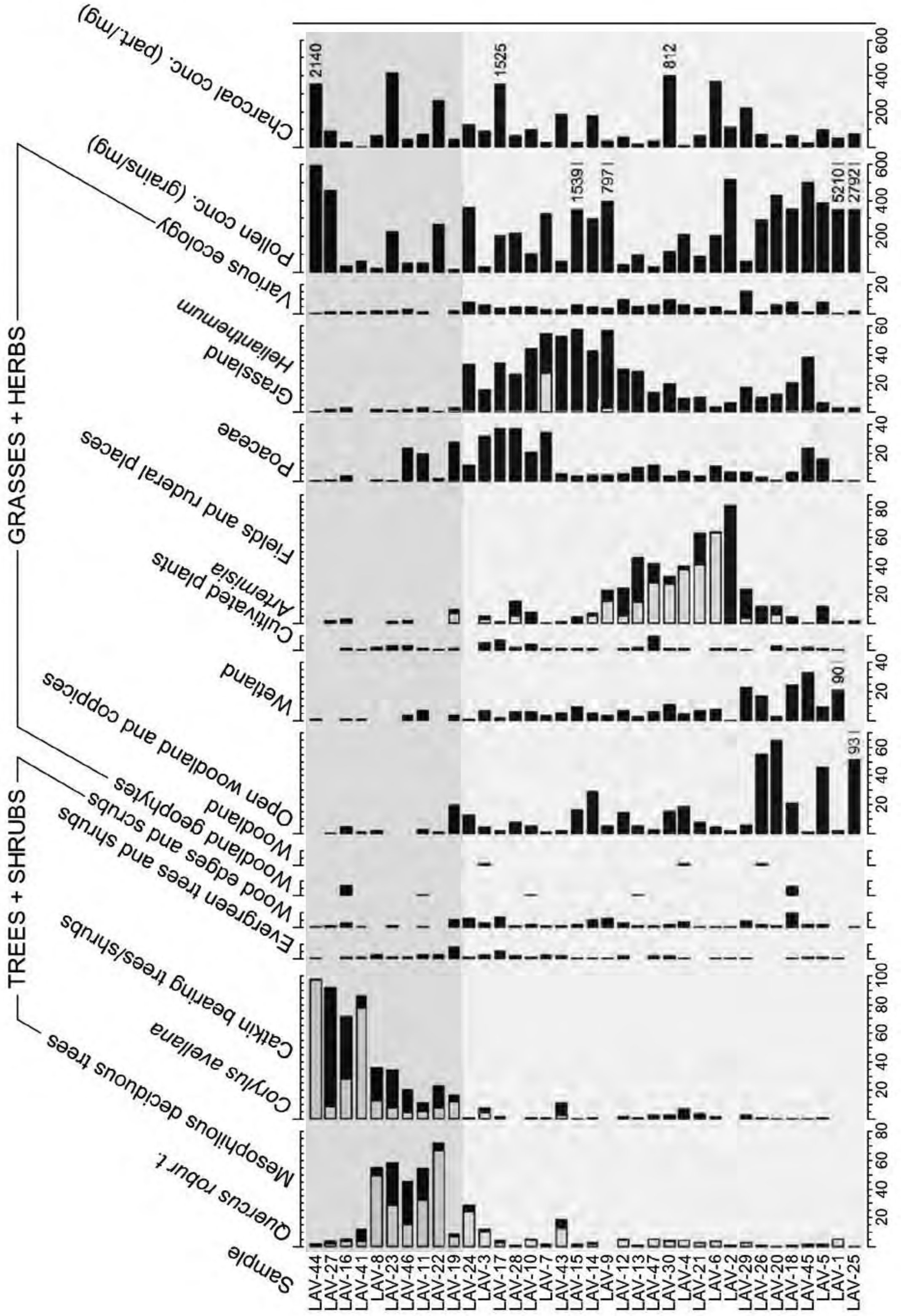


Fig. 7.3 – Plate of Lucone D analysed coprolites

Fig. 7.4 – Pollen diagram of Lucone D analysed coprolites (analysis and diagram by L. Wick, IPNA Basel University).

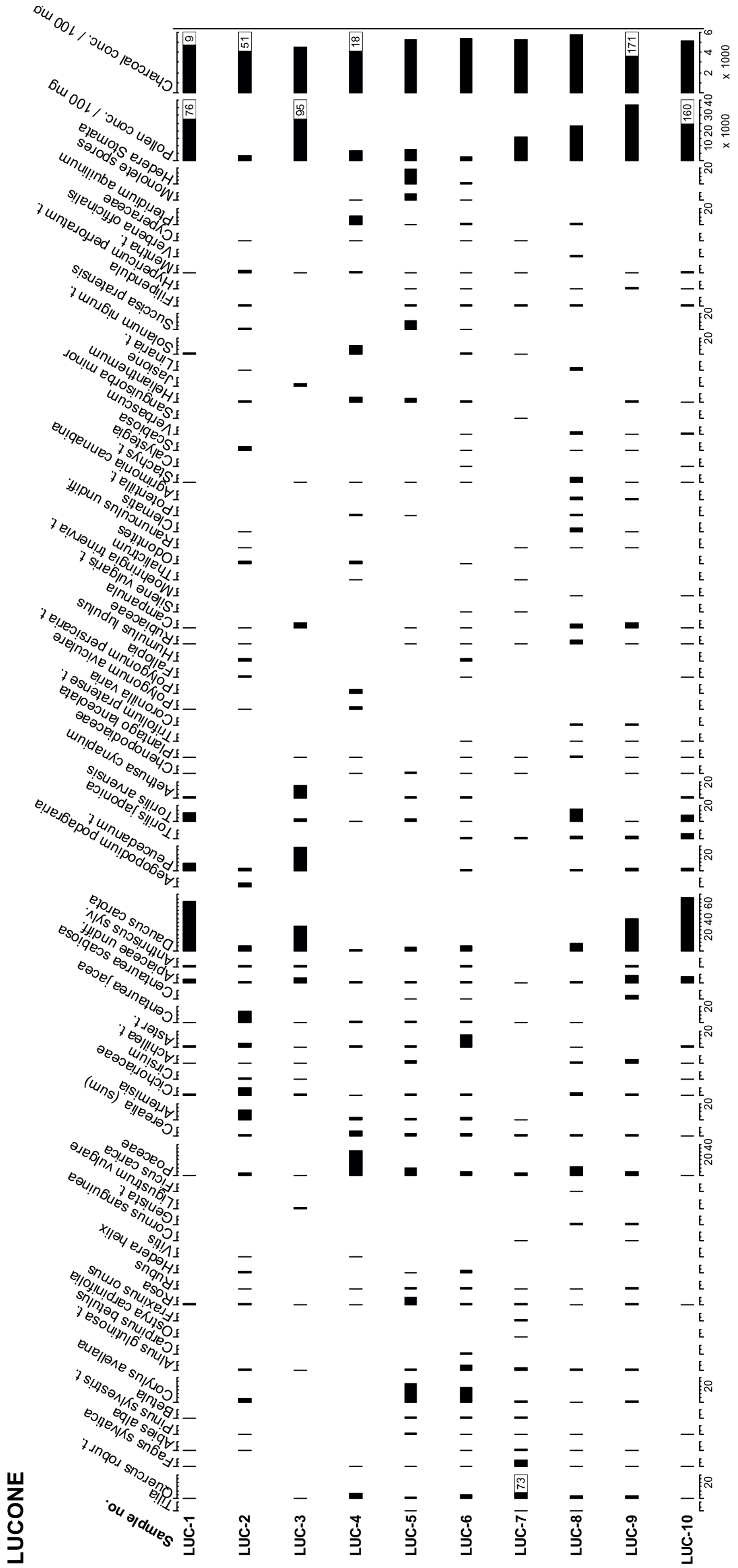


Fig. 8.1.1 (after de Marinis *et al.* 1996). – Lavagnone, Sector A (year 1994), southern section 57 (crossing quadrants 4-9 through N/O alignment; for detail of Sector A see Fig. 2.1). Along this section, the heap SU338 is cut through its summit. Here, the *cumulus* shape is more evident compared to the situation presented in Fig. 2.5 (section 98 through P alignment) referring to a marginal part of the heap.

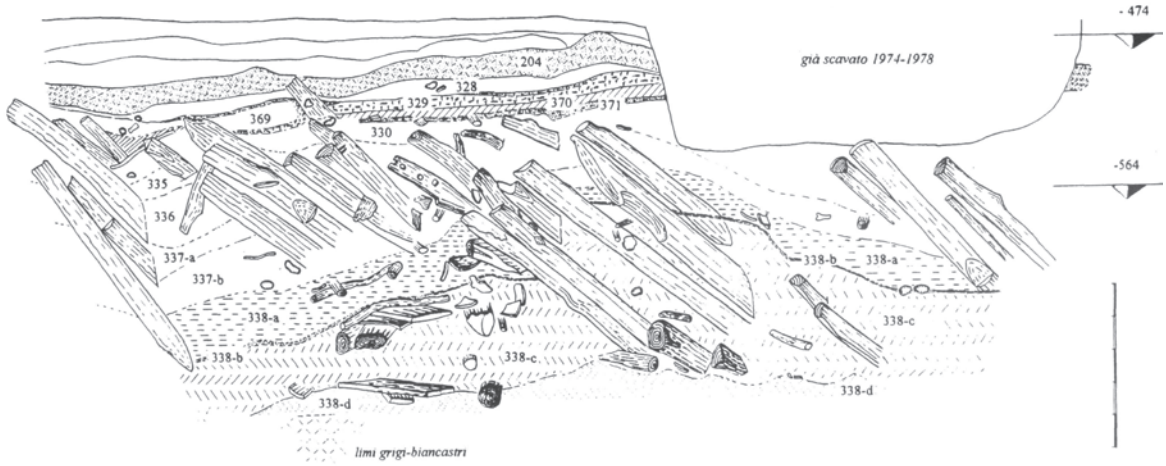
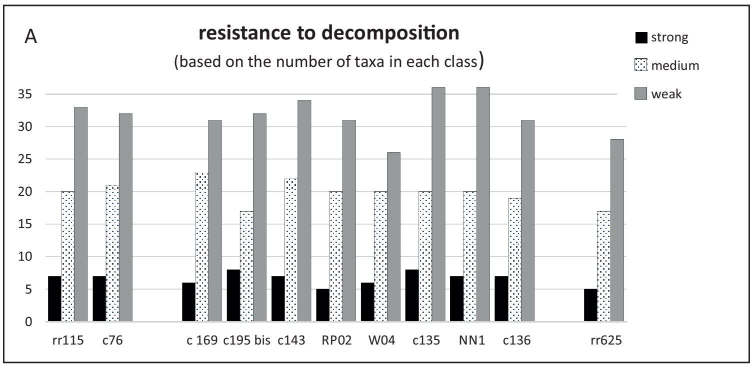
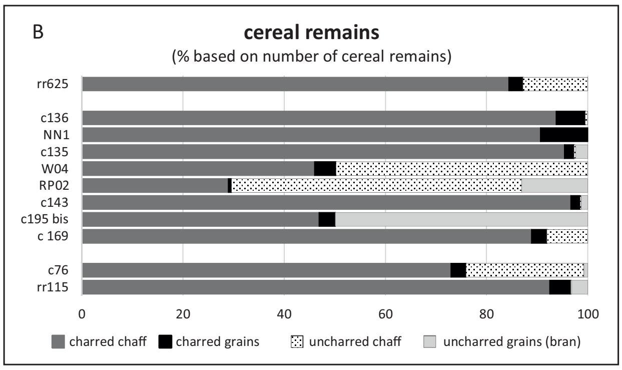


Fig. 8.1.2 (after de Marinis *et al.* 2005) – Lavagnone, Sector A (year 1999), northern section 76 through the 'I' alignment (for detail of Sector A see Fig. 2.1). The section is cut through the centre of the *cumulus* shaped heap SU338.

Fig. 8.1.3 – A detail of the Stratigraphic Units SU338c in Sector A, Lavagnone (for location of Sector A see Fig. 1.6.2.2).

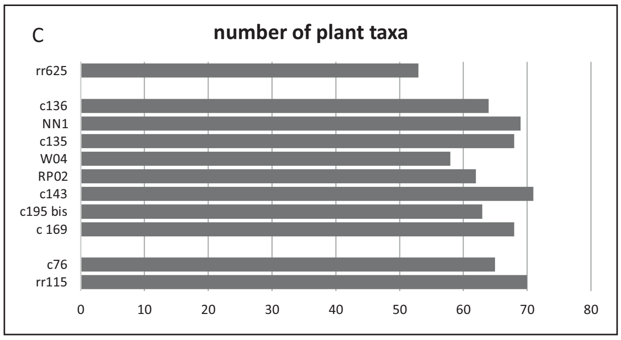
Fig. 8.1.4 – Diagrams showing the most important characteristics of the plant spectra of the EBA samples (Sector A, Lavagnone; for location see Fig. 1.6.2.2). Different parameters are presented in order to estimate the quality of preservation and to interpret the fossil plant assemblages. Samples are listed according to their Stratigraphic Units (see Appendix 3 and 4). A) classes of resistance to decomposition of waterlogged remains (uncharred remains are not included here); B) proportions of charred and uncharred remains of cereal chaff and grains, C) richness of biodiversity based on the number of plant taxa; D) suggested main routes of entry of the plant remains into the deposit; E) density of plant remains in the samples (remains per litre of sediment).

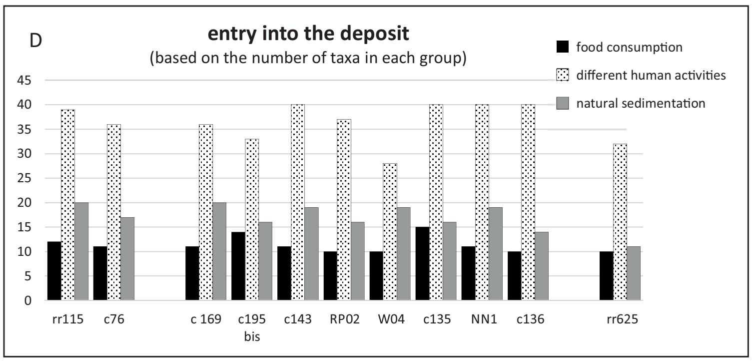




Classes of resistance to decomposition

Taxa included in <u>strong resistance class:</u> *Cornus mas, Cornus sanguinea, Corylus avellana, Crataegus monogyna, Prunus spinosa, Prunus* sp., *Rosa* sp., *Rubus* aggr. *fruticosus, Rubus* cf *idaeus, Rubus* sp., *Sambucus ebulus, Sambucus nigra, Sambucus* sp., *Solanum nigrum, Vitis vinifera* subsp. *sylvestris,* Characeae
Taxa included in <u>medium resistance class</u>: *Atriplex hastata, Carthamus* cf *lanatus, C. tinctorius, Ceratophyllum demersum, C. submersum, Chenopodium album, Clinopodium vulgare, Fagus sylvatica, Fallopia convolvulus, Ficus carica, Fragaria vesca, Ilex aquifolium, Lycopus europaeus, Malva sylvestris, Myriophyllum spicatum, Papaver dubium, P. rhoeas, Physalis alkekengi, Polygonum aviculare, P. lapathifolium, P. minus, P. persicaria, Portulaca oleracea, Potamogeton natans, Quercus sp., Ranunculus sceleratus, Rumex acetosa, R. acetosella, R. maritimus, R. sanguineus, Schoenoplectus* cf *mucronatus, S.* gr *supinus, S. lacustris, Solanum* sp., *Teucrium chamaedrys, Verbena officinalis, Viola arvensis / V. tricolor, V. riviriana/ V. reichenbachiana.*
All remnants taxa are included in <u>weak resistance class.</u>





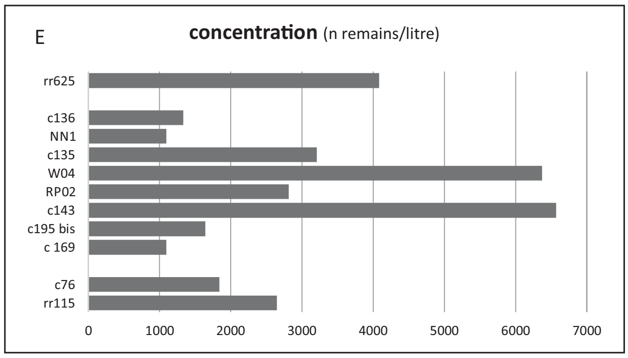
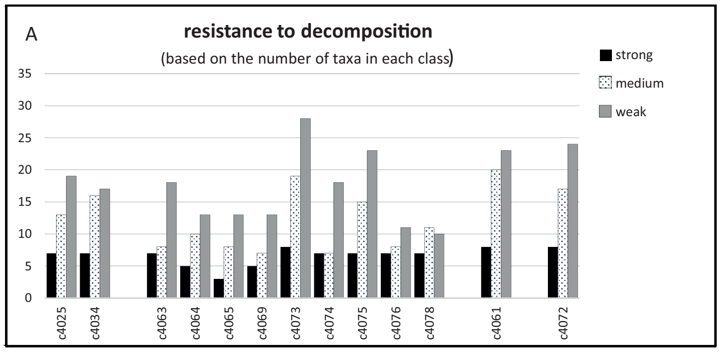
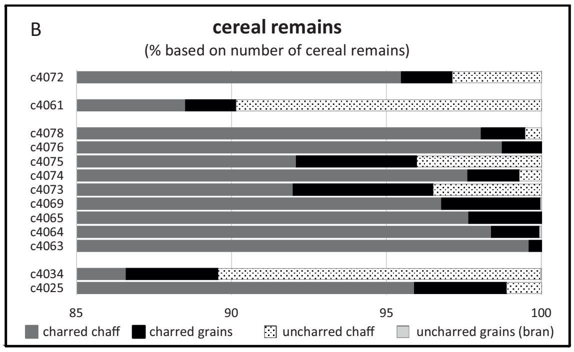


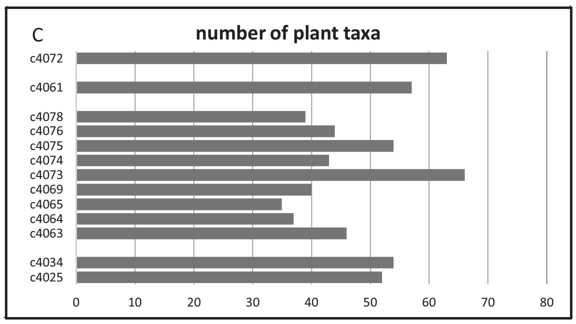
Fig. 8.1.5 – Diagrams showing the most important characteristics of the plant spectra of the MBA samples (Sector D, Lavagnone; for location see Fig. 1.6.2.2). Different parameters are presented in order to estimate the quality of preservation and to interpret the fossil plant assemblages. Samples are listed according to their Stratigraphic Units (see Appendix 3 and 4). A) classes of resistance to decomposition of waterlogged remains (uncharred remains are not included here); B) proportions of charred and uncharred remains of cereal chaff and grains, C) richness of biodiversity based on the number of plant taxa; D) suggested main routes of entry of the plant remains into the deposit; E) density of plant remains in the samples (remains per litre of sediment).

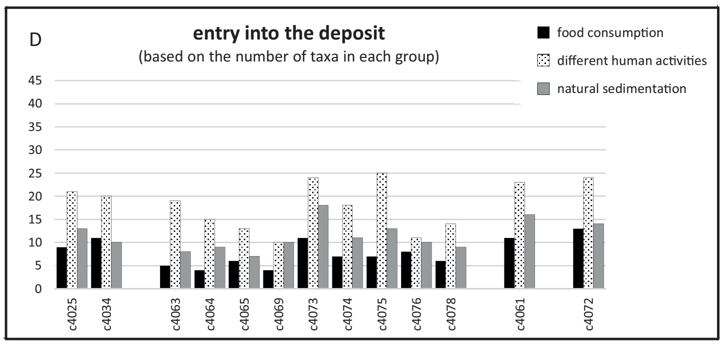




Classes of resistance to decomposition

Taxa included in strong resistance class: *Cornus mas, Cornus sanguinea, Corylus avellana, Prunus spinosa, Prunus* sp., *Rosa* sp., *Rubus* aggr. *fruticosus, Rubus* cf *idaeus, Rubus* sp., *Sambucus ebulus, Sambucus nigra, Solanum nigrum, Vitis vinifera* subsp. *sylvestris,* Characeae
Taxa included in medium resistance class: *Atriplex* sp., *Carpinus betulus, Carthamus* cf *lanatus, Ceratophyllum demersum, C. submersum, Chenopodium album, Euphorbia helioscopia, Fallopia convolvulus, Ficus carica, Fragaria vesca, Fumaria officinalis, Heliotropium europaeum, Lycopus europaeus,* cf *Myosoton aquaticum, Myriophyllum spicatum, Physalis alkekengi, Polycnemum arvense / P. majus, Polygonum aviculare, P. lapathifolium, P. persicaria, Portulaca oleracea, Potamogeton* sp., *Quercus sp., Ranunculus sceleratus, Rumex conglomeratus, R. maritimus, Salix* sp., *Sanguisorba minor, Schoenoplectus* cf*mucronatus, S. lacustris, S. tabernaemontani, Sparganium erectum, Verbena officinalis, Viola arvensis / V. tricolor, V. riviniana/ V. reichenbachiana.*
All remnants taxa are included in weak resistance class.





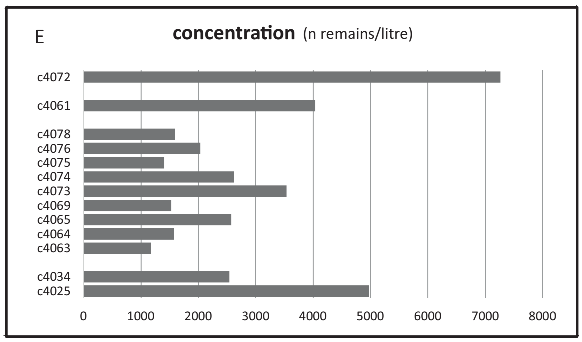
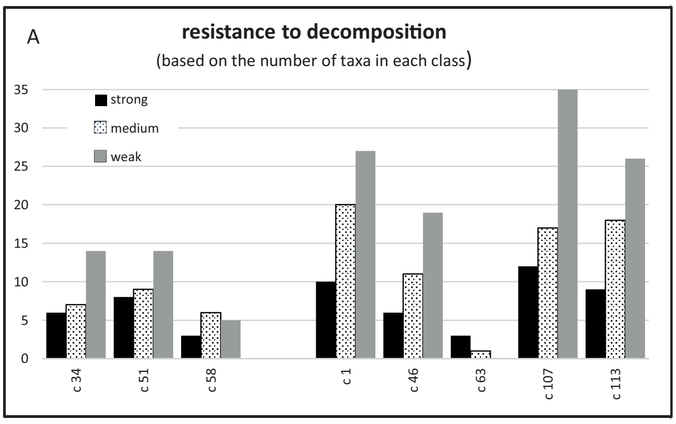
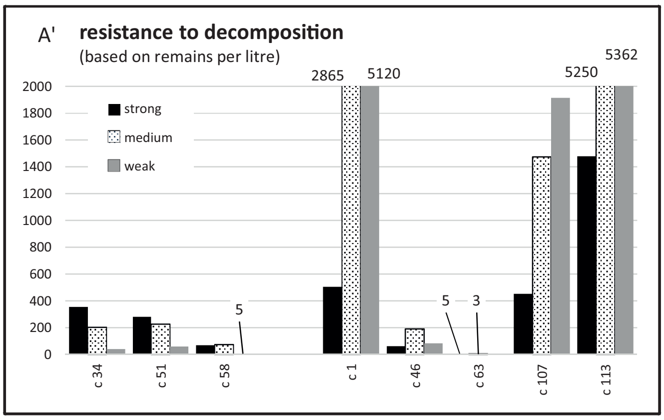


Fig. 8.1.6 – Distribution of different groups of remains or single taxa in Sector D, Lavagnone (MBA layers). For location of Sector D see Fig. 1.6.2.2, to identify the single samples see Fig. 2.2.

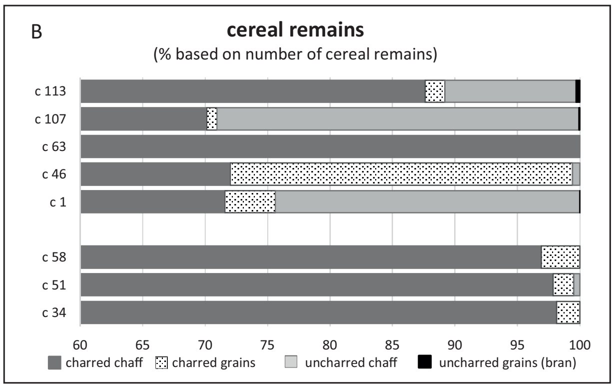
Fig. 8.1.7 – Diagrams showing the most important characteristics of the plant spectra of 1st settlement phase samples of Lucone D (EBA samples) (for location see Fig. 1.6.1.1). Different parameters are presented in order to estimate the quality of preservation and to interpret the fossil plant assemblages. Samples are grouped according to their Stratigraphic Units (see Appendix 3 and 4). A) classes of resistance to decomposition of waterlogged remains (uncharred remains are not included here); B) proportions of charred and uncharred remains of cereal chaff and grains, C) richness of biodiversity based on the number of plant taxa; D) suggested main routes of entry into the deposit; E) density of plant remains in the samples (remains per litre of sediment).

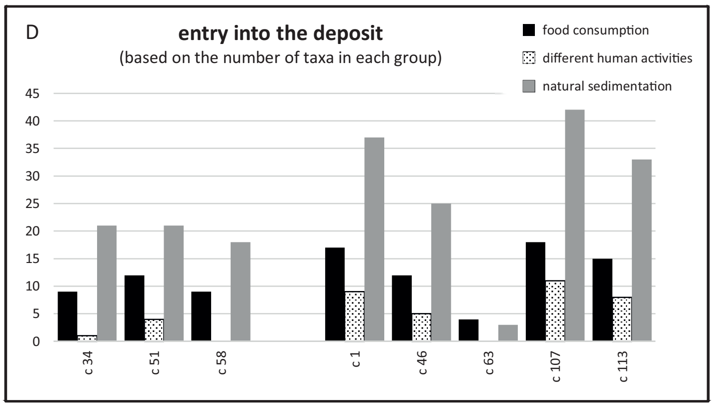


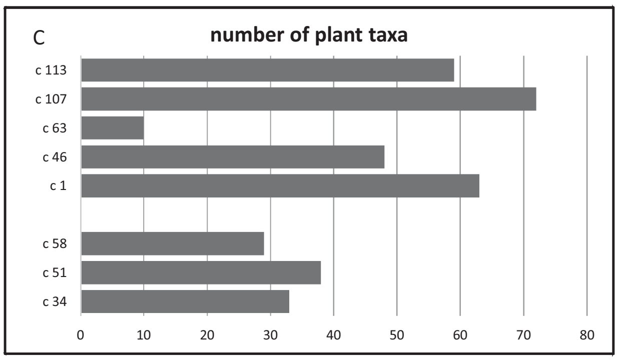


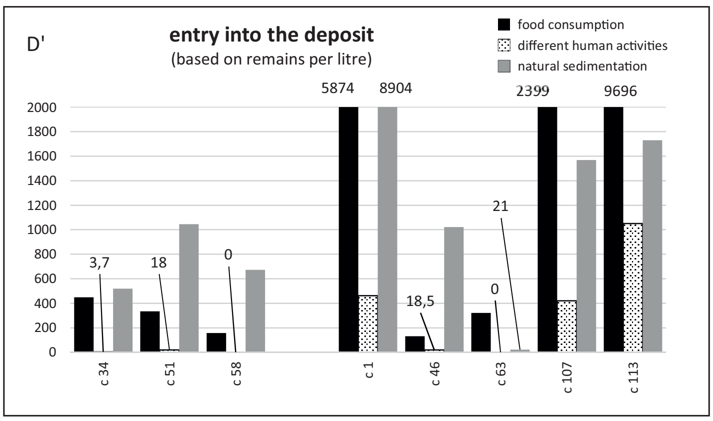
Classes of resistance to decomposition

Taxa included in strong resistance class: *Cornus mas, Cornus sanguinea, Corylus avellana, Crataegus monogyna, Prunus* cf *avium, P.* cf *mahaleb, P. spinosa, Rosa* sp., *Rubus* aggr. *fruticosus, R. idaeus, Sambucus ebulus, S. nigra, Solanum nigrum, Vitis vinifera* subsp. *sylvestris,* Characeae
Taxa included in medium resistance class: *Alnus* sp., *Carpinus betulus, cf Linum usitatissimum, Chenopodium album, C.* cf *glaucum, C.* cf *polyspermum, Fagus sylvatica, Fallopia convolvulus, Ficus carica, Fragaria vesca, Fumaria* sp., *Lycopus europaeus, Physalis alkekengi, Polygonum aviculare, P. hydropiper, P. lapathifolium, P. persicaria, Portulaca oleracea, Potamogeton natans, Quercus* sp., *Ranunculus sceleratus, Rumex acetosella, Sanguisorba minor, Teucrium chamaedrys, Triticum dicoccum, Verbena officinalis.*
All remnants taxa are included in weak resistance class.









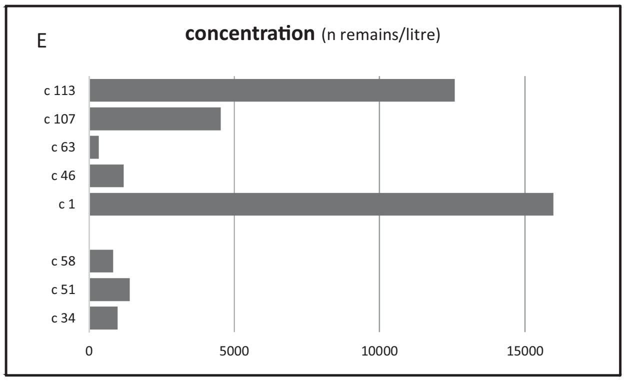


Fig. 8.1.8 – Diagrams showing the concentration of charred and waterlogged remains in the 1st and 2nd settlement phases of Lucone D (for location of Lucone D see Fig. 1.6.1.1, to identify the single samples see Fig. 2.3).

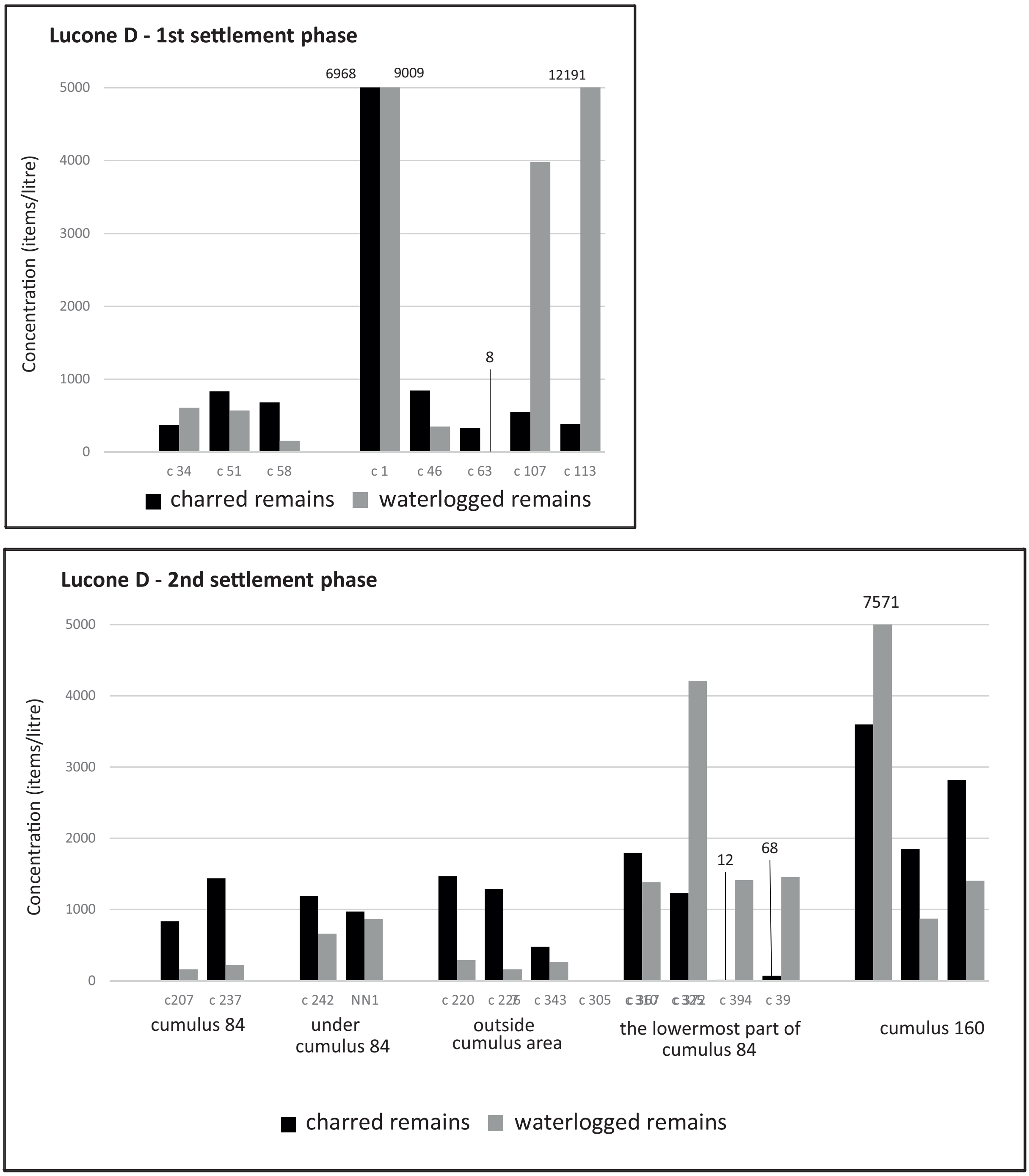
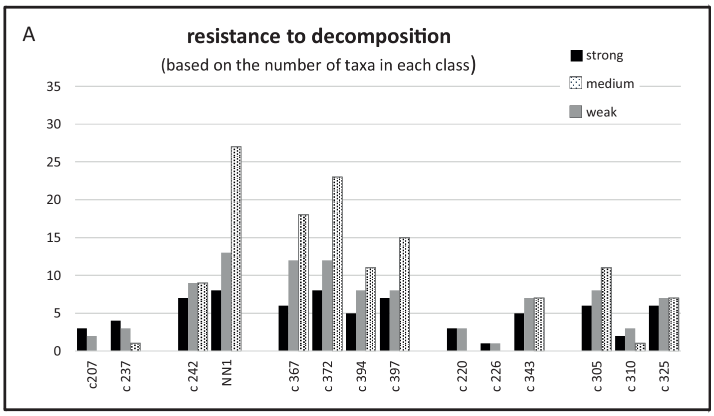
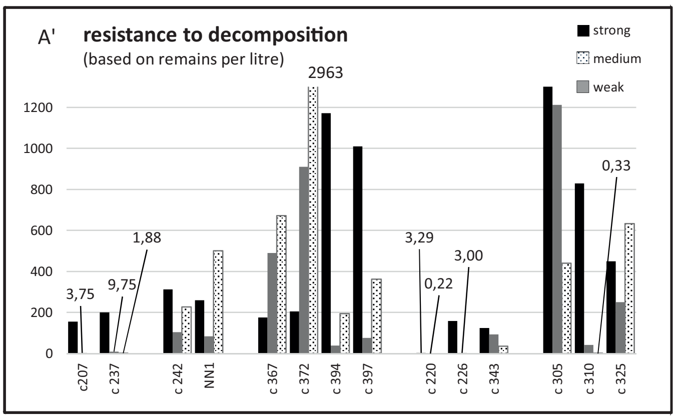


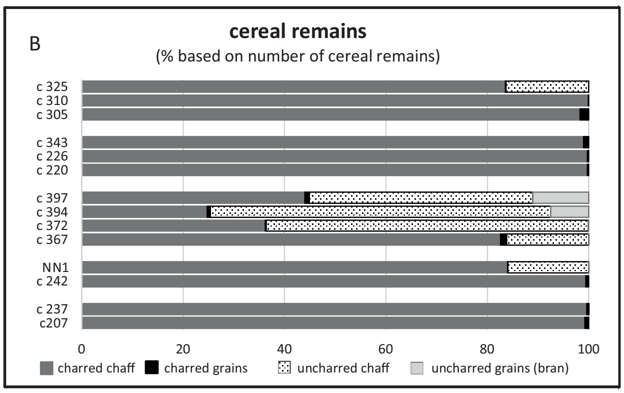
Fig. 8.1.9 – Diagrams showing the most important characteristics of the plant spectra of 2nd settlement phase samples of Lucone D (EBA samples) (for location see Fig. 1.6.1.1). Different parameters are presented in order to estimate the quality of preservation and to interpret the fossil plant assemblages. Samples are grouped according to their Stratigraphic Units (see Appendix 3 and 4). A) classes of resistance to decomposition of waterlogged remains (uncharred remains are not included here); B) proportions of charred and uncharred remains of cereal chaff and grains, C) richness of biodiversity based on the number of plant taxa; D) suggested main routes of entry into the deposit; E) density of plant remains in the samples (remains per litre of sediment).

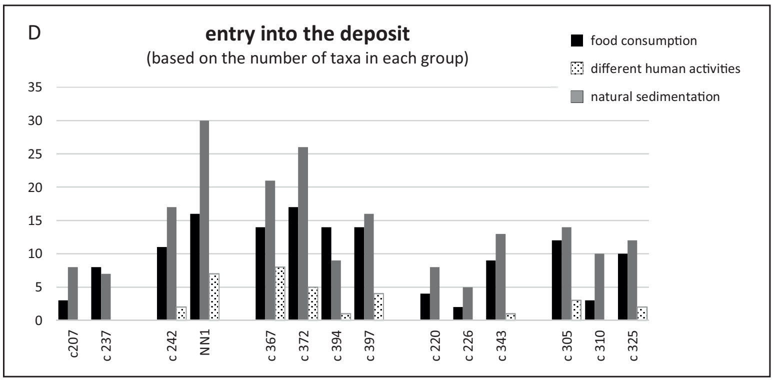


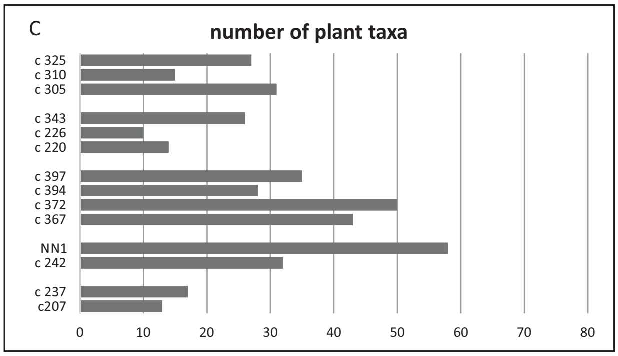


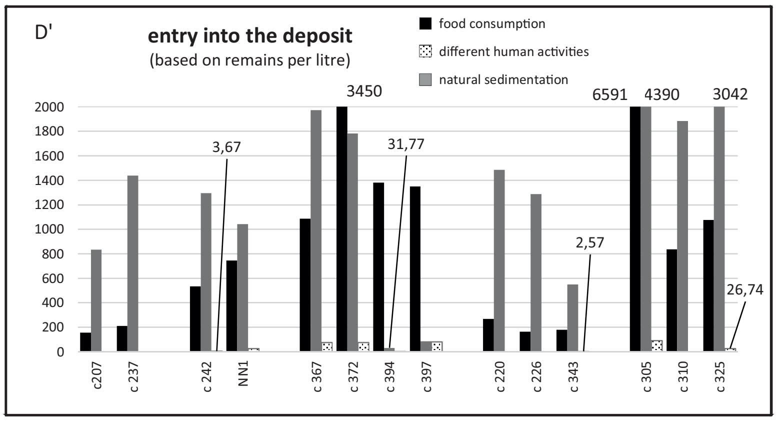
Classes of resistance to decomposition

Taxa included in <u>strong resistance class:</u> *Cornus mas, C. sanguinea, Corylus avellana, Prunus* cf*mahaleb, P. spinosa, Prunus* sp., *Rosa* cf *agrestis, Rubus* aggr. *fruticosus, Rubus* cf *idaeus, Sambucus ebulus, S. nigra, Solanum nigrum, Vitis vinifera* subsp. *sylvestris*, Characeae
Taxa included in <u>medium resistance class</u>: *Carpinus betulus, Ceratophyllum demersum, Chenopodium album, Cladium mariscus, Fagus sylvatica, Fallopia convolvulus, Ficus carica, Fragaria vesca, Lycopus europaeus, Physalis alkekengi, Polygonum aviculare, P. hydropiper, P. lapathifolium, P. minus, Portulaca oleracea, Potamogeton* sp., *Quercus* sp., *Ranunculus sceleratus, Teucrium chamaedrys, Triticum dicoccum* (partly charred), *Verbena officinalis.*
All remnants taxa are included in <u>weak resistance class.</u>









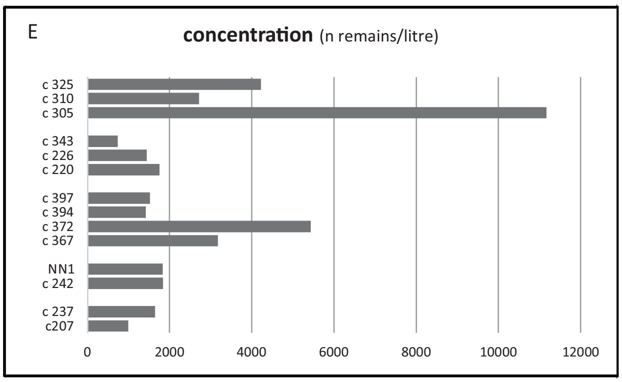
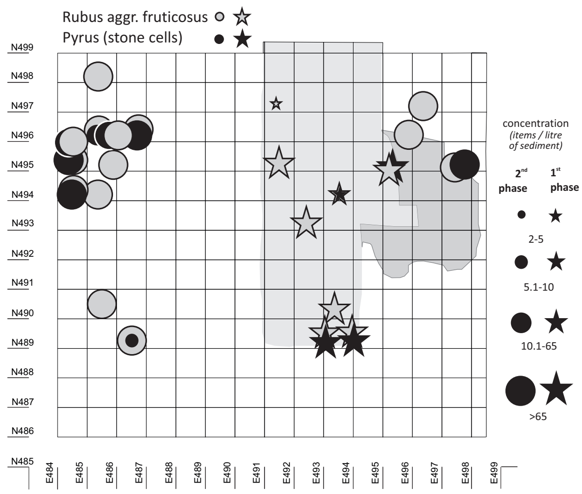
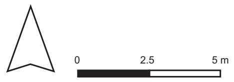


Fig. 8.1.10 – Distribution of different groups of remains or single taxa in the two settlement phases of Lucone site (to identify the single samples see Fig. 2.3).





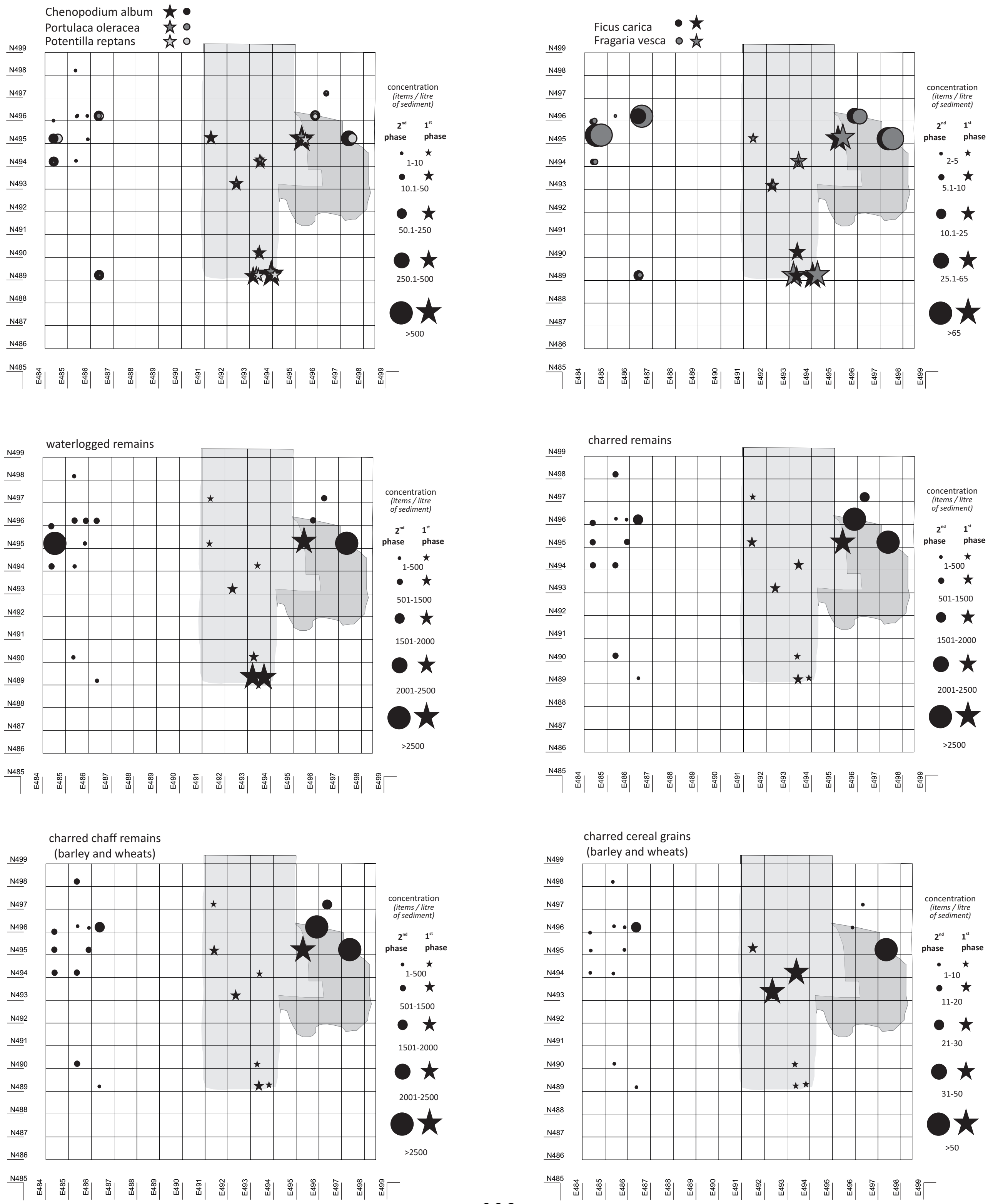


Fig. 8.2.1 A – Concentration (items/litre) of charred cereal chaff remains in the EBA samples of Lavagnone (sector A; for location of Sector A see Fig. 1.6.2.2, for information on the samples see Appendix 3 and 4), c = charred.

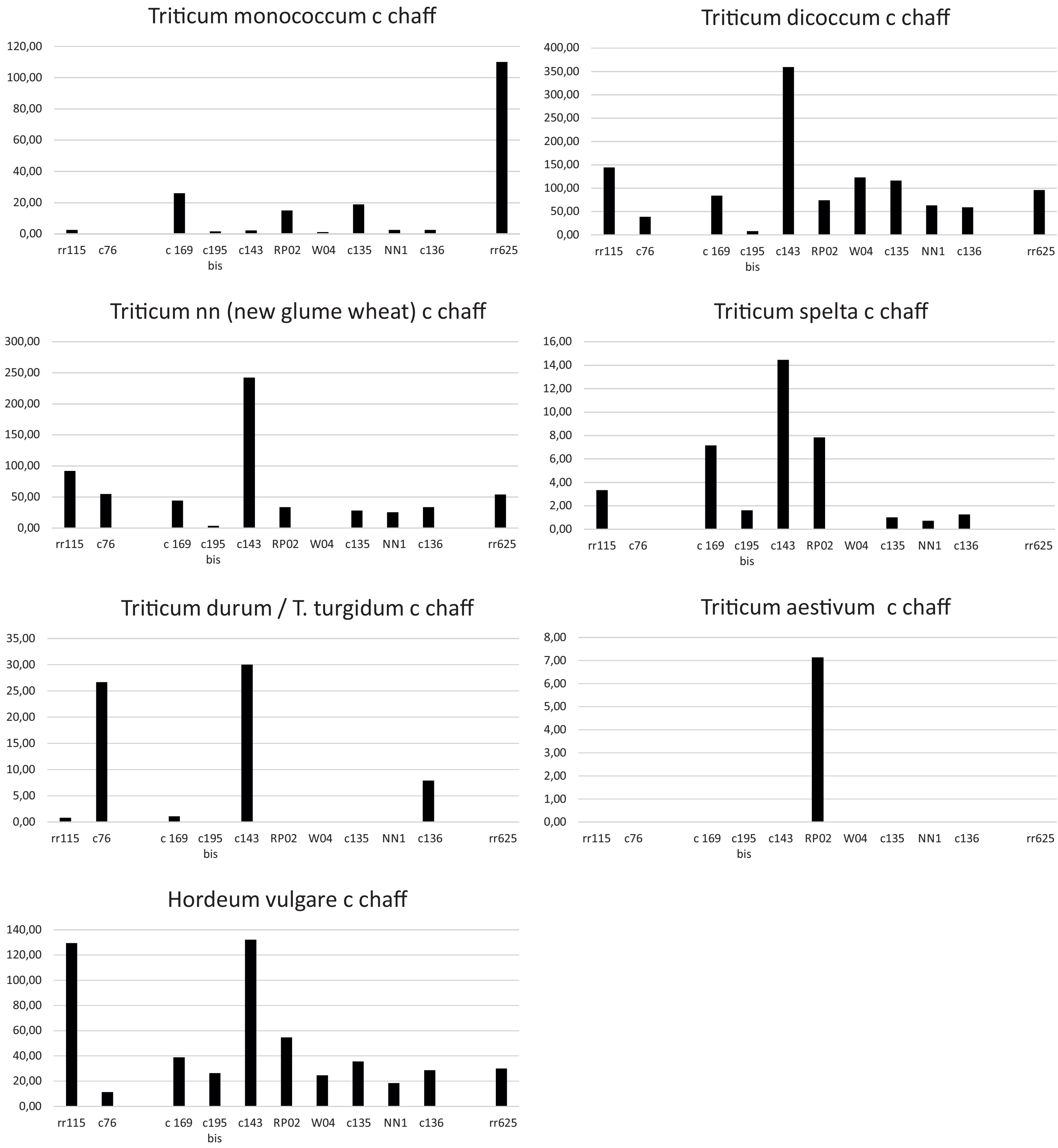


Fig. 8.2.1 B – Concentration (items/litre) of charred cereal grains and waterlogged cereal remains (chaff and *testa* fragments) in the EBA samples of Lavagnone (Sector A; for location of Sector A see Fig. 1.6.2.2, for information on the samples see Appendix 3 and 4), c = charred; u = waterlogged; frg = fragment.

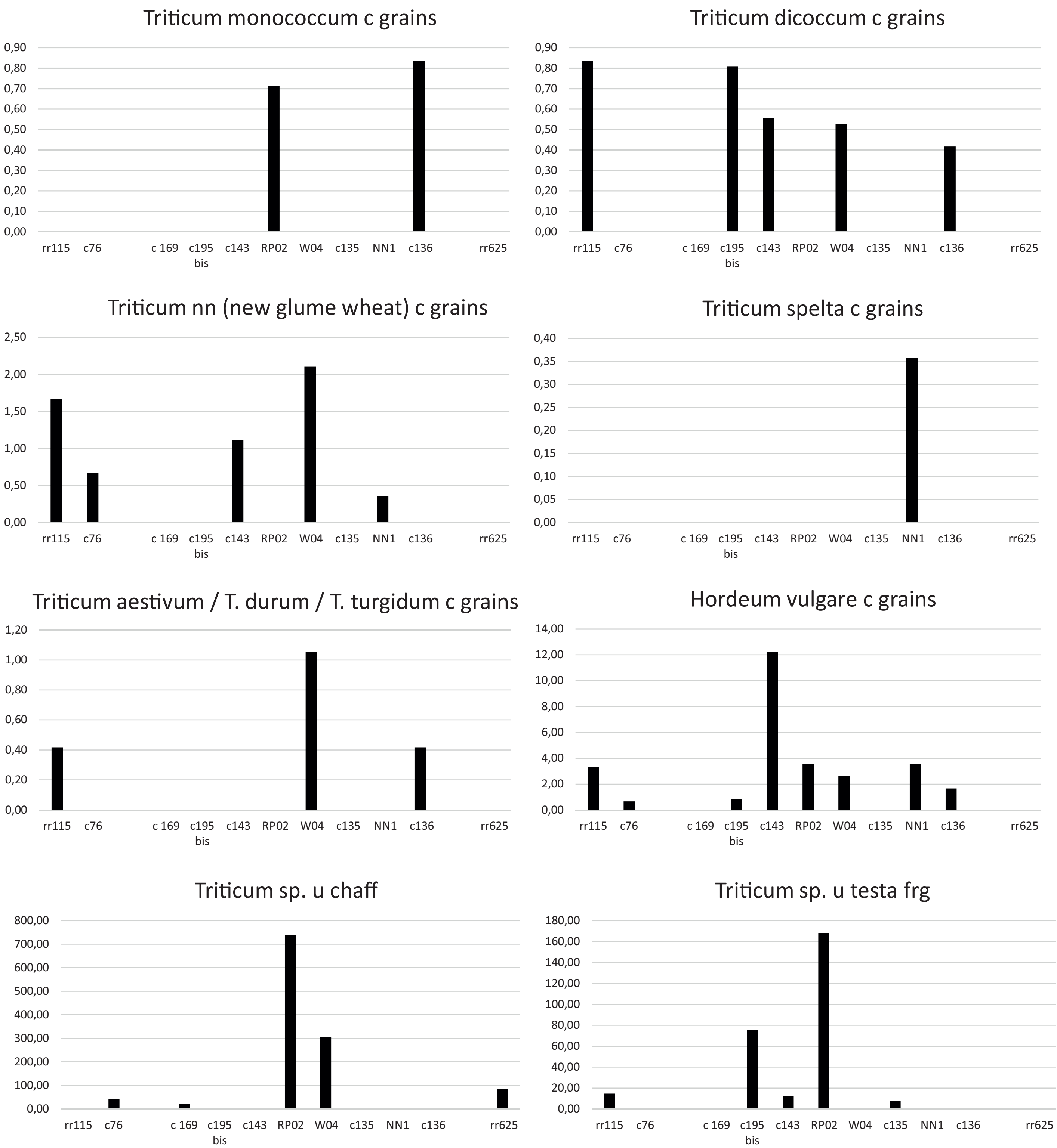


Fig. 8.2.2 A – Concentration (items/litre) of charred cereal chaff remains in the MBA samples of Lavagnone (Sector D; for location of Sector D see Fig. 1.6.2.2, for information on the samples see. Appendix 3 and 4); c = charred.

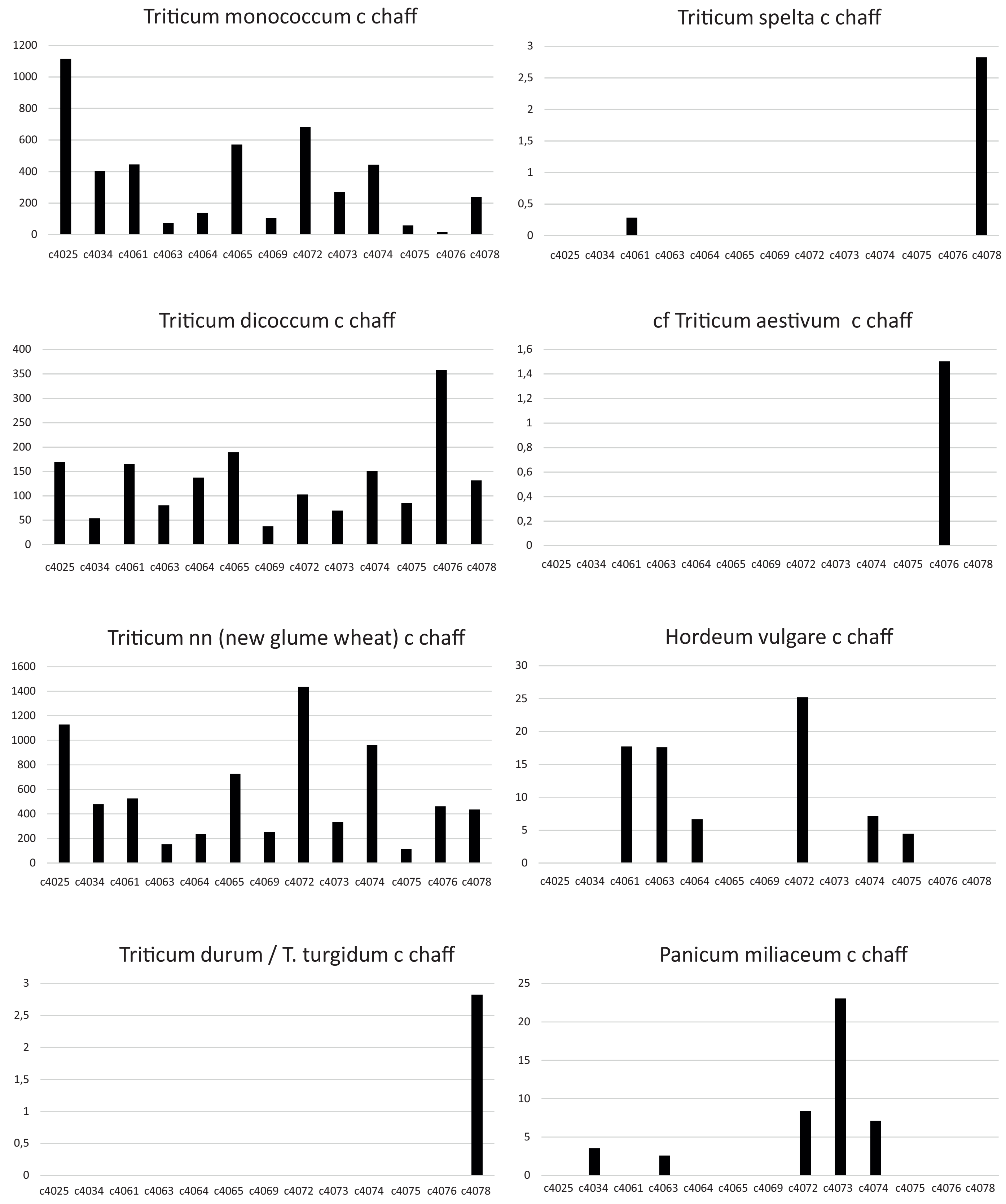


Fig. 8.2.2 B – Concentration (items/litre) of charred cereal grains in the MBA samples of Lavagnone (sector D; for location of Sector D see Fig. 1.6.2.2, for information on the samples see. Appendix 3 and 4); c = charred.

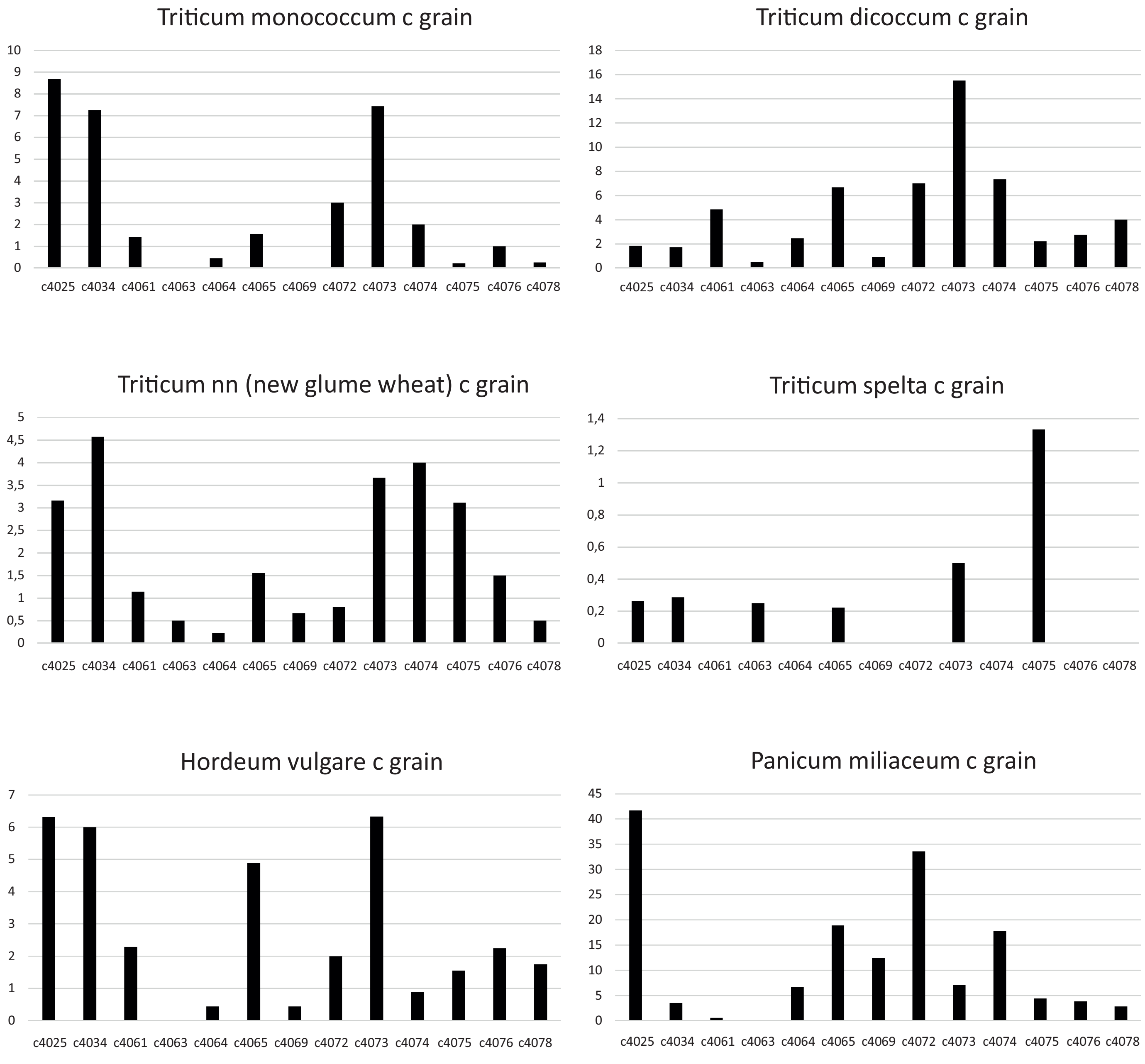


Fig. 8.2.2 C – Concentration (items/litre) of waterlogged cereal remains (chaff and testa fragments) and charred seeds of horse bean (*Vicia faba* var. *minor*) in the MBA samples of Lavagnone (sector D; for location of Sector D see Fig. 1.6.2.2, for information on the samples see. Appendix 3 and 4);
c = charred, u = waterlogged.

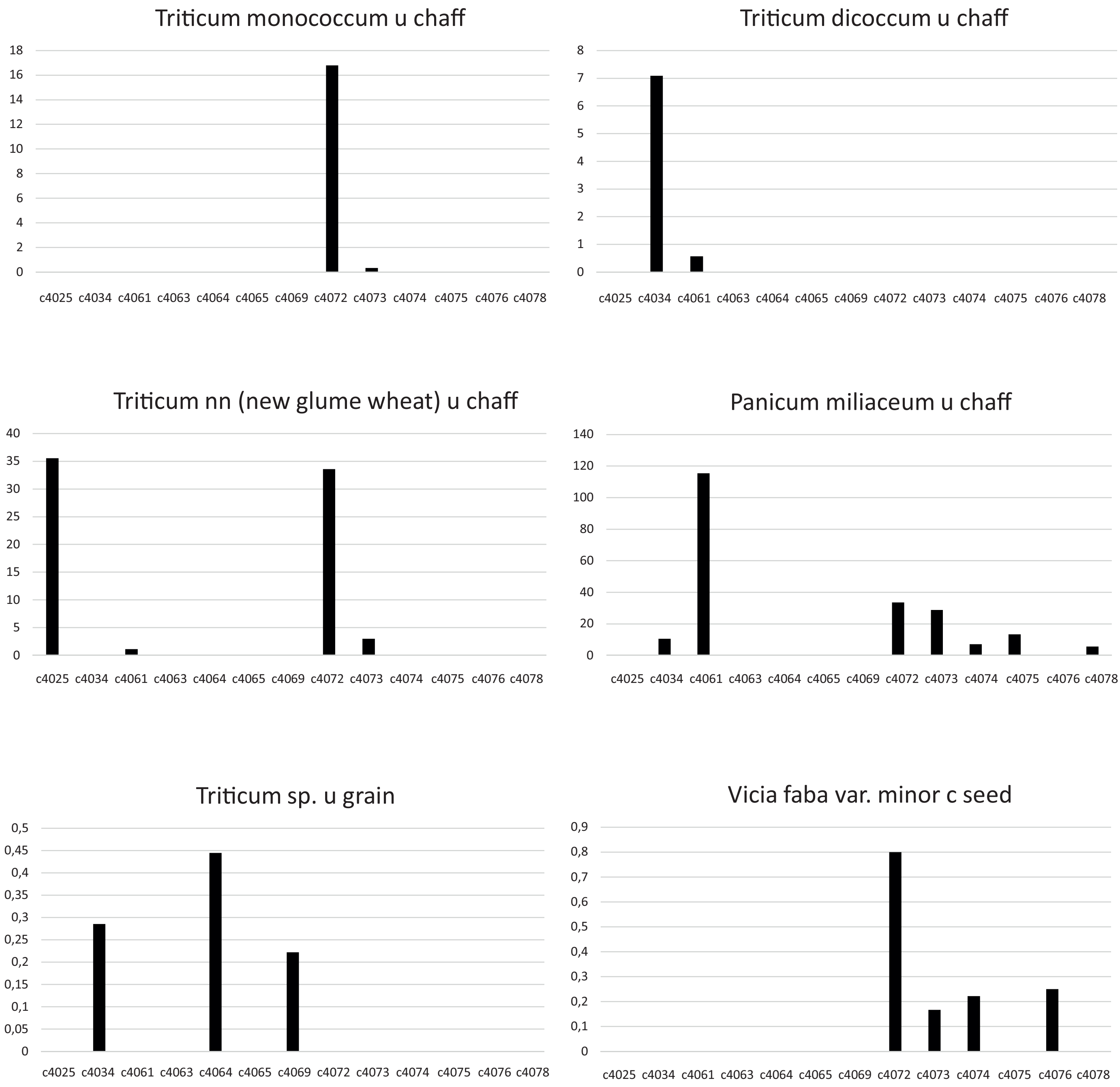


Fig. 8.2.3 A – Concentration (items/litre) of charred cereal chaff remains in the first settlement phase samples of Lucone D (for information on the samples see Appendix 3 and 4); c = charred.

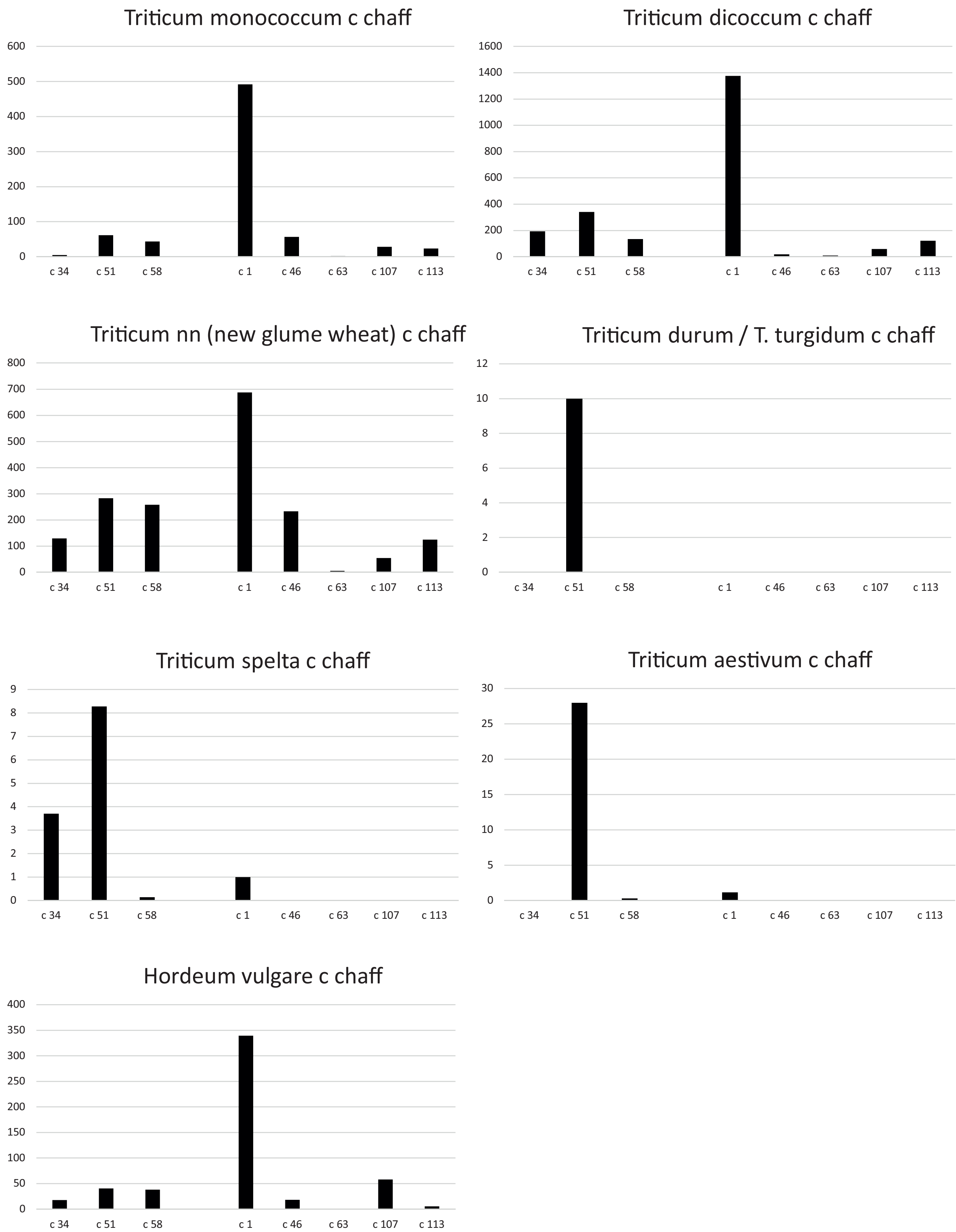


Fig. 8.2.3 B – Concentration (items/litre) of charred cereal grains in the first settlement phase samples of Lucone D (for information on the samples see Appendix 3 and 4); c = charred.

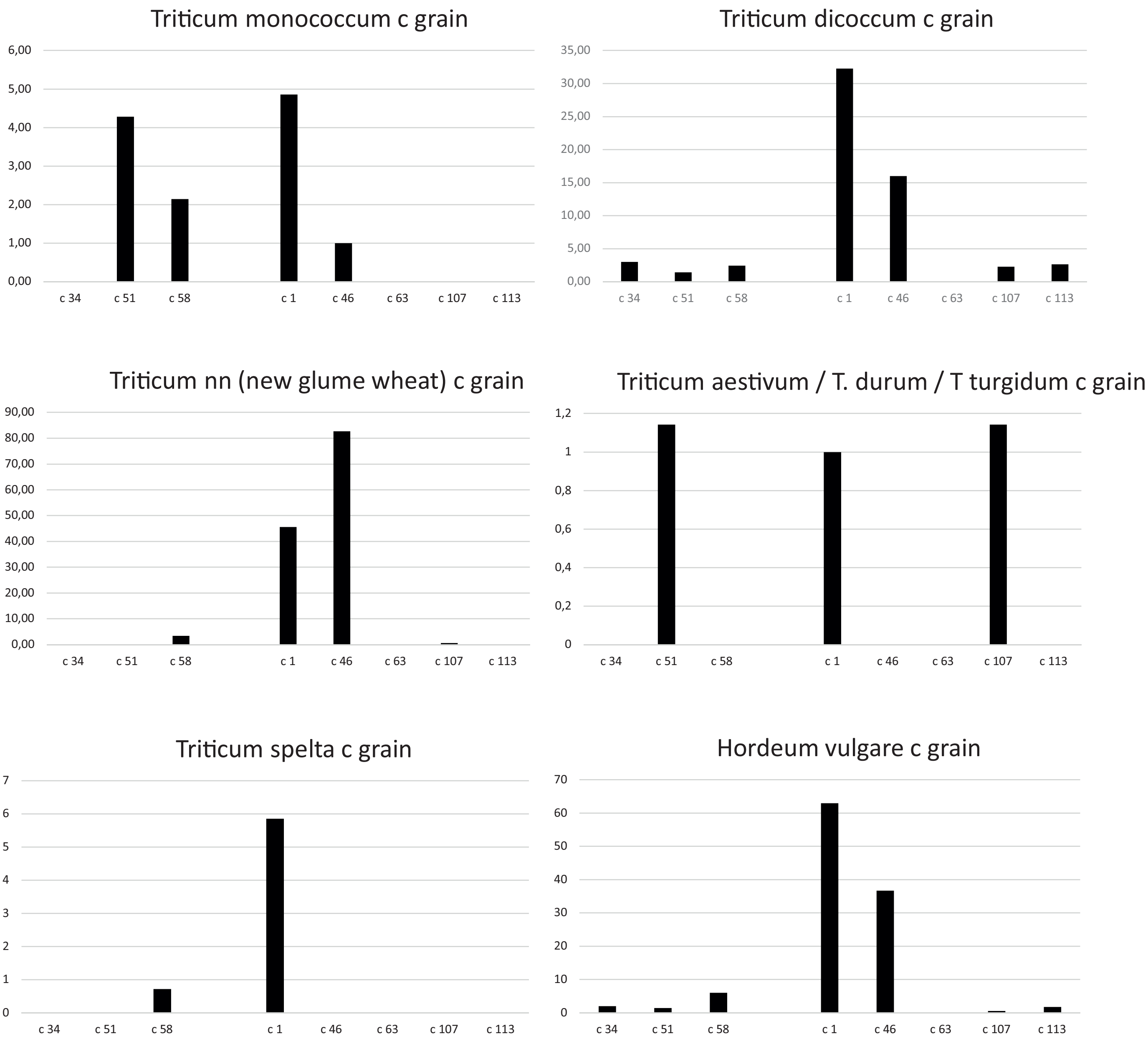


Fig. 8.2.3 C – Concentration (items/litre) of waterlogged cereal remains (chaff and *testa* fragments) in the first settlement phase samples of Lucone D (for information on the samples see Appendix 3 and 4); u = waterlogged.

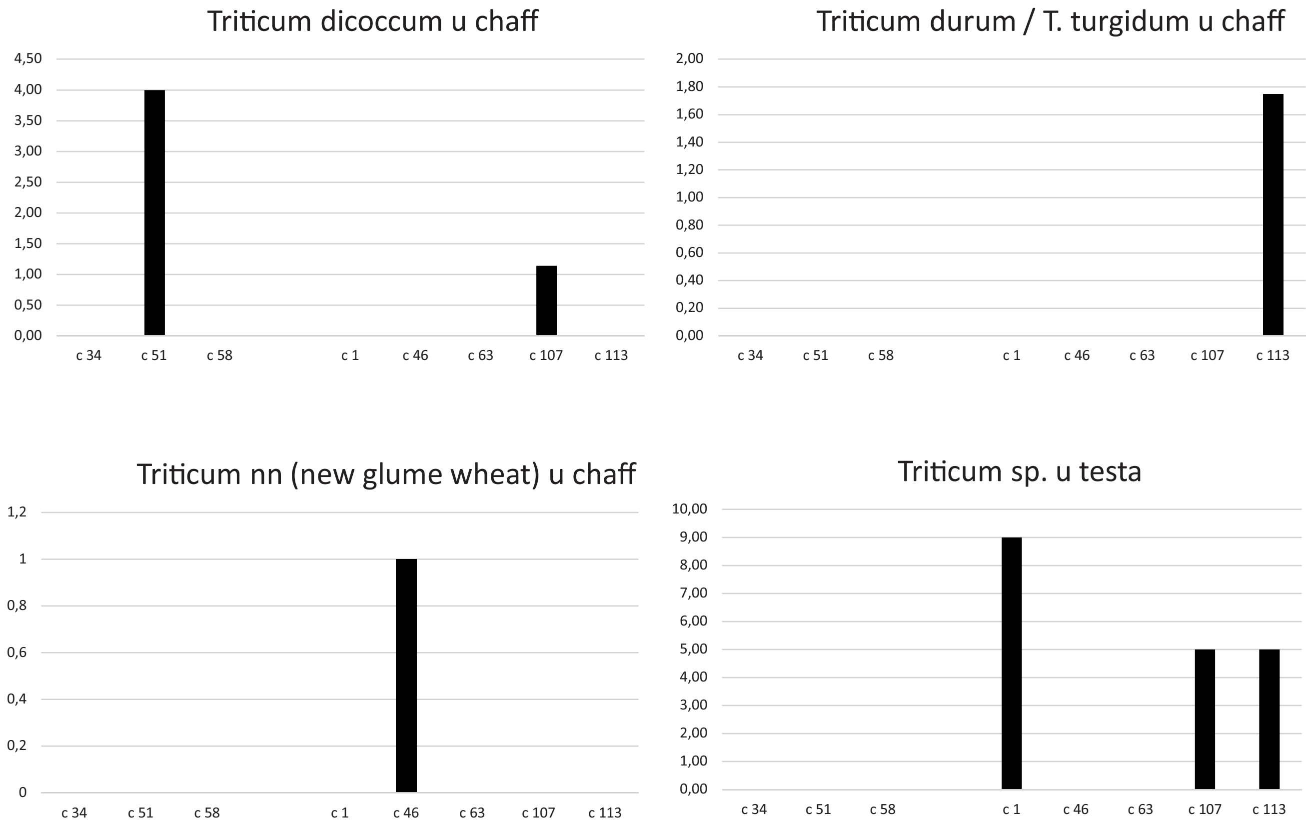


Fig. 8.2.4 A – Concentration (items/litre) of) charred cereal chaff remains in the second settlement phase samples of Lucone D (for information on the samples see Appendix 3 and 4); c = charred.

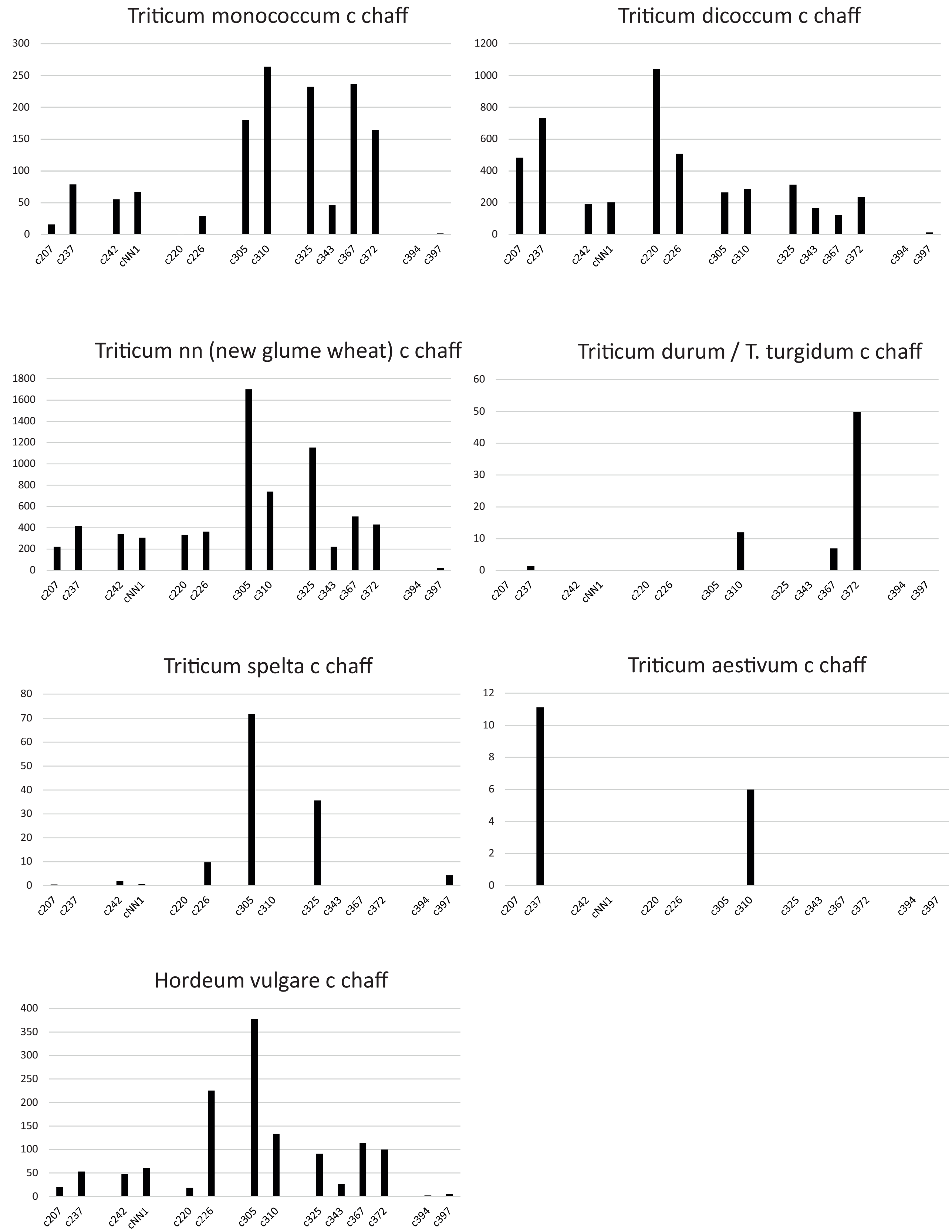


Fig. 8.2.4 B – Concentration (items/litre) of charred cereal grains in the second settlement phase samples of Lucone D (for information on the samples see Appendix 3 and 4); c = charred.

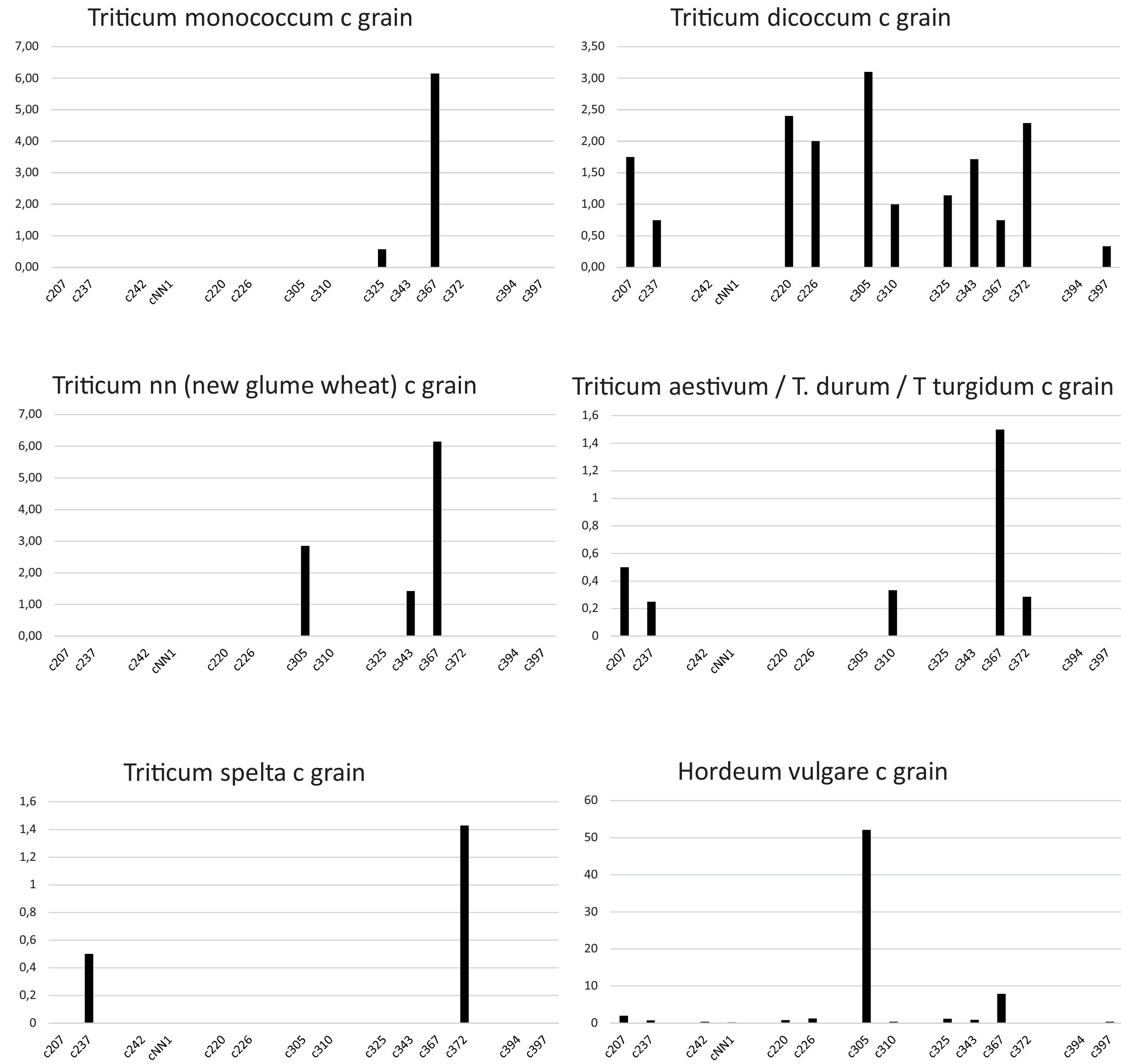


Fig. 8.2.4 C – Concentration (items/litre) of waterlogged cereal remains (chaff and testa fragments) in the second settlement phase samples of Lucone D (for information on the samples see Appendix 3 and 4); u = waterlogged.

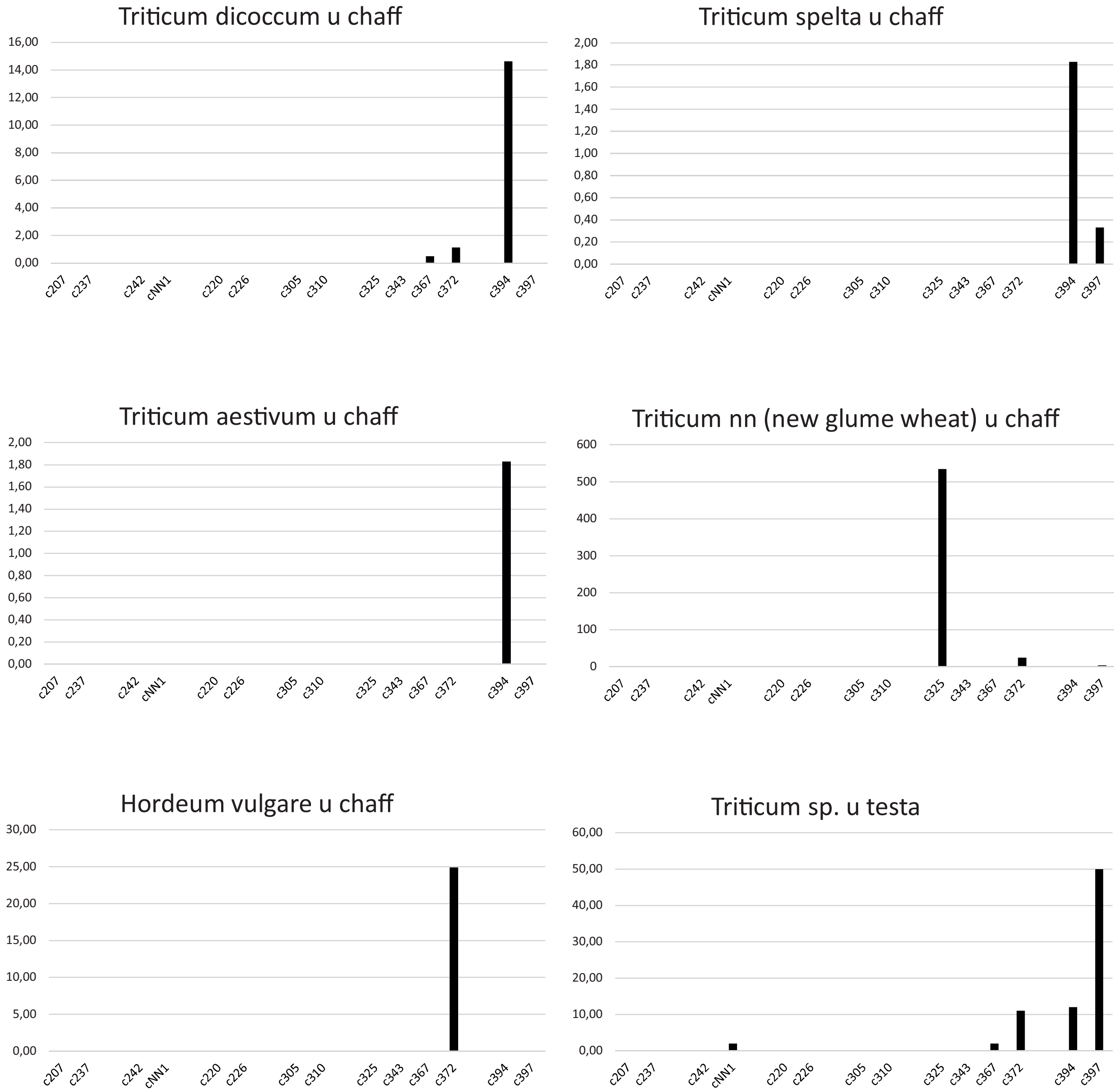


Fig. 8.2.5 – Ear accumulation found in the burnt layer of Lucone D (sample LUC c408).

Fig. 8.2.6 – Harvesting knife from Polada, two of the four flint blades are missing (after de Marinis 2000).

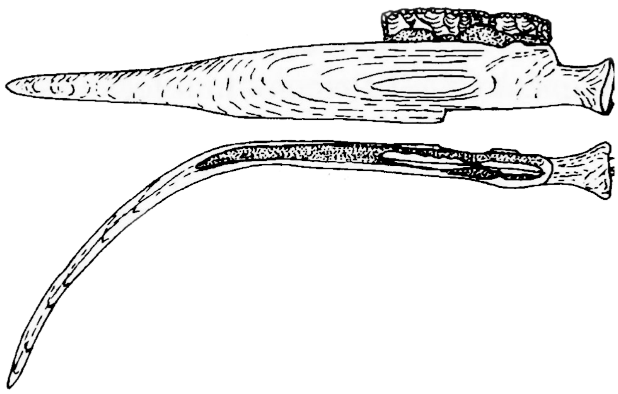


Fig. 8.2.7 – Sickle from Lucone D, RR1473 (© photo by Civico Museo Archeologico della Val Sabbia, reproduced with permission).

Fig. 8.6.1 – Present-day distribution of *Orlaya grandiflora* (from Meusel and Jäger 1992)

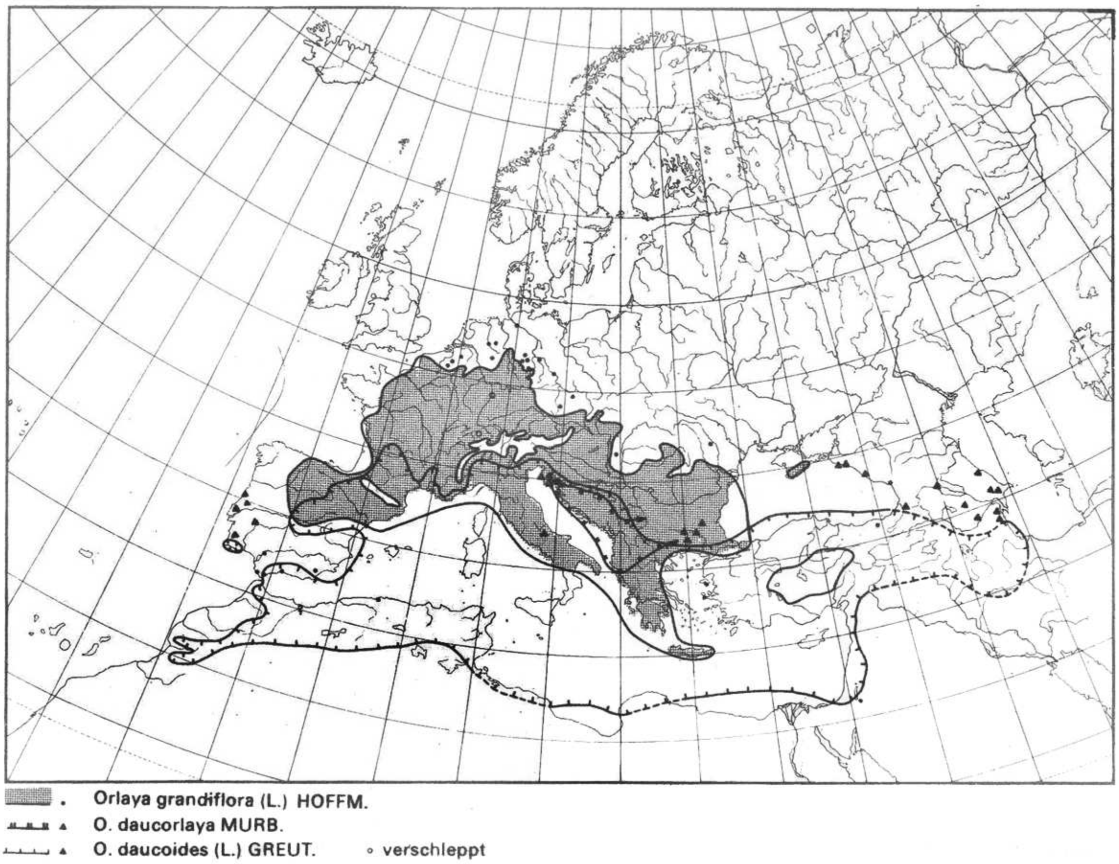


Fig. 8.8.1 – Flowering specimen of *Carthamus tinctorius* safflower, on the left, and of *C. lanatus* (Rocca di Manerba, luglio 2008) on the right (© photos C. Ravazzi).

Fig. 8.8.2 – a) Original cultivation area of *Carthamus tinctorius* (from Meusel & Jägger 1992);

(b) location of the sites with *Carthamus* fossil finds (after Marinova & Riehl 2009), sites with identifications of *Carthamus tinctorius* are marked in red. The new finds from Lavagnone and Lucone D are added.

a

b

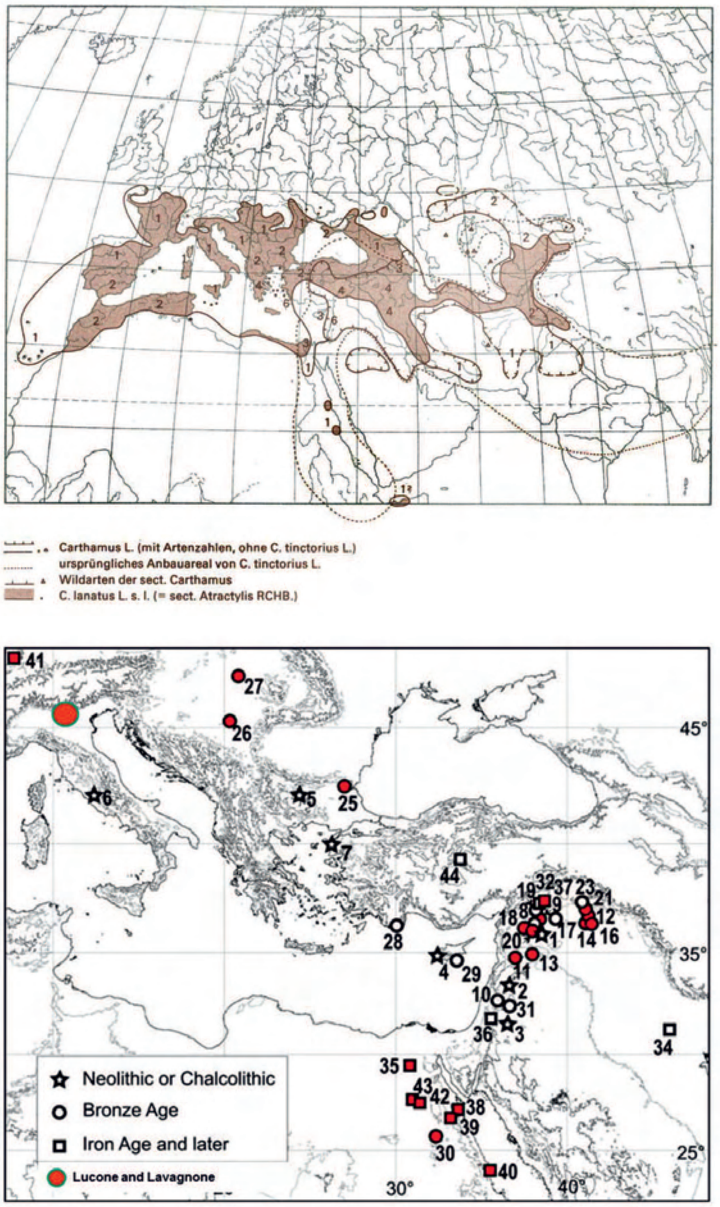
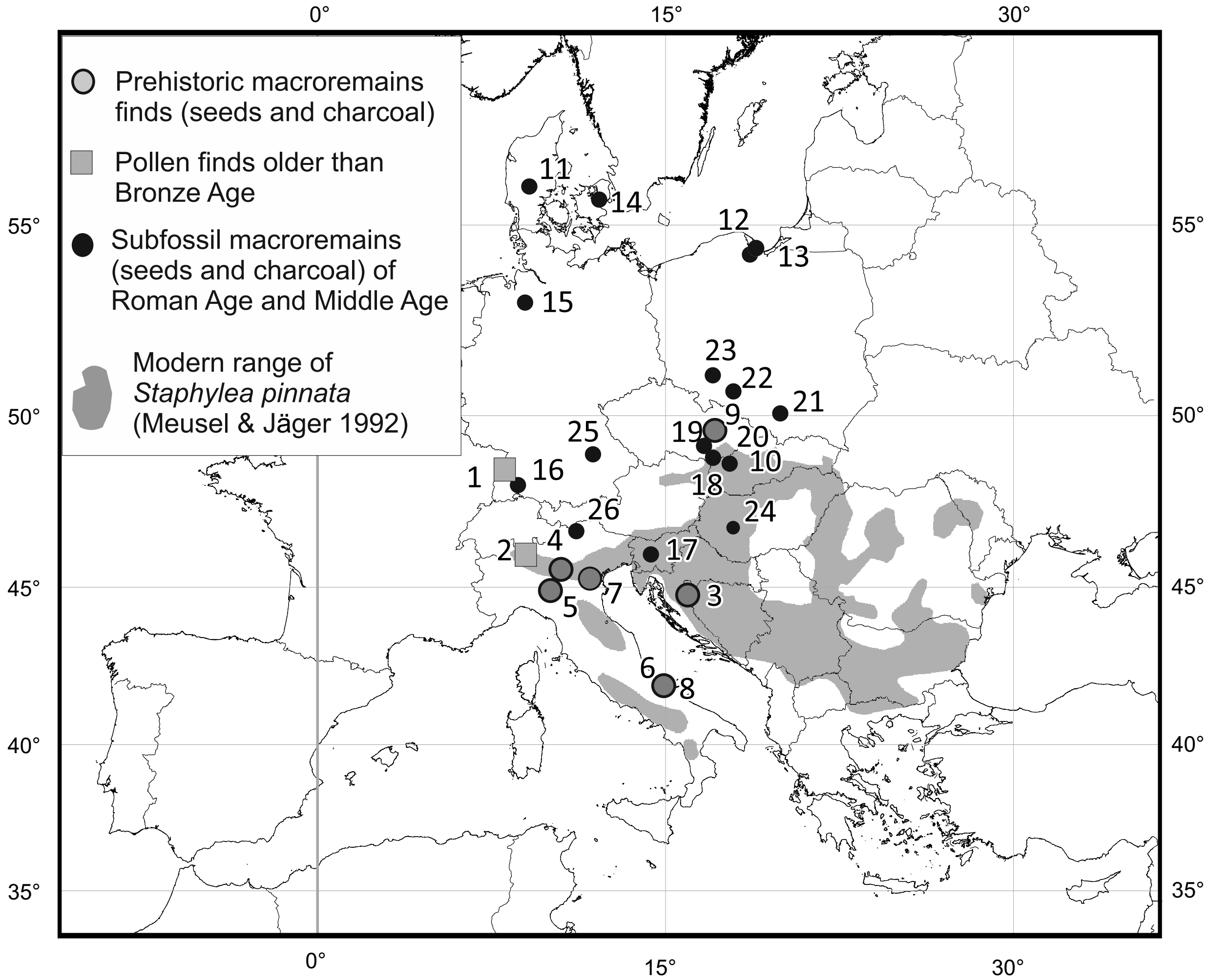


Fig. 8.8.3 – On the left, a specimen of *Staphylea pinnata;* on the right, details of flowers and fruits (Rocca di Manerba).

Fig. 8.8.4 – Modern range of *Staphylea pinnata* (from Meusel & Jägger 1992). Fossil finds of *Staphylea pinnata* are marked in the map according to type of remains and age (see the table below for an explanation of numbers).



Site		Age		type of remain	references
3 Ripać	BiH	"prehistoric"	--	seeds	Anonymous 1894, Heiss 2010
4 Lucone D (Brescia)	I	Early Bronze Age	2030-1980 BC	seeds (15 + 1 fragments)	this paper
5 Castione dei Marchesi (Parma)	I	Bronze Age	--	seeds (2)	Strobel & Pigorini 1864, Avetta 1908, Mutti et al. 1988, Latalowa 1994
6 Masseria Mammarella (Campobasso)	I	Late Bronze Age	--	seeds? (2)	Barker et al. 1995, Costantini 2002
7 Arquà Petrarca (Padova)	I	Bronze Age ??	--	seeds (2)	unpub.
8 Santa Margherita (Campobasso)	I	Early Iron Age	8th-6th c. BC	seeds? (11)	Barker et al. 1995, Costantini 2002
9 Těšetice	CZ	Early Iron Age	--	wood fragments (2)	Opravil 1961, 1967, Latalowa 1994
10 Očkov (Nitra)	SK	early Roman period	--	wood fragments	Kolnìk 1959, cited in Hendrych 1980
11 Brænde	DK	Roman period		seeds (1 + 2 fragments)	Mackeprang 1936, cited in Latalowa 1994
12 Pruszcz Gdański (Praust)	PL	Roman period	end 2nd c. AD	seeds (7)	Latalowa 1994
13 Pruszcz Gdański (Praust)	PL	Roman period	3rd/4th c. AD	seeds (1)	Pietrzak 1997, cited in Heiss 2010
14 Vindinge (Roskilde)	DK	Roman period	3rd/4th c. AD	seeds (1)	Robinson 1992, cited in Heiss 2010
15 Mahndorf (Bremen)	D	late Roman period	--	seeds (1)	Baas 1975, cited in Latalowa 1994
16 Trossingen (Kreis Tuttlingen)	D	Early Medieval	6th c. AD	seeds	Rösch & Fischer 2004
17 Resnikov Prekop (Ljubljansko Barje)	SL	Early Medieval	680-880 cal AD (1250 ± 40 uncal)	seeds (120 + 7 fragments)	Culiberg 2006
18 Mikulčice	CZ	Early Medieval	8th-10th c. AD	seeds (7 + 2 fragments)	Opravil 1972, cited in Opravil 2000
19 Lišeň	CZ	Early Medieval	8th-10th c. AD	wood fragments (3)	Opravil 1961, 1967, cited in Opravil 2000
20 Brno	CZ	Medieval	ca 1100 AD	seeds (6)	Rybníček et al. 1998
21 Kraków	PL	Medieval	10th-11th c. AD	seeds (1)	Wasylikowa unpubl., cited in Latalowa 1994
22 Opole	PL	Medieval	10th-12th c. AD	seeds (2)	Klichowska 1956, cited in Latalowa 1994
23 Wroclaw	PL	Medieval	11th-13th c. AD	several seeds	Kosina 1995
24 Kerekì	H	Medieval	--	seeds	Hartyáni & Nováki (1975), cited in Opravil (2000)
25 Kelheim	D	Late Medieval	--	seeds (1)	Gregor 1985
26 Tirolo	I	Late Medieval		seeds (3)	Oeggl & Heiss (2002), cited in Heiss 2010
1 Origlio lake (Lugano, Ticino)	CH		5000-5500 cal BP	pollen grains (sporadic)	Tinner et al. 1999
2 Huzenbacher See (Baiersbronn)	D		ca 8700 and 5500 cal BP	pollen grains (2)	Rösch pers. com.

Fig. 8.8.5 – The two artefacts including bladdernut seeds from EBA layers of Lucone D (© photos Civico Museo Archeologico della Val Sabbia, reproduced with permission).

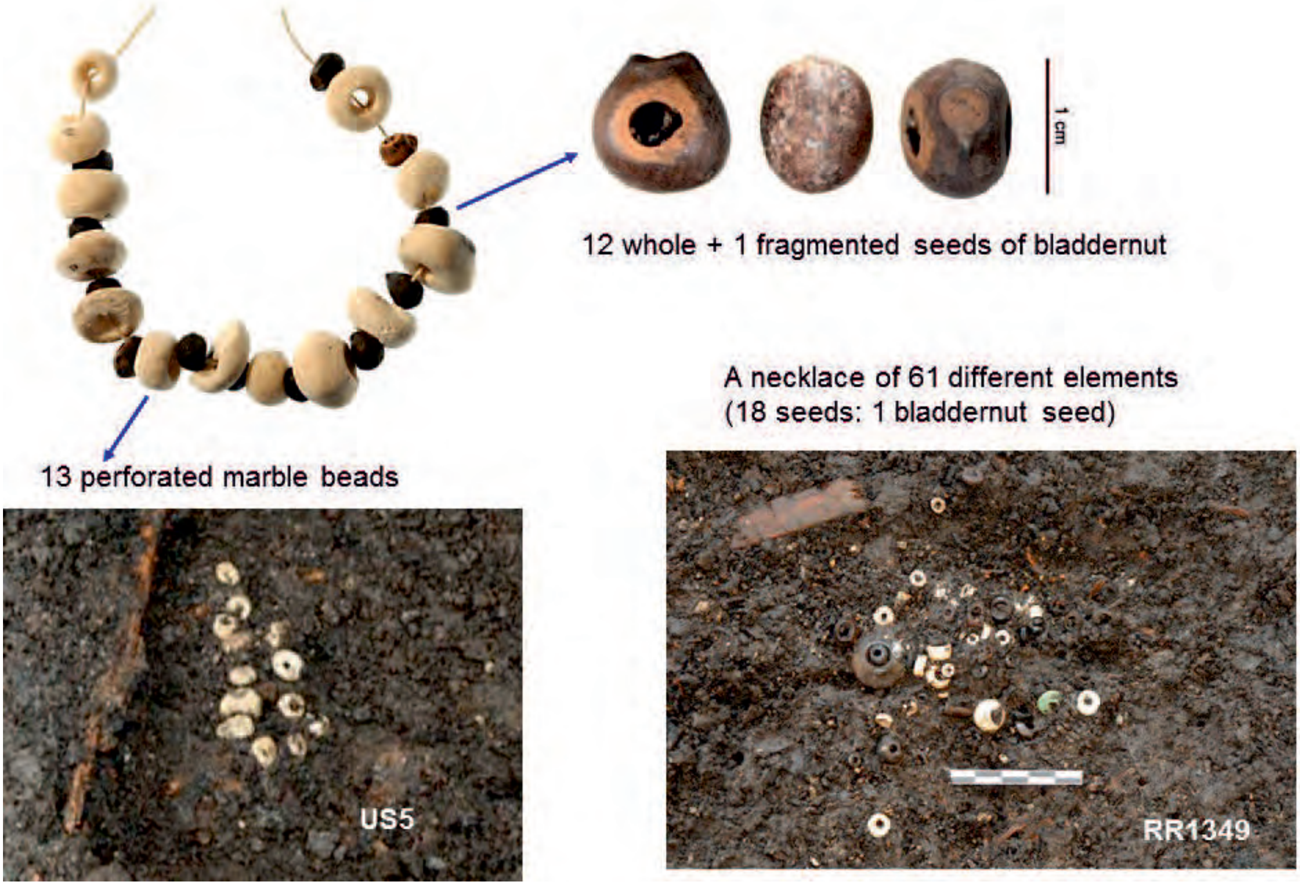
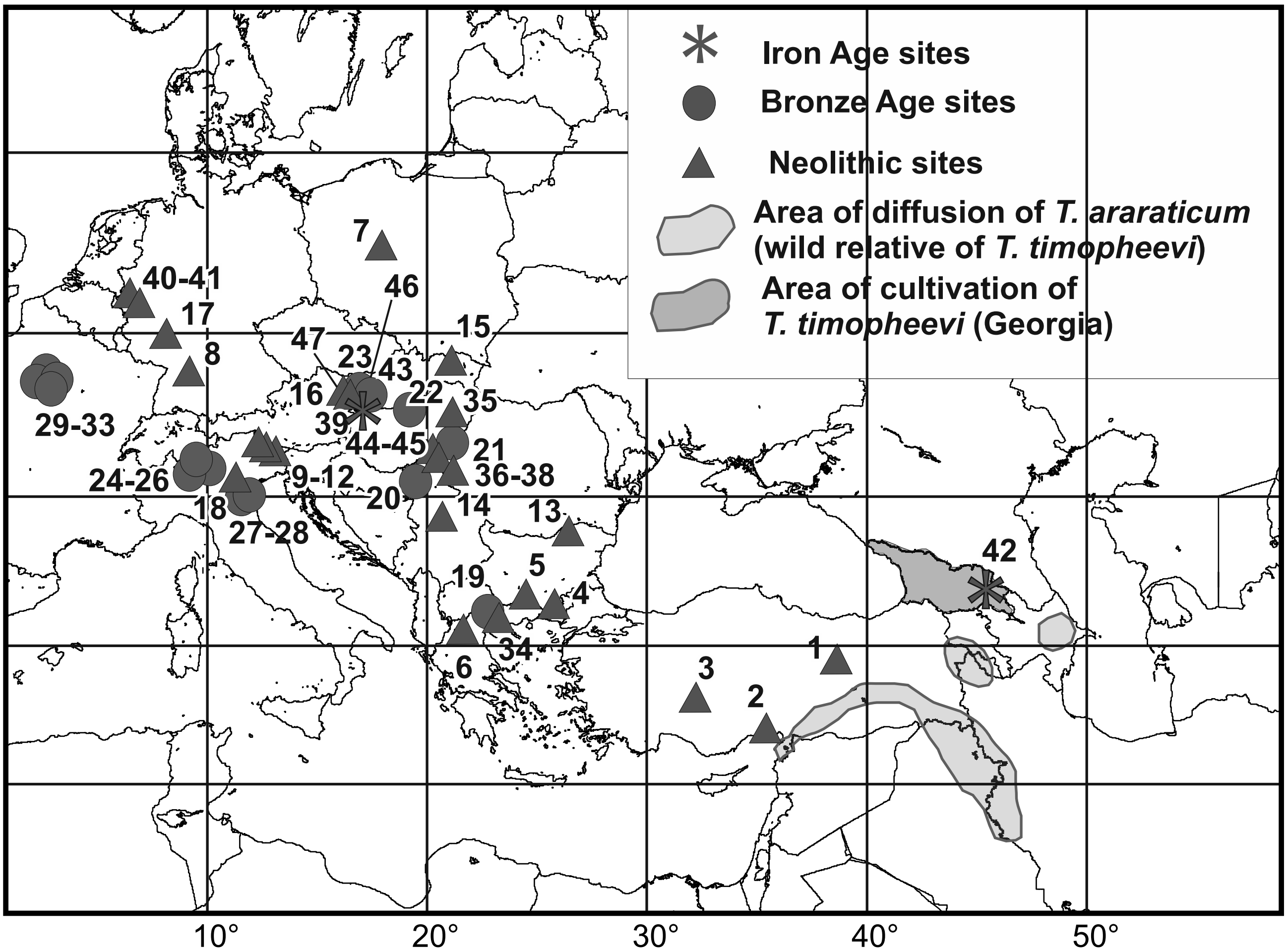


Fig. 8.8.6 – Distribution of fossil finds of NGW (see the list below for an explanation of numbers).



1 Cafer Höyük, TK (de Moulins 1993)
2 Mersin Yumuktepe, TK (Fiorentino & Ulas 2010)
3 Catalhöyük, TK (Fairbairn et al. 2002)
4 Makri, GR (Jones et al. 2000)
5 Arkadikos, GR (Jones et al. 2000)
6 Makriyialos, GR (Jones et al. 2000)
7 Kujawy region (several sites), P (Bieniek 2002)
8 Vaihingen, D (Bogaard 2002)
9 Sammardenchia, I (Rottoli 2005)
10 Piancada, I (Rottoli 2005)
11 Pavia di Udine, I (Pessina et al., 2004)
12 Vela di Trento, I (De Gasperi et al. 2006)
13 Karanovo, BG (Kreuz et al. 2005)
14 Vinca, SRB (Borojevic 2010)
15 Brehov-pod, SK (Hajnalova 2007)
16 Hundssteig, A (Kohler-Schneider and Caneppele 2009)
17 Würges, D (Kreuz et al. 2005)
18 Ponte Ghiara, I Carra (in press)
19 Assiros Toumba, GR (Jones et al. 2000)
20 Feudvar, SRB (Borojevic 1991, in Kohler-Schneider 2003)
21 Klara Falva, H (Jones et al., in Kohler-Schneider 2003)
22 Szazhalombattar, H (Berzsenyl et al., 2010)
23 Stillfried, A (Kohler-Schneider 2001)
24 Lucone D, I (Perego this paper)
25 Lavagnone, I (Perego 2007)
26 Sergnano, I (Zanon, unpubl.)
27 Solarolo, I (Carra et al. (in press)
28 Monterenzio Vecchio, I (Carra et al. (in press)
29 Buchères, Aube F (Toulemonde 2013)
30 Bréviandes, Aube F (Toulemonde 2013)
31 Noyen-sur-Seine, Seine-et-Marne F (Toulemonde 2013)
32 Jaulnes, Seine-et-Marne F (Toulemonde 2013)
33 Balloy, Seine-et-Marne F (Toulemonde 2013)
34 Giannitsa, GR (Valamoti and Kotsakis 2007)
35 Ecsegfalva, HU (Bogaard et al. 2007)
36 Hódmezővásárhely-Gorzsa, HU (www.archaeobotany.de, cited in Kenez et al. 2014)
37 Dudeştii Vechi, RO (Fischer and Rösch 2004)
38 Uivar and Parta, RO (Fischer and Rösch 2004)
39 Franchthi Cave, GR (Hansen 1991)
40 Wanlo, DE (Knörzer 1980)
41 Bedburg-Garsdorf , DE (Knörzer 1974)
42 Atskouri, GEO (Bieniek and Licheli 2007)
43 Petit-Beaulieu-Puy-Long, F (Durand and Thirault 2013)
44 Michelstetten, A (Kohler-Schneider and Heiss 2010)
45 Sandberg/Roseldorf, A (Caneppele et al. 2010)
46 Kärnten, Kathreinkogel, A (Zach 2012)
47 Stoitzendorf, Ratzersdorf, Traisen, Ossarn, Grub an der March, A (Kohler-Schneider and Caneppele 2009)

TABLES

Tab. 1.5.1 – Bronze Age sites with archaeobotanical data (fruits/seeds) in N-Italy. For the location of the sites see Fig. 1.5.2

	Site	province	Periods	Datings of archaeological periods	site on drained mineral soil	waterlogged site	m asl	ARCHAEOBOTANY reference publication	carpoflora	anthracology	pollen	wood	dendrochronology
1	Alba	CN	MBA, LBA		X		170	Motella De Carlo 1995	X	X		X	
2	Zignago	SP	LBA (Bronzo Recente)		X		700	Castelletti 1976	X	X			
3	Arene Candide	SV	N, Ch, EBA, MBA	c. 5800-1500	X		60	Nisbet 1997, 2006; Arobba et al. 1996, 1999b, 1997; Arobba & Vicino 2003; Evett & Renfrew 1971; Biagi & Nisbet 1986; Castelletti & Castiglioni 1999	X	X	X		
4	Bric Tana	SV	MBA, LBA		X		501	Nisbet & Scaife 1998	X	X			
5	Savona - Arma di Nasino	SV	B		X		990	Arobba & Caramiello 2006	X				
6	Castellaro di Uscio	GE	eneolithic/EBA, LBA (Bronzo Finale)		X		721	Nisbet 1990	X	X			
7	Genova - Foce Torrente Bisagno	GE	Ch, EBA		X		10	Arobba & Caramiello 2010	X	X	X	X	
8	Buco del Corno (Entratico)	BG	B		X		270	Castelletti 1972	X				
9	Gavardo-Monte Covolo	BS	N, Ch, EBA		X		554	Pals & Voorrips 1979; Poggiani et al. 2002	X	X	X		
10	Lavagnone (Desenzano del Garda)	BS	EBA IA; EBA IB; EBA II; MBA I; MBA II	2100-1375		X	101	Arpenti et al. 2002; Perego R. (this work); de Marinis et al. 2005	X		X		X
11	Lucone D (Lucone di Polpenazze)	BS	EBA I A; EBA I B; MBA	2100-1305		X	249	Badino et al. 2011; Perego (this work); Martinelli 1989 and 1990 (dendro); Valsecchi et al. 2006	X	X	X		X
12	Castellaro del Vhò di Piadena	CR	MBA I - LBA I	1600-1225	X	X	21	Rottoli 1997, 2001; Ravazzi et al. 2001; Martinelli 2001	X	X	X		X
13	Ostiano San Salvatore	CR	EBA		X		42	Nisbet 1982	X				
14	Bosisio Parini	LC	EBA			X	280	Sordelli 1896, Castelletti 1972	X				
15	Barche di Solferino	MN	EBA II	1800-1600		X	154	Landi 1954; Follieri 1970, 1974; Acanfora 1970	X			X	
16	Castellaro Lagusello	MN	MBA I; MBA II	1575-1305		X	99	Bertoldi, 1968; Carra 2007; Dal Corso et al. 2013; Carra & Cattani 2002	X		X		
17	Monte Castellaccio	BO	EBA, MBA, LBA	2600-1200	X		76	Bandini Mazzanti et al. 1996; Mercuri et al. 1999	X		X		
18	Monterenzio Vecchio	BO	B		X		586	Carra 2013	X				
19	Sant'Agata Bolognese - Viadotto Crocetta	BO	MBA	1400-1300	X		14	Marchesini et al. 2010	X	X	X		
20	Montale, Casetlnuovo di Rangone	MO	MBA; LBA	1600-1175	X		71	Forlani et al. 1988; Mercuri et al. 2006	X	X	X	X	
21	Tabina di Magreta (terramara), Formigine	MO	MBA II; LBA	1600-1175	X		57	Bertolani et al. 1988; Bandini Mazzanti & Taroni 1988a, b; Forlani et al. 1988	X			X	
22	Monte Leoni	PR	MBA, LBA		X		150	Ammermann 1976; Pals & Vorresp 1979	X	X	X		
23	Noceto, vasca	PR	MBA		X		81	Aceti et al. 2009; Rottoli 2009	X	X	X	X	
24	Solarolo	RA	MBA, LBA (Bronzo Recente)	1650-1550, 1200	X		25	Carra 2009	X				
25	Terramara S. Rosa di Poviglio	RE	MBA; LBA	1600-1175	X		21	Ravazzi 1992; Ravazzi et al. 2004; Rottoli 1987; Rottoli & Motella 2003	X	X	X	X	
26	Fiavè	TN	EBA II; MBA	1800-1305		X	651	Greig 1984; Rowley Conwy & Jones 1984; Jones 1985; Schweingruber F.H. 1984; Karg 1998; Jarmann & Gamble 1975	X	X	X	X	
27	Molina di Ledro	TN	EBA	2100-1600		X	656	Dalla Fior 1947, 1940, 1969; Beug 1961; Pinton & Carrara 2007; Coccolini 2006	X		X		
28	Peciapian - Segonzano	TN	MBA, LBA	1400-1000		X	1209	Silvestri et al. 2009	X	X	X	X	
29	Riparo del Santuario di Lasino	TN	EBA, MBA		X		450	Costantini et al. 2001	X				
30	Riparo Gaban, Piazzina di Martignano	TN	EBA		X		270	Oeggl 1992; Nisbet 1984	X				

Tab. 1.5.1 - continued

	Site	province	Periods	Datings of archaeological periods	site on drained mineral soil	waterlogged site	m asl	ARCHAEOBOTANY reference publication	carpoflora	anthracology	pollen	wood	dendrochronology
31	Schlern, Burgstall	BZ	LBA, R		X		2510	Heiss 2008, 2010; Heiss et al. 2005; Steiner & Heiss 2005	X	X			
32	Maneidtal/Val Maneda Grubensee	BZ	LBA, I, R		X		2435	Heiss 2006, 2008, 2010	X	X			
33	Schluderns, Ganglegg	BZ	MBA; LBA	1400-1000	X		1142	Schmidl & Oeggl 2005, 2007; Schmidl et al 2005; Heiss 2008; Schmidl 2002	X	X			
34	Seeberg - Schwarzsee/Lago Nero	BZ	LBA		X		2035	Castiglioni & Cottini 2000; Oeggl in Niederwanger & Tecchiati 2000	X	X			
35	Seeberg-Sarntal	BZ	B		X		2100	Oeggl 1992	X				
36	Sotciastel	BZ	MBA-LBA		X		1404	Swidrak & Oeggl 1998	X				
37	Elvas Strada, Bressanone	BZ	LBA		X		566	Oeggl unpub. in Schmidl et al. 2005	X				
38	St. Walburg (Ulten), Kirchbichl	BZ	BA	500-200	X		1200	Heiss, 2008, 2010; Heiss et al., 2005; Steiner and Heiss, 2005	X	X			
39	Castel de Pedena	BL	B, I		X		610	Castiglioni & Rottoli 2012	X	X			
40	Cisano	VR	EBA I; EBA II; MBA	2100-1305		X	69	Nisbet 1996	X	X			
41	Custoza	VR	LBA		X		119	Nisbet, 1999	X	X			
42	Fabbrica dei Soci	VR	MBA, LBA		X		10	Castiglioni & Rottoli 1992, 1994	X	X			
43	Gazzo Veronese - Ponte Nuovo	VR	BA		X		17	Marchesini & Marvelli 2007	X				
44	Lazise-La Quercia	VR	EBA I B; EBA I C; EBA II; MBA	1990-1305		X	69	Castelletti et al. 1992, Aspes 1987 (dendro)	X	X			X
45	Povegliano Veronese, loc. Muraiola	VR	BA		X		460	Motella 1997	X	X		X	
46	Valeggio sul Mincio	VR	EBA, MBA	1500-1700		X	92	Villaret von Rochow 1958	X				
47	Montegrotto - via Neroniana	PD	B, I, R, Ma	1st c. BC-1st c. AD; 9th-12th c. AD	X		8	Miola et al. 2011	X		X		
48	Treviso - Piazza San Pio X	TV	LBA, I	10th - 9th c.BC	X		19	Marchesini & Marvelli 2004	X	X	X		
49	Canàr di San Pietro Polesine	RO	EBA I; EBA II	2100-1600		X	7	Accorsi et al. 1998; Castiglioni et al. 1998; Martinelli et al. 1998	X	X	X	X	X
50	Porpetto	UD	EBA, MBA, LBA	2100-1175		X	9	Rottoli & Martinelli 1995	X				X

Tab. 2.1 – Overview of the studied samples.

LAVAGNONE

N° of samples analysed	archaeological sector / age *SU (Stratigraphic Unit)*	type of sample	method	organic fraction analysed: mm (n° of samples)	quantification
24	sector A / EBA	surface samples	rapid screening	4, 2, 0.35 (11)	semi-quantified
7	*SU338a*				
15	*SU338c*				
2	*SU338d*				
11	sector A / EBA	surface samples	full analysis	4, 2, 0.35	fully quantified
2	*SU338a*				
8	*SU338c*				
1	*SU472*				
9	sector A_profile section 98 / EBA	samples from profile sequence	full analysis	4, 2, 0.35	fully quantified
1	*SU337*				
1	*SU338a*				
7	*SU338c*				
13	sector D / MBA	surface samples	full analysis	4, 2, 0.35	fully quantified
9	*SU4006*				
1	*SU4009*				
1	*SU4010*				
2	*SU4004*				
88	sector D_core LAV37 / Neolithic-MBA	samples from the stratigraphic sequence of Lavagnone basin	full analysis	1, 0.35	fully quantified
23	*MBA*				
15	*EBA II*				
3	*EBA IC*				
2	*EBA IB*				
4	*EBA IA*				
15	*Chal*				
26	*Neol*				

LUCONE D

N° of samples analysed	archaeological sector / age *SU (Stratigraphic Unit)*	type of sample	method	organic fraction analysed: mm (n° of samples)	quantification
13	1st phase / EBA	surface samples	rapid screening	4 (12), 2 (12), 0.35 (6)	semi-quantified
8	*SU4 (=SU12)*				
5	*SU5*				
8	1st phase / EBA	surface samples	full analysis	4, 2, 0.35	fully quantified
3	*SU4 (=SU12)*				
5	*SU5*				
25	2nd phase / EBA	surface samples	rapid screening	4(23), 2 (24), 0.35 (8)	semi-quantified
3	*cumulus SU84*				
2	*SU127 under SU84*				
5	*lower part of cumulus SU84*				
3	*US outside any cumulus areas*				
10	*cumulus SU160*				
2	*cumulus SU88(=SU116)*				
14	2nd phase / EBA	surface samples	full analysis	4, 2, 0.35	fully quantified
2	*cumulus SU84*				
2	*SU127 under SU84*				
4	*lower part of cumulus SU84*				
3	*US outside any cumulus areas*				
3	*cumulus SU160*				

Tab. 2.2 – Overview of the analysed goat/sheep coprolites.

LUCONE D

sediment sample	archaeological phase	n° of analysed coprolites	name of coprolites
LUC c1	1st phase	10	LUC 1-LUC 10
LUC c107	1st phase	10	LUC 11-LUC 12, LUC 14, LUC 17, LUC 19-LUC 24
LUC c113	1st phase	4	LUC 13, LUC 15-LUC 16, LUC 18
LUC cNN1	2nd phase	24	LUC 25-LUC 48
LUC c320	2nd phase	10	LUC 49-LUC 58
LUC c397	2nd phase	1	LUC 59
LUC c372	2nd phase	2	LUC 60-LUC 61
LUC c394	2nd phase	3	LUC 62-LUC 64
total		**64**	

LAVAGNONE

sediment samples	cultural age	n° of analysed coprolites	name of coprolites
LAV c258	EBA	10	LAV 1- LAV 8, LAV 34-LAV 35
LAV B2/12	EBA	6	LAV 9-LAV 14
LAV B2/18	EBA	1	LAV 15
LAV c195bis	EBA	5	LAV 16-LAV 20
LAV W04	EBA	3	LAV 21, LAV 23, LAV 37
LAV E2	EBA	3	LAV 22, LAV 25, LAV 28
LAV E1	EBA	2	LAV 24, LAV 27
LAV c195	EBA	5	LAV 26, LAV 31-LAV 32, LAV 36, LAV 39
LAV c168	EBA	1	LAV 29
LAV B2/07	EBA	2	LAV 30, LAV 41
LAV RP02	EBA	2	LAV 33, LAV 42
LAV c132	EBA	1	LAV 38
LAV c76	EBA	1	LAV 40
LAV B1/02	EBA	3	LAV 43-LAV 45
LAV B2/03	EBA	2	LAV 46-LAV 47
core LAV 37 108-113 cm	MBA	1	LAV48
LAV 4075	MBA	1	LAV49
total		**49**	

Tab. 2.3 – Criteria for the quantification of plant remains

Taxa	**Type of remains**	**quantification / recording**
All taxa	whole diaspore (fruit or seed)	1
Cereals	whole grain (carb)	1
	grain fragments with embryo end (carb)	1
	all other grain fragments (carb)	*
	testa (fragments)	*
	spikelet fork	2
	glume base	1
	rachis	n. of internodes
	uppermost ear spikelet	2
	Panicum miliaceum glume fragm	*
	P. miliaceum glume base	1
Linum usitatissimum	whole seeds	1
	seed fragm. with *hilum*	1
	all other seeds fragments	*
	capsule (whole)	10
	top fragm. of capsule segment	1
	other fragm. of capsule segment	*
	fibres	*
Corylus avellana	pericarp fragments (2 cm^2)	1
Quercus sp.	Acorn	1
	Half acorn	1/2
	Pericarp fragments (2 cm^2)	1
	Acorn base	1
	Cupule fragments	*
Cornus mas	stone fragment	*
Maloideae pericarp	half	2
	< ¼	1
Pyrus sp.	Stone cells	*
	Calyx tube remnant	1
Medicago minima	Pod ornament.	1
	Pod ornament. fragm >1/2	1
	Pod ornament. fragm <1/2	*
Trigone seed/fruit (*Fallopia*, *Rumex*, *Carex* etc.)	whole	1
	1/3 fragm	1/3
Bilateral seed/fruit (*Chenopodium album, Portulaca oler. Ranunculus sceleratus* etc.)	whole	1
	half	1/2

* counted in the total number of remains, but not included in the statistical analysis.

Tab. 2.4 – Definition of the plant groups based on their today's ecology and their possible use, based on ethnographical data.

	n.	Ecological and ethnographical groups	Dominant growth forms	Phytosociology Class (Order)	Diagnostic taxa common in the macroremains record
C	**1**	**Cultivated plants**	Terophytes		*Triticum spp., Hordeum spp., Panicum miliaceum, Linum usitatissimum*
		Weeds			
WW	**2.1**	Winter crop weeds on carbonatic-rich soils	Terophytes	Secalinetea	*Aphanes arvensis, Camelina sativa, Fallopia convolvulus, Scleranthus annuus, Torilis arvensis, Valerianella dentata, V. rimosa*
SW	**2.2**	Summer crop weeds / mostly annual ruderals	Terophytes	Chenopodietea (Polygono – Chenopodietalia)	*Anagallis arvensis, Chenopodium album, Legousia sp., Malva sylvestris, Polygonum lapathifolium, P. persicaria, Portulaca oleracea, Setaria viridis, Solanum nigrum, Stellaria media*
RU	**2.3**	Ruderal and crop fields ubiquitary species	Terophytes	Secalinetea-Chenopodietea	*Polycnemum arvense, Viola arvensis*
RU	**2.4**	Ruderal and nitrophilous communities, dry orchards	Geophytes (rizoms), Hemicriptophytes	Artemisietea (Convolvuletalia, Artemisietalia), Chenopodietea (Sisymbrietalia)	*Carex hirta, Lapsana communis, Picris hieracioides, Plantago major, Polygonum aviculare, Potentilla reptans, Ranunculus repens/bulbosus, Sambucus ebulus, Urtica dioica, Verbena officinalis*
MP	**3.1**	**Dry fallow on carbonatic-rich, regolithic soils**	Terophytes and short-lived perennials	Artemisietea (Onopordetalia) Sedo-Scleranthetea (All.: Alysso-Sedion)	*Ajuga chamaepitys, Arenaria serpyllifolia, Daucus carota, Nepeta cataria, Petrorhagia prolifera, Stachys annua*
		Pastures and meadows (seminatural)			
MP	**4.1**	Dry pastures and meadows with summer water deficit, either on thin rocky soils or on well-developed soils	Hemicriptophytes, geophytes	Festuco-Brometea (Brometalia All.: Xero- and Mesobromion)	*Dianthus sp., Teucrium chamaedrys , Thymus sp.*
MP	**4.2**	Drained pastures and meadows with no summer water deficit, with or without manuring	Hemicriptophytes	Molinion-Arrhenatheretea (Arrhenatheretalia)	*Ranunculus acer, Trifolium sp.*
MP	**4.3**	Indistinct pastures and meadows		Mol.-Arrhenateretea and Festuco-Brometea	*Medicago sp., Prunella vulgaris, Rumex acetosella, Silene vulgaris,*
F	**5.1**	**Woodlands, wood edges, clearings**		*varia*	*Agrimonia eupatoria, Cornus mas, Corylus avellana, Ficus carica, Fragaria vesca, Hypericum perforatum, Malus/Pyrus, Origanum vulgare, Physalis alkekengi, Prunus sp., Pyrus sp., Quercus sp., R. gr fruticosus, Sambucus nigra, Torilis japonica, Vitis vinifera subsp.sylvestris*
		Wetlands			
LS	**6.1**	Wet terrestrial herb communities (meadows)	Hemicriptophytes, including many tall herbs	Molinion-Arrhenatheretea (Molinetalia, All.: Filipendulion)	*Lycopus europaeus, Lythrum salicaria, Mentha spicata / suaveolens, Ranunculus sardous,*
LS	**6.2**	Telmatic, seasonally dried-up belt	Annual or biennial species completing their life cycle between two floods and survive as dormant seed	Bidentetea (Bidentetalia, All.: Bidention tripartitae (Rumicetum palustris))	*Bidens cernua, Cyperus flavescens, Ranunculus sceleratus, Rumex palustris, R. maritimus, Scirpus radicans*
LS	**6.3**	Flooded or waterlogged littoral zone, 0.5 – 1 m depth	Helophytes	Phragmitetea (Phragmitetalia)	*Alisma plantago aquatica, Schoenoplectus* spp., *Cyperus glomeratus, Polygonum* sp., *Typha latifolia/angustifolia*
A	**7.1**	**Aquatics / open water** Depth > 0.8 m (optimum > 1 m)	Water plants, including rooted and free floating	Potamogetonetea (Potamogetonetalia) + Characeae communities	*Ceratophyllum demersum*, Characeae, *Lemna minor , Myriophyllum spicatum, Najas* spp., *Nymphaea alba, Potamogenton natans, R.* gr *batrachium,*

Tab. 3.1 – Lavagnone: number of taxa according to type of preservation and dating of the samples (25 EBA and 13 MBA samples).

	charred	*slightly charred*	*waterlogged*	*total*
EBA samples	17	2	180	187
MBA samples	28	6	118	135
All samples (EBA + MBA)	33	7	208	223

Tab. 3.2a – Results (n. of remains) of the fully analysed samples of the EBA layers from Sector A of Lavagnone (11 samples). Also ubiquity values are shown.

11 samples

total volume 22,84 litres
total remains (extrapolated) = 65136
total remains (identified) = 10195
total remains identified for statistic analysis = 9853
mean concentration (n. remains / litre) = 2975,48

ecol grp	large ecol grp	taxon	pres.	remain type	n. tot remains	ubiq %	ubiq n.samples	LAV c195 bis	LAV c143	LAV rr115	LAV c 169	LAV c135	LAV NN1	LAV c136	LAV c76	LAV W04	LAV RP02	LAV rr625
				volume saturated in water (l)				1,24	1,80	2,40	1,80	2,00	2,80	2,40	1,50	1,90	4,00	1,00
				concentration (n. remains / l)				**1643,8871**	**6571,6944**	**2650,5313**	**1095,4722**	**3213,0931**	**1099,5714**	**1336,6875**	**1844,1**	**6374,3829**	**2814,5833**	**4086,25**
				n. remains				2038,42	11829,05	6361,275	1971,85	6426,1863	3078,8	3208,05	2766,15	12111,328	11258,333	4086,25
FIELDS																		
cultivated plants																		
1.1	C	Triticum monococcum	c	spikelet fork 2 grains	7,7	18,18	2	0	0	0	0	2	0	0	0	0	5,7	0
1.1	C	Triticum monococcum	c	glume base	25,95	36,36	4	0	0	0	9,7	1	1	0	0	0	14,25	0
1.1	C	Triticum monococcum	c	grain	4,85	18,18	2	0	0	0	0	0	0	2	0	0	2,85	0
1.1	C	Triticum monococcum	c	spikelet fork	219,96	81,82	9	2	0	6	37,1	34,66	6	6	0	2	34,2	92
1.1	C	Triticum cf monococcum	c	glume base	5,7	9,09	1	0	0	0	0	0	0	0	0	0	5,7	0
1.1	C	Triticum cf monococcum	c	spikelet fork	4	9,09	1	0	4	0	0	0	0	0	0	0	0	0
1.1	C	cf Triticum monococcum	c	spikelet fork	18	9,09	1	0	0	0	0	0	0	0	0	0	0	18
1.1	C	Triticum dicoccum	c	ear uppermost part	22	18,18	2	0	0	0	2	0	0	0	0	0	0	20
1.1	C	Triticum dicoccum	c	spikelet fork	1322,68	90,91	10	0	264	177,96	106,5	148,64	126	78	26	159,98	159,6	76
1.1	C	Triticum dicoccum	c	glume base	939,69	90,91	10	10,2	378	149,28	42,95	65,32	51	64	32	69,99	76,95	0
1.1	C	Triticum dicoccum	c	grain	6	45,45	5	1	1	2	0	0	0	1	0	1	0	0
1.1	C	Triticum cf dicoccum	c	ear uppermost part	2	9,09	1	0	0	2	0	0	0	0	0	0	0	0
1.1	C	Triticum cf dicoccum	c	glume base	3,85	18,18	2	0	0	1	0	0	0	0	0	0	2,85	0
1.1	C	Triticum cf dicoccum	c	spikelet fork	99	45,45	5	0	4	16	0	18	0	0	0	4	57	0
1.1	C	Triticum nn (new glume wheat)	c	glume base	210,11	72,73	8	0	66	52,98	33,95	15,33	9	14	16	0	2,85	0
1.1	C	Triticum nn (new glume wheat)	c	spikelet fork	931,14	90,91	10	4	370	159,28	45,1	36,66	62	60	66	0	74,1	54
1.1	C	Triticum nn (new glume wheat)	c	grain	8	18,18	2	0	0	4	0	0	0	0	0	4	0	0
1.1	C	Triticum cf nn (cf new glume wheat)	c	glume base	11,4	9,09	1	0	0	0	0	0	0	0	0	0	11,4	0
1.1	C	Triticum cf nn (cf new glume wheat)	c	spikelet fork	63,6	36,36	4	0	0	8	0	4	0	6	0	0	45,6	0
1.2	C	Triticum cf nn (cf new glume wheat)	c	grain	4	27,27	3	0	2	0	0	0	1	0	1	0	0	0
1.1	C	Triticum durum / T. turgidum	c	rachis	93	45,45	5	0	54	2	2	0	0	19	16	0	0	0
1.1	C	cf Triticum durum/turgidum	c	spikelet fork	16	9,09	1	0	0	0	0	0	0	0	16	0	0	0
1.1	C	cf Triticum durum/turgidum	c	rachis	8	9,09	1	0	0	0	0	0	0	0	8	0	0	0
1.1	C	Triticum spelta	c	ear base	2,85	9,09	1	0	0	0	0	0	0	0	0	0	2,85	0
1.1	C	Triticum spelta	c	spikelet fork	15,4	18,18	2	0	0	0	4	0	0	0	0	0	11,4	0
1.1	C	Triticum spelta	c	glume base	64,1	72,73	8	2	26	8	4	2	2	3	0	0	17,1	0
1.1	C	Triticum spelta	c	grain	1	9,09	1	0	0	0	0	0	1	0	0	0	0	0
1.1	C	cf Triticum spelta	c	glume base	4,85	9,09	1	0	0	0	4,85	0	0	0	0	0	0	0
1.1	C	Triticum aestivum	c	rachis	28,5	9,09	1	0	0	0	0	0	0	0	0	0	28,5	0
1.1	C	Triticum aestivum / T. durum / T. turgidum	c	grain	4	27,27	3	0	0	1	0	0	0	1	0	2	0	0
1.1	C	Triticum monococcum / T. dicoccum	c	spikelet fork	18	27,27	3	0	0	4	4	0	0	0	0	0	0	10
1.1	C	Triticum monococcum / T. dicoccum	c	glume base	9	27,27	3	0	2	6	1	0	0	0	0	0	0	0
1.1	C	Triticum dicoccum / T.spelta	c	spikelet fork	4	9,09	1	0	0	0	0	0	0	4	0	0	0	0
1.1	C	Triticum dicoccum / T.spelta	c	glume base	4	27,27	3	0	0	0	2	1	1	0	0	0	0	0
1.1	C	Triticum dicoccum / T. nn	c	glume base	47,99	18,18	2	0	0	0	0	45,99	0	2	0	0	0	0

Tab. 3.2a - continued

11 samples								LAV c195 bis	LAV c143	LAV rr115	LAV c 169	LAV c135	LAV NN1	LAV c136	LAV c76	LAV W04	LAV RP02	LAV rr625
					sample name													
1.1	C	Triticum dicoccum / T. nn	c	spikelet fork	52,66	27,27	3	0	0	4	0	40,66	0	8	0	0	0	0
1.1	C	Triticum dicoccum / T. durum / T. turgidum	c	glume base	1	9,09	1	0	0	0	0	0	1	0	0	0	0	0
1.1	C	Triticum dicoccum / T. durum / T. turgidum	c	spikelet fork	6	18,18	2	0	4	0	0	0	2	0	0	0	0	0
1.1	C	Triticum nn / T. monococcum	c	spikelet	9,7	9,09	1	0	0	0	9,7	0	0	0	0	0	0	0
1.1	C	Triticum sp.	c	spikelet fork	293,28	54,55	6	0	50	0	29,1	61,32	0	0	0	46,66	34,2	72
1.1	C	Triticum sp.	c	glume base	321,28	72,73	8	7,2	44	0	29,1	30,66	8	4	0	93,32	0	105
1.1	C	Triticum sp.	c	rachis frg	211,07	72,73	8	28,8	67	1	0	15,33	8	0	1	69,99	19,95	0
1.1	C	Triticum sp.	c	ear uppermost part	60,66	18,18	2	0	0	0	0	0	0	14	0	46,66	0	0
1.1	C	Triticum sp.	c	grain	56,69	54,55	6	0	0	17,66	0	0	8	1	1	23,33	5,7	0
1.1	C	Triticum sp.	c	ear base	24,25	54,55	6	0	1	2	3	2	0	2	0	0	14,25	0
1.1	C	Triticum sp.	c	glume frg	n.c.	18,18	2	0	0	n.c.	0	0	0	0	0	n.c.	0	0
1.1	C	Hordeum vulgare	c	grains	65,25	72,73	8	1	22	8	0	0	10	4	1	5	14,25	0
1.1	C	Hordeum vulgare	c	rachis frg	51,5	63,64	7	0	4	8	5,85	4	0	3	1	0	25,65	0
1.1	C	Hordeum vulgare	c	spikelet fork	1104,44	100,00	11	32,8	234	302,56	64,2	67,32	52	66	16	46,66	192,9	30
1.1	C	Linum usitatissimum	c	capsule	32	18,18	2	0	22	0	10	0	0	0	0	0	0	0
1.1	C	Linum usitatissimum	c	seed/fruit	22,4	27,27	3	0	0	0	19,4	1	0	0	0	0	0	2
1.1	C	Cerealia	c	1st rachis segm. frg	629,7	9,09	1	0	0	0	0	0	0	0	0	0	629,7	0
1.1	C	Cerealia	c	spikelet fork	2	9,09	1	0	0	0	0	2	0	0	0	0	0	0
1.1	C	Cerealia	c	glume base	50	27,27	3	0	4	0	0	0	0	0	1	0	0	45
1.1	C	Cerealia	c	stem	7	54,55	6	0	0	0	0	0	0	7	0	0	0	0
1.1	C	Cerealia	c	glume frg	52,98	63,64	7	0	0	52,98	0	0	0	0	0	0	0	0
1.1	C	Cerealia	c	rachis frg	322,28	81,82	9	1	99	70,64	7	50,99	0	15	1	0	25,65	52
1.1	C	Cerealia	c	grain	128,55	100,00	11	4	7	14	15	13	14	14	5	15	8,55	19
1.1	C	Cerealia	c	embryo	n.c.	9,09	1	0	0	0	0	0	0	0	0	n.c.	0	0
1.1	C	Triticum sp.	u	spikelet fork	1938,1	81,82	9	0	2	2	21,4	2	0	2	48	233,3	1545,4	82
1.1	C	Triticum sp.	u	glume base	1707,8	45,45	5	0	0	0	19,4	0	0	0	8	349,95	1325,45	5
1.1	C	Triticum sp.	u	rachis frg	91,1	27,27	3	0	2	0	0	0	0	0	8	0	81,1	0
1.1	C	Triticum sp.	u	testa frg	838,25	81,82	9	93,6	22	35,32	0	15,33	0	0	0	0	672	0
1.1	C	Cerealia testa fragm.	u	seed/fruit	n.c.	18,18	2	0	0	0	0	n.c.	0	0	n.c.	0	0	0
1.1	C	Carthamus tinctorius	u	seed/fruit	2	18,18	2	0	0	0	0	0	0	1	1	0	0	0
1.1	C	Linum usitatissimum	u	fibres	n.c.	45,45	5	n.c.	0	0	n.c.	n.c.	0	0	0	n.c.	0	n.c.
1.1	C	Linum usitatissimum	u	seed/fruit	433,85	100,00	11	14,4	22	37,32	14,55	15,33	8	8	8	116,65	125,6	64
1.1	C	Linum usitatissimum	u	capsule	853,28	100,00	11	28,8	1	1	58,2	15,33	8	1	17	116,65	590,3	16
1.1	C	Triticum dicoccum	u/c	spikelet fork	46,66	18,18	2	0	0	0	0	30,66	16	0	0	0	0	0

Tab. 3.2a - continued

								LAV c195 bis	LAV c143	LAV rr115	LAV c 169	LAV c135	LAV NN1	LAV c136	LAV c76	LAV W04	LAV RP02	LAV rr625
11 samples					sample name													
winter crop weeds																		
2.1	ww	Fallopia convolvulus	c	seed/fruit	23,33	9,09	1	0	0	0	0	0	0	0	0	23,33	0	0
2.1 / 2.3	ww	Buglossoides arvensis	u	seed/fruit	2,85	9,09	1	0	0	0	0	0	0	0	0	0	2,85	0
2.1	ww	Camelina sativa	u	seed	34,85	9,09	1	0	0	0	0	0	0	0	0	0	34,85	0
2.1	ww	Camelina sativa	u	siliqua frg	37,51	27,27	3	0	0	17,66	1	0	0	0	0	0	18,85	0
2.1	ww	Fallopia convolvulus	u	seed/fruit	303,8	100,00	11	45,2	25	3	10,7	64,32	51	31	32	23,33	14,25	4
2.1	ww	cf Fallopia convolvulus	u	seed/fruit	1	9,09	1	0	0	1	0	0	0	0	0	0	0	0
2.1	ww	Papaver argemone	u	seed/fruit	22,53	18,18	2	7,2	0	0	0	15,33	0	0	0	0	0	0
2.1	ww	Papaver dubium	u	seed/fruit	38,66	18,18	2	0	0	0	0	30,66	0	0	8	0	0	0
2.1	ww	Papaver rhoeas	u	seed/fruit	8	9,09	1	0	0	0	0	0	8	0	0	0	0	0
2.1	ww	Scleranthus annuus	u	seed/fruit	30,53	18,18	2	7,2	0	0	0	0	0	0	0	23,33	0	0
2.1	ww	cf Sclerantus annuus	u	seed/fruit	2,85	9,09	1	0	0	0	0	0	0	0	0	0	2,85	0
2.1	ww	Stachys annua	u	seed/fruit	35	36,36	4	0	22	1	0	0	0	0	8	0	0	4
2.1	ww	Torilis arvensis	u	seed/fruit	157,39	45,45	5	0	44	0	0	45,99	0	7	0	0	59,4	1
2.1	ww	cf Torilis arvensis	u	seed/fruit	1	9,09	1	0	1	0	0	0	0	0	0	0	0	0
2.1	ww	Valerianella dentata	u	seed/fruit	1676,57	100,00	11	36	489	283,56	40,8	261,61	98	49	97	116,65	131,95	73
2.1	ww	Valerianella rimosa	u	seed/fruit	1	9,09	1	0	0	0	0	0	0	0	0	1	0	0
summer crop weeds / mostly annual ruderal																		
2.2	sw	Anagallis arvensis	u	seed/fruit	62	36,36	4	0	23	0	0	0	16	7	16	0	0	0
2.2	sw	cf Anagallis	u	seed/fruit	5	9,09	1	0	0	0	0	0	0	0	0	0	0	5
2.2	sw	Atriplex hastata	u	seed/fruit	2,85	9,09	1	0	0	0	0	0	0	0	0	0	2,85	0
2.2 / 2.4	sw	Capsella bursa-pastoris	u	seed/fruit	8	9,09	1	0	0	0	0	0	0	0	8	0	0	0
2.2 / 2.3 / 2.4	sw	Chenopodium album	u	seed/fruit	2226,75	100,00	11	100,8	712	181,6	53,35	185,96	50	233	280	186,64	187,4	56
2.2 / 2.3 / 2.4	sw	Chenopodium sp.	u	seed/fruit	30,53	18,18	2	7,2	0	0	0	0	0	0	0	23,33	0	0
2.2	sw	cf Eragrostis minor	u	seed/fruit	297,73	63,64	7	0	66	35,32	29,1	107,31	16	28	16	0	0	0
2.2	sw	Lamium purpureum	u	seed/fruit	8	9,09	1	0	0	0	0	0	0	0	8	0	0	0
2.2	sw	Lepidium graminifolium	u	seed/fruit	51,66	18,18	2	0	0	0	0	30,66	0	21	0	0	0	0
2.2	sw	Malva sp.	u	seed/fruit	7,2	9,09	1	7,2	0	0	0	0	0	0	0	0	0	0
2.2	sw	Malva sylvestris	u	seed/fruit	54,66	27,27	3	0	0	0	0	15,33	0	0	0	23,33	16	0
2.2	sw	Oxalis corniculata	u	seed/fruit	17,66	9,09	1	0	0	17,66	0	0	0	0	0	0	0	0
2.2	sw	Picris hieracioides	u	seed/fruit	22,4	18,18	2	14,4	0	0	0	0	0	0	8	0	0	0
2.2	sw	Portulaca oleracea	u	seed/fruit	404,35	81,82	9	7,2	154	17,66	4,85	76,65	16	42	0	69,99	16	0
2.2	sw	cf Portulaca oleracea	u	seed/fruit	23,33	9,09	1	0	0	0	0	0	0	0	0	23,33	0	0
2.2 / 5.	sw	Solanum nigrum	u	seed/fruit	45	9,09	1	0	45	0	0	0	0	0	0	0	0	0
2.2 / 2.3	sw	Stellaria media	u	seed/fruit	117,98	36,36	4	0	22	18,66	0	61,32	0	0	16	0	0	0
2.2 / 2.3	sw	Viola arvensis / V. tricolor	u	seed/fruit	4,85	9,09	1	0	0	0	4,85	0	0	0	0	0	0	0

Tab. 3.2a - continued

11 samples					sample name			LAV c195 bis	LAV c143	LAV rr115	LAV c 169	LAV c135	LAV NN1	LAV c136	LAV c76	LAV W04	LAV RP02	LAV rr625
RUDERAL AND CROP FIELD UBIQUITARY SPECIES																		
2.3	RU	Cuscuta sp	u	seed/fruit	7	9,09	1	0	0	0	0	0	0	7	0	0	0	0
2.3	RU	Galeopsis sp.	u	seed/fruit	2,85	9,09	1	0	0	0	0	0	0	0	0	0	2,85	0
2.3	RU	Polygonum persicaria	u	seed/fruit	550,42	81,82	9	14,4	220	52,98	19,4	122,64	16	56	48	0	0	1
2.4	RU	Anthemis tinctoria	u	seed/fruit	63,5	27,27	3	0	0	35,32	4,85	0	0	0	0	23,33	0	0
2.4	RU	Carex hirta	u	seed/fruit	12,85	18,18	2	0	0	0	4,85	0	8	0	0	0	0	0
2.4	RU	Lapsana communis	u	seed/fruit	27,85	27,27	3	0	0	0	4,85	0	0	7	0	0	16	0
2.4	RU	cf Lapsana communis	u	seed/fruit	1	9,09	1	0	0	0	0	0	0	0	0	0	0	1
2.4	RU	Polygonum aviculare	u	seed/fruit	746,13	90,91	10	37	178	127,62	4,85	109,31	82	35	48	0	111,35	13
2.4 / 4.2	RU	Potentilla reptans	u	seed/fruit	454,26	100,00	11	7,2	132	36,32	24,25	61,32	1	15	8	93,32	66,85	9
2.4 / 4.2	RU	Potentilla cf reptans	u	seed/fruit	93	18,18	2	0	0	0	0	0	16	77	0	0	0	0
2.4	RU	Ranunculus acris / R. repens / R. bulbosus	u	seed/fruit	22	9,09	1	0	22	0	0	0	0	0	0	0	0	0
2.4	RU	Ranunculus repens	u	seed/fruit	2	18,18	2	0	0	0	0	1	0	1	0	0	0	0
2.4	RU	Sambucus ebulus	u	seed/fruit	20,66	36,36	4	0	1	17,66	0	1	0	1	0	0	0	0
2.4 / 3. / 2.1	RU	Silene alba	u	seed/fruit	15	18,18	2	0	0	0	0	0	8	7	0	0	0	0
2.4 / 3. / 2.1	RU	Silene cf alba	u	seed/fruit	1	9,09	1	0	0	1	0	0	0	0	0	0	0	0
2.4	RU	Urtica dioica	u	seed/fruit	37,73	18,18	2	14,4	0	0	0	0	0	0	0	23,33	0	0
2.4	RU	Verbena officinalis	u	seed/fruit	1080,05	100,00	11	50,4	469	124,62	14,55	122,64	56	57	104	69,99	2,85	9

Tab. 3.2a - continued

							sample name	LAV c195 bis	LAV c143	LAV rr115	LAV c 169	LAV c135	LAV NN1	LAV c136	LAV c76	LAV W04	LAV RP02	LAV rr625
11 samples																		
GRASSLAND: MEADOWS AND PASTURES																		
2.1 / 2.2 / 3.1	MP	Ajuga cf chamaepytis	u	seed/fruit	2	9,09	1	0	0	0	0	0	0	0	0	0	0	2
2.1 / 2.2 / 3.1	MP	Ajuga chamaepytis	u	seed/fruit	25,66	18,18	2	0	0	17,66	0	0	8	0	0	0	0	0
3.1	MP	Arenaria serpyllifolia	u	capsule	453,7	9,09	1	0	0	0	0	0	0	0	0	0	453,7	0
3.1	MP	Arenaria serpyllifolia	u	seed/fruit	3225,86	100,00	11	123,4	902	548,46	53,35	444,57	176	252	128	489,93	54,15	54
3.1 / 4.1	MP	Carex mucronata	u	seed/fruit	14	9,09	1	0	0	0	0	0	0	14	0	0	0	0
3.1	MP	Carthamus cf lanatus	u	seed/fruit	1	9,09	1	0	0	0	0	0	1	0	0	0	0	0
3.1	MP	Daucus carota	u	seed/fruit	157,42	45,45	5	14,4	66	35,32	9,7	0	0	0	32	0	0	0
3.1	MP	cf Daucus carota	u	seed/fruit	15,33	9,09	1	0	0	0	0	15,33	0	0	0	0	0	0
3.1	MP	Medicago minima	u	seed/fruit (ornam.pod)	9	18,18	2	0	0	0	0	0	1	0	8	0	0	0
3.1	MP	Nepeta cataria	u	seed/fruit	108,5	54,55	6	0	22	17,66	4,85	45,99	8	0	0	0	0	10
3.1	MP	Pastinaca sativa	u	seed/fruit	1	9,09	1	0	0	0	0	0	0	0	0	0	0	1
3.1	MP	Petrorhagia prolifera	u	seed/fruit	117,43	54,55	6	14,4	22	0	9,7	0	16	0	32	23,33	0	0
3.1	MP	Verbascum thapsus / V. crassifolium / V. densiflorum	u	seed/fruit	16	9,09	1	0	0	0	0	0	0	0	0	0	16	0
4.1	MP	Acinos arvensis	u	seed/fruit	15,33	9,09	1	0	0	0	0	15,33	0	0	0	0	0	0
4.1	MP	Campanula rapunculus	u	seed/fruit	15,33	9,09	1	0	0	0	0	15,33	0	0	0	0	0	0
4.1	MP	Carex caryophyllea	u	seed/fruit	23,33	18,18	2	0	0	0	0	15,33	8	0	0	0	0	0
4.1	MP	cf Leucanthemum vulgare	u	seed/fruit	14,2	18,18	2	7,2	0	0	0	0	0	7	0	0	0	0
4.1	MP	cf Plantago media	u	seed/fruit	7,2	9,09	1	7,2	0	0	0	0	0	0	0	0	0	0
4.1	MP	Potentilla cf tabernaemontani	u	seed/fruit	8	9,09	1	0	0	0	0	0	8	0	0	0	0	0
4.1	MP	Potentilla rupestris	u	seed/fruit	7	9,09	1	0	0	0	0	0	0	7	0	0	0	0
4.1	MP	Silene nutans	u	seed/fruit	20,18	18,18	2	0	0	0	4,85	15,33	0	0	0	0	0	0
4.1	MP	Silene vulgaris	u	seed/fruit	2,85	9,09	1	0	0	0	0	0	0	0	0	0	2,85	0
4.1	MP	Teucrium chamaedrys	u	seed/fruit	191,5	72,73	8	14,4	113	3	4,85	0	0	1	24	0	30,25	1
4.1	MP	Thymus sp.	u	seed/fruit	17,66	9,09	1	0	0	17,66	0	0	0	0	0	0	0	0
4.3	MP	cf Alchemilla vulgaris	u	seed/fruit	30,66	9,09	1	0	0	0	0	30,66	0	0	0	0	0	0
4.3	MP	Carex cf pallescens	u	seed/fruit	16	9,09	1	0	0	0	0	0	16	0	0	0	0	0
4.1 / 4.3	MP	Dianthus seguieri / D. carthusianorum	u	seed/fruit	8	9,09	1	0	0	0	0	0	8	0	0	0	0	0
4.3	MP	Knautia arvensis	u	seed/fruit	1	9,09	1	0	0	1	0	0	0	0	0	0	0	0
4.3	MP	Knautia cf arvensis	u	seed/fruit	69,99	9,09	1	0	0	0	0	0	0	0	0	69,99	0	0
4.3	MP	Knautia sp.	u	seed/fruit	137,51	45,45	5	7,2	0	0	0	107,31	8	7	8	0	0	0
4.3	MP	Petrorhagia saxifraga	u	seed/fruit	44,4	27,27	3	14,4	0	0	0	0	0	14	0	0	16	0
4.3	MP	Rumex acetosa	u	seed/fruit	1	9,09	1	0	0	0	0	0	0	0	0	0	0	1
4.3	MP	Rumex acetosella	u	seed/fruit	44,7	54,55	6	0	2	3	9,7	1	0	28	0	0	0	1
4.3	MP	Scabiosa columbaria	u	seed/fruit	2	18,18	2	0	0	0	0	0	1	0	0	0	0	1
4.3	MP	Trifolium cf pratense	u	calix	8	9,09	1	0	0	0	0	0	0	0	8	0	0	0
4.3	MP	Trifolium repens	u	petal	18,85	9,09	1	0	0	0	0	0	0	0	0	0	18,85	0
4.3	MP	Trifolium sp.	u	petal	8	9,09	1	0	0	0	0	0	0	0	8	0	0	0
4.3 / 2.4	MP	Prunella vulgaris	u	seed/fruit	46,55	54,55	6	0	1	0	9,7	0	8	0	24	0	2,85	1

Tab. 3.2a - continued

								LAV c195 bis	LAV c143	LAV rr115	LAV c 169	LAV c135	LAV NN1	LAV c136	LAV c76	LAV W04	LAV RP02	LAV rr625
11 samples					sample name													
WOODLAND, WOOD EDGES, CLEARINGS																		
5.1	F	Agrimonia eupatoria	c	seed/fruit	1	9,09	1	0	1	0	0	0	0	0	0	0	0	0
5.1	F	Corylus avellana	c	seed/fruit frg	0,2	9,09	1	0	0	0	0	0	0,2	0	0	0	0	0
5.1	F	Agrimonia eupatoria	u	seed/fruit	186,05	100,00	11	11,2	3	49,32	11	15	5	14	12	28,33	35,2	2
5.1	F	Alnus sp.	u	fruit scale	1	9,09	1	0	0	0	0	0	0	0	0	0	0	1
5.1	F	Campanula trachelium / C. rapunculoides	u	seed/fruit	22	9,09	1	0	22	0	0	0	0	0	0	0	0	0
5.1	F	Carex cf remota	u	seed/fruit	7,2	9,09	1	7,2	0	0	0	0	0	0	0	0	0	0
5.1	F	Clinopodium vulgare	u	seed/fruit	67,7	36,36	4	0	22	0	0	0	8	0	16	0	21,7	0
5.1	F	Cornus mas	u	stone	132	90,91	10	1	10	8	1	5	13	11	3	7	0	73
5.1	F	Cornus sanguinea	u	stone	1	9,09	1	1	0	0	0	0	0	0	0	0	0	0
5.1	F	Corylus avellana	u	seed/fruit frg	6,35	90,91	10	0,15	1	0,4	0,2	0,75	0,75	0,85	0,65	1,35	0	0,25
5.1	F	Crataegus monogyna	u	stone	8	36,36	4	4	0	0	0	1	2	1	0	0	0	0
5.1	F	Fagus sylvatica	u	seed/fruit	1	9,09	1	0	0	0	0	0	0	0	0	1	0	0
5.1	F	Ficus carica	u	seed/fruit	224,06	81,82	9	7,2	91	53,98	4,85	15,33	9	8	0	0	5,7	29
5.1	F	cf Ficus carica	u	seed/fruit	4,85	9,09	1	0	0	0	4,85	0	0	0	0	0	0	0
5.1	F	Fragaria vesca	u	seed/fruit	8362,27	100,00	11	165,6	2279	667,42	141,95	953,46	421	577	258	1354,14	750,7	794
5.1	F	Hypericum perforatum	u	seed/fruit	1185,76	100,00	11	28,8	462	70,64	4,85	137,97	88	112	16	116,65	130,85	18
5.1	F	Ilex aquifolium	u	seed/fruit	1	9,09	1	0	0	0	0	0	0	0	1	0	0	0
5.1	F	Luzula cf luzuloides	u	seed/fruit	22	9,09	1	0	22	0	0	0	0	0	0	0	0	0
5.1	F	Maloideae	u	pericarp <1/4 frg	643,04	100,00	11	11,2	23	40,66	23,55	18,33	3	7	32	251,3	210	23
5.1	F	Malus / Pyrus	u	seed/fruit	16,2	36,36	4	7,2	0	0	0	0	0	7	1	0	0	1
5.1	F	Malus sp.	u	seed/fruit	20,55	63,64	7	3	1	1	2	0	2	0	0	3	8,55	0
5.1	F	Malus sylvestris	u	seed/fruit	14	27,27	3	0	0	0	0	1	1	0	0	0	0	12
5.1	F	Origanum vulgare	u	seed/fruit	1026,38	100,00	11	93,6	154	142,28	14,55	183,96	88	84	80	69,99	80	36
5.1 / 6.3	F	Physalis alkekengi	u	seed/fruit	604,7	90,91	10	15,4	91	58,98	9,7	49,99	17	17	9	256,63	80	0
5.1	F	Phyteuma spicatum	u	seed/fruit	40,99	18,18	2	0	0	17,66	0	0	0	0	0	23,33	0	0
5.1	F	Prunus spinosa	u	stone	1	9,09	1	1	0	0	0	0	0	0	0	0	0	0
5.1	F	Prunus sp.	u	stone frg	6,85	27,27	3	0	0	1	4,85	0	0	0	1	0	0	0
5.1	F	Pyrus piraster	u	seed/fruit	50,33	63,64	7	3	0	0	2	15,33	9	0	1	1	0	19
5.1	F	Pyrus sp.	u	seed	8	9,09	1	0	0	0	0	0	0	0	8	0	0	0
5.1	F	Pyrus sp.	u	stone cells	957,81	63,64	7	7,2	88	70,64	0	30,66	0	0	72	163,31	0	526
5.1	F	cf Pyrus	u	seed/fruit frg	21,7	9,09	1	0	0	0	0	0	0	0	0	0	21,7	0
5.1	F	Quercus sp.	u	aborted acorn	15,33	9,09	1	0	0	0	0	15,33	0	0	0	0	0	0
5.1	F	Quercus sp.	u	cupule frg	98,85	18,18	2	0	0	0	4,85	0	0	0	0	0	0	94
5.1	F	Quercus sp.	u	seed/fruit base	81	81,82	9	0	4	9	1	8	2	6	12	6	0	33
5.1	F	Quercus sp.	u	seed/fruit frg> 5mm	302,4818	100,00	11	1,07	6,05	5,415	22	5,76625	3,85	3,2	10,5	19,9975	113,633	111
5.1	F	Rosa sp.	u	seed/fruit	8,85	27,27	3	0	0	0	0	0	0	0	5	1	2,85	0
5.1	F	Rubus aggr. fruticosus	u	seed/fruit	5395,91	100,00	11	176,4	1081	539,5	101,85	630,88	509	365	84	1011,53	211,75	685
5.1	F	Rubus cf idaeus	u	seed/fruit	15,33	9,09	1	0	0	0	0	15,33	0	0	0	0	0	0
5.1	F	Rubus sp.	u	seed/fruit	8	9,09	1	0	0	0	0	0	0	0	8	0	0	0
5.1	F	Rumex sanguineus	u	seed/fruit	4,85	9,09	1	0	0	0	4,85	0	0	0	0	0	0	0
5.1	F	Sambucus nigra	u	seed/fruit	137	9,09	1	0	0	0	0	0	0	0	0	0	0	137
5.1	F	Silene dioica	u	seed/fruit	14	9,09	1	0	0	0	0	0	0	14	0	0	0	0
5.1	F	cf Sorbus aria	u	seed/fruit	1	9,09	1	0	0	0	0	1	0	0	0	0	0	0
5.1	F	Stachys sylvatica	u	seed/fruit	22	9,09	1	0	22	0	0	0	0	0	0	0	0	0
5.1	F	Torilis japonica	u	seed/fruit	1	9,09	1	0	0	0	0	0	0	0	0	0	0	1
5.1	F	Viola riviniana/ V. reichenbachiana	u	seed/fruit	22	9,09	1	0	22	0	0	0	0	0	0	0	0	0
5.1	F	Vitis sp.	u	tendril frg	7,2	9,09	1	7,2	0	0	0	0	0	0	0	0	0	0
5.1	F	Vitis vinifera sub. sylvestris	u	seed/fruit	291,15	100,00	11	14,2	18	43	8	40	48	34	4	24	19,95	38

Tab. 3.2a - continued

11 samples								LAV c195 bis	LAV c143	LAV rr115	LAV c 169	LAV c135	LAV NN1	LAV c136	LAV c76	LAV W04	LAV RP02	LAV rr625
LAKE SHORE VEGETATION					sample name													
6.1	LS	Carex flacca	u	seed/fruit	8	9,09	1	0	0	0	0	0	8	0	0	0	0	0
6.1	LS	Carex cf muricata aggr.	u	seed/fruit	58,65	27,27	3	0	0	35,32	0	15,33	0	0	8	0	0	0
6.1	LS	Epilobium parviflorum	u	seed/fruit	93,32	9,09	1	0	0	0	0	0	0	0	0	93,32	0	0
6.1	LS	Eupatorium cannabinum	u	seed/fruit	8	9,09	1	0	0	0	0	0	0	0	8	0	0	0
6.1	LS	Lychnis flos-cuculi	u	seed/fruit	8	9,09	1	0	0	0	0	0	8	0	0	0	0	0
6.1	LS	Lycopus europaeus	u	seed/fruit	273,35	90,91	10	28,8	44	72,64	24,25	16,33	16	14	16	23,33	0	18
6.1	LS	Lythrum salicaria	u	seed/fruit	57,85	27,27	3	7,2	0	35,32	0	15,33	0	0	0	0	0	0
6.1	LS	Mentha aquatica / M. arvensis	u	seed/fruit	29,33	18,18	2	0	0	0	0	15,33	0	14	0	0	0	0
6.1	LS	Mentha spicata / M. suaveolens	u	seed/fruit	113,86	54,55	6	7,2	22	17,66	0	0	16	35	16	0	0	0
6.1	LS	Ranunculus sardous	u	seed/fruit	293,25	100,00	11	7,2	88	5	10,7	31,66	17	14	24	70,99	21,7	3
6.1	LS	Valeriana officinalis	u	seed/fruit	16	9,09	1	0	0	0	0	0	0	0	0	0	16	0
6.2	LS	Bidens cernua	u	seed/fruit	2,85	9,09	1	0	0	0	0	0	0	0	0	0	2,85	0
6.2	LS	Cyperus flavescens	u	seed/fruit	879,19	81,82	9	64,8	220	264,9	4,85	76,65	96	42	40	69,99	0	0
6.2	LS	Lythrum cf portula	u	seed/fruit	17,66	9,09	1	0	0	17,66	0	0	0	0	0	0	0	0
2.2 / 2.3 / 6.2	LS	Polygonum lapathifolium	u	perianth	1	9,09	1	0	0	0	0	0	1	0	0	0	0	0
2.2 / 2.3 / 6.2	LS	Polygonum lapathifolium	u	seed/fruit	594,82	100,00	11	8,2	67	52,98	33,1	32,66	83	22	33	139,98	120,9	2
6.2	LS	Polygonum minus	u	seed/fruit	28,18	18,18	2	0	0	0	4,85	0	0	0	0	23,33	0	0
6.2 / 6.1	LS	Ranunculus sceleratus	u	seed/fruit	758,78	90,91	10	58,6	110	37,32	15,55	76,65	32	0	200	46,66	80	102
6.2	LS	Rumex maritimus	u	seed/fruit	192,53	63,64	7	7,2	22	0	0	15,33	56	35	48	0	0	9
6.2	LS	Rumex maritimus	u	perianth	425,82	90,91	10	73	0	39,32	39,95	65,32	83	1	42	25,33	55,9	1
6.2	LS	Schoenoplectus gr supinus	u	seed/fruit	1	9,09	1	0	0	1	0	0	0	0	0	0	0	0
6.2	LS	Scirpus radicans	u	seed/fruit	3267,45	100,00	11	28,8	220	248,24	74,75	337,26	104	35	64	1516,45	611,95	27
6.3	LS	Alisma plantago-aquatica	u	seed	7	9,09	1	0	0	0	0	0	0	7	0	0	0	0
6.3	LS	Alisma plantago-aquatica	u	fruit	80,71	36,36	4	7,2	22	0	4,85	0	0	0	0	46,66	0	0
6.3	LS	Caldesia parnassifolia	u	seed/fruit	4,85	9,09	1	0	0	0	4,85	0	0	0	0	0	0	0
6.3	LS	Cyperus glomeratus	u	seed/fruit	881,82	90,91	10	36	110	105,96	24,25	30,66	16	0	88	349,95	112	9
6.3	LS	Juncus cf articulatus	u	seed/fruit	22	9,09	1	0	22	0	0	0	0	0	0	0	0	0
6.3	LS	Schoenoplectus cf mucronatus	u	seed/fruit	191,49	54,55	6	0	88	52,98	4,85	30,66	0	7	8	0	0	0
6.3	LS	Schoenoplectus lacustris	u	seed/fruit	55,33	18,18	2	0	0	0	0	0	0	0	0	23,33	32	0
6.3	LS	Schoenoplectus sp	u	seed/fruit	5,7	9,09	1	0	0	0	0	0	0	0	0	0	5,7	0
6.3	LS	Typha latifolia/ T. angustifolia	u	seed/fruit	757,66	90,91	10	180	44	88,3	19,4	0	24	7	24	279,96	64	27
AQUATICS																		
7.1	A	Ceratophyllum demersum	u	seed/fruit	212,25	90,91	10	7	7	17	19	9	14	8	1	57	73,25	0
7.1	A	Ceratophyllum submersum	u	seed/fruit	4	18,18	2	0	0	0	1	0	0	0	0	3	0	0
7.1	A	Ceratophyllum sp.	u	seed/fruit	39,53	36,36	4	7,2	0	0	0	0	8	0	0	23,33	0	1
7.1	A	Characeae	u	seed/fruit	3605,7	90,91	10	7,2	89	141,28	275,6	137,97	8	49	16	2449,65	432	0
7.1	A	Lemna minor	u	seed/fruit	212,04	72,73	8	7,2	44	17,66	4,85	0	8	0	0	23,33	80	27
7.1	A	Myriophyllum spicatum	u	seed/fruit	128,32	27,27	3	0	91	36,32	0	0	1	0	0	0	0	0
7.1	A	Myriophyllum sp.	u	leaf frg	9	18,18	2	0	0	0	0	0	1	0	8	0	0	0
7.1	A	Najas marina	u	seed/fruit	2	9,09	1	0	0	0	2	0	0	0	0	0	0	0
7.1	A	Nuphar lutea	u	seed/fruit	3	27,27	3	1	0	1	0	0	0	0	0	1	0	0
7.1	A	Nymphaea alba	u	seed/fruit	20,18	27,27	3	0	0	0	2	15,33	0	0	0	0	2,85	0
7.1	A	Nymphaea sp.	u	seed/fruit	101,36	45,45	5	0	22	0	4,85	0	9	0	0	46,66	18,85	0
7.1	A	Potamogeton natans	u	seed/fruit	107,1	45,45	5	0	22	0	35,1	0	1	0	0	33	16	0
7.1	A	Potamogeton sp.	u	seed/fruit	135,97	63,64	7	0	0	0	1	1	0	2	8	97,32	25,65	1
7.1	A	Ranunculus subgen. Batrachium	u	seed/fruit	8	9,09	1	0	0	0	0	0	8	0	0	0	0	0

Tab. 3.2a - continued

11 samples

VARIA

								LAV c195 bis	LAV c143	LAV rr115	LAV c 169	LAV c135	LAV NN1	LAV c136	LAV c76	LAV W04	LAV RP02	LAV rr625
					sample name													
0.	VA	Poaceae	c	seed/fruit	65,99	45,45	5	0	22	17,66	0	15,33	3	0	8	0	0	0
0.	VA	Apiaceae	u	seed/fruit	61,86	45,45	5	7,2	22	17,66	0	0	8	7	0	0	0	0
0.	VA	Asteraceae	u	seed/fruit	2	9,09	1	0	0	0	0	0	0	0	0	0	0	2
0.	VA	Brassicaceae	u	seed/fruit	1021,97	90,91	10	21,6	242	53,98	19,4	91,98	16	84	16	279,96	197,05	0
0.	VA	cf Bromus	u	seed/fruit	20,85	18,18	2	0	0	0	4,85	0	0	0	0	0	16	0
0.	VA	Carex bicarpellate	u	seed/fruit	161,7	54,55	6	0	22	0	4,85	0	8	2	0	0	114,85	10
0.	VA	Carex tricarpellate	u	seed/fruit	131,54	81,82	9	1	68	18,66	0	16,33	8	1	8	0	8,55	2
0.	VA	Carex sp.	u	utriculus	185	45,45	5	0	0	0	1	0	24	0	16	0	0	144
0.	VA	Caryophyllaceae	u	seed/fruit	123,18	36,36	4	0	1	0	0	15,33	8	0	0	0	98,85	0
0.	VA	Cerastium sp.	u	seed/fruit	152,92	54,55	6	21,6	22	0	0	30,66	8	0	24	46,66	0	0
0.	VA	Cyperaceae	u	seed/fruit	4,85	27,27	3	0	0	0	0	0	1	1	0	0	2,85	0
0.	VA	Dianthus / Petrorhagia	u	seed/fruit	32,99	18,18	2	0	0	17,66	0	15,33	0	0	0	0	0	0
0.	VA	Fabaceae	u	seed	1	9,09	1	0	0	0	0	0	0	0	0	0	0	1
0.	VA	cf Fabaceae	u	seed/fruit	1	9,09	1	0	0	0	0	0	1	0	0	0	0	0
0.	VA	Fabaceae	u	pod frg	24,2	36,36	4	7,2	0	0	0	0	0	0	0	0	16	1
0.	VA	Fallopia / Polygonum	u	seed/fruit	15,33	9,09	1	0	0	0	0	15,33	0	0	0	0	0	0
0.	VA	Hieracium sp.	u	seed/fruit	15,33	9,09	1	0	0	0	0	15,33	0	0	0	0	0	0
0.	VA	Juncus sp.	u	seed/fruit	16	9,09	1	0	0	0	0	0	0	0	0	0	16	0
0.	VA	Lamiaceae	u	seed/fruit	3,85	18,18	2	0	0	0	0	0	1	0	0	0	2,85	0
0.	VA	Linum sp.	u	seed	16	9,09	1	0	0	0	0	0	16	0	0	0	0	0
0.	VA	Mentha sp.	u	seed/fruit	19,18	27,27	3	0	0	1	0	15,33	0	0	0	0	2,85	0
0.	VA	Poaceae	u	seed/fruit	415,95	90,91	10	7,2	22	75,64	8,85	0	1	7	40	164,31	83,95	6
0.	VA	Polygonaceae	u	perianth	1	9,09	1	0	0	0	0	0	0	1	0	0	0	0
0.	VA	Polygonaceae	u	seed/fruit	22,7	18,18	2	0	0	0	0	0	0	0	0	0	21,7	1
0.	VA	Polygonum sp.	u	seed/fruit	63,23	54,55	6	7,2	0	0	9,7	0	8	7	8	23,33	0	0
0.	VA	Potentilla sp.	u	seed/fruit	324,9	27,27	3	0	7	195,26	0	122,64	0	0	0	0	0	0
0.	VA	cf Potentilla	u	seed/fruit	34,2	9,09	1	0	0	0	0	0	0	0	0	0	34,2	0
0.	VA	Ranunculus sp.	u	seed/fruit	9	18,18	2	0	0	1	0	0	0	0	8	0	0	0
0.	VA	Rumex sp.	u	seed/fruit	1	9,09	1	1	0	0	0	0	0	0	0	0	0	0
0.	VA	Sambucus sp.	u	seed/fruit	10,85	18,18	2	0	0	0	0	0	8	0	0	0	2,85	0
0.	VA	Scabiosa sp.	u	seed/fruit	13,85	27,27	3	0	0	0	4,85	0	0	0	8	0	0	1
0.	VA	Silene sp.	u	seed/fruit	22	9,09	1	0	22	0	0	0	0	0	0	0	0	0
0.	VA	Solanaceae	u	seed/fruit	30,25	9,09	1	0	0	0	0	0	0	0	0	0	30,25	0
0.	VA	Solanum sp.	u	seed/fruit	23,33	9,09	1	0	0	0	0	0	0	0	0	23,33	0	0
0.	VA	Stachys sp.	u	seed/fruit	49,66	45,45	5	0	0	17,66	0	0	8	7	8	0	0	9
0.	VA	Teucrium sp.	u	seed/fruit	24,33	18,18	2	0	0	0	0	0	0	1	0	23,33	0	0
0.	VA	Torilis arvensis / Torilis japonica	u	seed/fruit	4,85	9,09	1	0	0	0	4,85	0	0	0	0	0	0	0
0.	VA	Verbascum sp.	u	seed/fruit	7,2	9,09	1	7,2	0	0	0	0	0	0	0	0	0	0
0.	VA	undet.	u	seed/fruit	748,5	81,82	9	57,6	71	105,96	0	245,28	0	116	61	53,66	0	38
0.	VA	Vicia sp.	u/c	seed/fruit	1	9,09	1	0	0	0	0	0	0	0	0	0	0	1

Tab. 3.2b – Semiquantitative analysis (rapid screening) of the EBA samples from sector A of Lavagnone (24 samples).

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiquity %	ubiquity	LAV c195 bis			LAV c95		LAV rr140		LAV c143			LAV rr115			LAV c169		LAV c135			LAV E2		LAV NN1			LAV rr114		LAV c136			LAV c258		LAV c134			LAV rr131		LAV c76		
				original vol / vol saturated in water (litres)			1,30	1,24		1,50	1,30	11,00	9,20	2,00	1,80		2,50	2,40		1,80	1,80	2,00	2,00		2,00	1,80	3,00	2,80		7,00	6,10	2,50	2,20		1,00	0,80	2,00	2,00		4,80	4,00	1,70	1,50	
				fraction vol (ml)			300	170	360	600	120	1740	640	520	200	440	600	250	530	450	130	370	170	460	980	280	940	560	240	1220	400	560	400	140	450	80	500	250	450	1500	300	190	100	480
				subsample volume (ml)					100							100			100					100					100					100					100					100
							4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm
FIELDS cultivated plants																																												
1.1	C	Triticum monococcum	C	spikelet fork	70,83	17	1		2		2	2	2			2		2	2		2		2	2	1			2	1		2		2	2				2	2	2	2			1
1.1	C	Triticum monococcum	C	glume base	37,50	9					2	1							1				1					1						1						1	1			
1.1	C	Triticum monococcum	C	spikelet fork 2 grain	12,50	3							1										1																					
1.1	C	Triticum monococcum	C	grain	8,33	2																											2											
1.1	C	Triticum cf monococcum	C	glume base	4,17	1																																						
1.1	C	Triticum cf monococcum	C	spikelet fork	8,33	2						1			2																													
1.1	C	Triticum cf monococcum	C	grain	4,17	1															1																							
1.1	C	Triticum dicoccum	C	spikelet fork	95,83	23			2		2	2	3		3	3	2	3	2		3		3	3	2	2	2	3	2	1	3		3	1		1	2	3	2	2	2		2	2
1.1	C	Triticum dicoccum	C	glume base	83,33	20	2	1	1		2		3		2	2	2	2	2	2	2	1	2	3	1	1	1	2			2		1	1			2	3	2	2	2			2
1.1	C	Triticum dicoccum	C	grain	54,17	13		1		2	2		2	1				2					2			2					2	1						1		2	2			
1.1	C	Triticum dicoccum	C	ear uppermost part	4,17	1														1	1																							
1.1	C	Triticum cf dicoccum	C	spikelet fork	37,50	9						2	3	2			2	2				1	2														2	3		2	2			
1.1	C	Triticum cf dicoccum	C	glume base	20,83	5						2	2				1																				2	2		1	1			
1.1	C	Triticum cf dicoccum	C	ear base	4,17	1																															1							
1.1	C	Triticum cf dicoccum	C	ear uppermost part	4,17	1											1																											
1.1	C	Triticum nn (new glume wheat)	C	spikelet fork	75,00	18		2	2				2		2	2	1	2	2		2		2	2	1		2	2	3		3		2	2			2	3	1	2	2		1	2
1.1	C	Triticum nn (new glume wheat)	C	glume base	33,33	8										2								2				1	1					2					2					2
1.1	C	Triticum nn (new glume wheat)	C	grain	12,50	3												2																										
1.1	C	Triticum cf nn (cf new glume wheat)	C	spikelet fork	33,33	8					1							2					2			2							2					2			2			
1.1	C	Triticum cf nn (cf new glume wheat)	C	glume base	4,17	1																																						
1.1	C	Triticum cf nn (cf new glume wheat)	C	grain	20,83	5						1			2													1										1					1	
1.1	C	Triticum durum / T. turgidum	C	rachis	45,83	11					1		2		2	2	1				1					1					2		2	1			1	2		1				
1.1	C	Triticum aestivum / T. durum / T. turgidum	C	grain	33,33	8												1					1								1		1							1				
1.1	C	Triticum aestivum	C	rachis	8,33	2							1																					2										
1.1	C	Triticum cf aestivum	C	rachis	12,50	3																																1			1			
1.1	C	Triticum spelta	C	spikelet fork	20,83	5							2								2																2							
1.1	C	Triticum spelta	C	glume base	58,33	14		2					2		2			2	1	2	2		2			1		2			1		2	2			2	2						1
1.1	C	Triticum spelta	C	ear uppermost part	8,33	2							2																															
1.1	C	Triticum spelta	C	ear base	4,17	1																																						
1.1	C	Triticum spelta	C	grain	12,50	3						1																1			1													
1.1	C	Triticum cf spelta	C	spikelet fork	4,17	1						1																																
1.1	C	Triticum monococcum / T. dicoccum	C	spikelet fork	25,00	6												2		2						2					2										1			
1.1	C	Triticum monococcum / T. dicoccum	C	glume base	25,00	6							1	2				2			1					1															1			
1.1	C	Triticum monococcum / T. nn	C	spikelet fork	4,17	1										1																												
1.1	C	Triticum dicoccum / T. spelta	C	glume base	25,00	6					1		1								1		1					1										1						
1.1	C	Triticum dicoccum / T. spelta	C	ear uppermost part	4,17	1																																1						
1.1	C	Triticum dicoccum / T. spelta	C	spikelet fork	12,50	3																		1									2								1			
1.1	C	Triticum dicoccum / T. nn	C	spikelet fork	16,67	4							3					2					2										2											
1.1	C	Triticum dicoccum / T. nn	C	glume base	4,17	1																											2											
1.1	C	Triticum dicoccum / T. durum / T. turgidum	C	spikelet fork	12,50	3					2				2													1																
1.1	C	Triticum dicoccum / T. durum / T. turgidum	C	glume base	4,17	1																						1																
1.1	C	Triticum sp.	C	spikelet fork	50,00	12			1				1		2	2			1				1						1		1			2						1	1			
1.1	C	Triticum sp.	C	glume base	29,17	7			1				1			2															1	2		2					2					
1.1	C	Triticum sp.	C	rachis frg	33,33	8							1		1		1												2	2	1									2			1	
1.1	C	Triticum sp.	C	ear uppermost part	8,33	2																									1										1			
1.1	C	Triticum sp.	C	grain	29,17	7																		1							5		2					2			2		1	
1.1	C	Triticum sp.	C	ear base	33,33	8							1		1			2			2		2										2					1						
1.1	C	Triticum sp.	C	glume frg	4,17	1											1																											
1.1	C	Hordeum vulgare	C	spikelet fork	79,17	19	1	2			2	1	3	1	2	2	2	2	2		2		2	2		2		2	2		2		2	2			2	3	2	2	2			1
1.1	C	Hordeum vulgare	C	grain	79,17	19		1		2	2		2				1	2		1	2		2			2	2	2			2		2				1	2			2		1	
1.1	C	Hordeum vulgare	C	rachis frg	54,17	13					2			2	2	1	2	2			1		2		1								2					2		2	2		1	
1.1	C	Cerealia	C	1st rachis segm. Frg	4,17	1																																						

Tab. 3.2b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiquity %	ubiquity	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm
				sample name			LAV c195 bis			LAV c95		LAV rr140		LAV c143			LAV rr115			LAV c169		LAV c135			LAV E2		LAV NN1			LAV rr114		LAV c136			LAV c258		LAV c134			LAV rr131		LAV c76		
				original vol / vol saturated in water (litres)			1,30	1,24		1,50	1,30	11,00	9,20	2,00	1,80		2,50	2,40		1,80	1,80	2,00	2,00		2,00	1,80	3,00	2,80		7,00	6,10	2,50	2,20		1,00	0,80	2,00	2,00		4,80	4,00	1,70	1,50	
				fraction vol (ml)			300	170	360	600	120	1740	640	520	200	440	600	250	530	450	130	370	170	460	980	280	940	560	240	1220	400	560	400	140	450	80	500	250	450	1500	300	190	100	480
				subsample volume (ml)					100							100			100					100					100					100					100					100
1.1	C	Cerealia	c	glume frg	54,17	13		2			1	2	3	2	2		2	2		2	3		2			2		2					1				1	1						
1.1	C	Cerealia	c	grain	87,50	21		2	1	2	3	2	3	2	2		1	3	1	1	3		3		2	2	1	3		2	2	2	3				2	3		2	2		2	
1.1	C	Cerealia	c	rachis	70,83	17		1			2	1	2		3			2		1	2		2	1		2				2	1		2					3			2		1	
1.1	C	Cerealia	c	stem	50,00	12					1		3		1			1			2		2										1				2	2			1			
1.1	C	Cerealia	c	glume base	16,67	4									2																1										2		1	
1.1	C	Cerealia	c	embryo	8,33	2			1																																			
1.1	C	Linum usitatissimum	c	seed/fruit	16,67	4																1		1							1			1										
1.1	C	Linum usitatissimum	c	capsule frg	4,17	1															2																							
1.1	C	Triticum dicoccum	u	spikelet fork	4,17	1																		1																				
1.1	C	Triticum sp.	u	spikelet fork	66,67	16			2			2			1		1			1			1			2							1			1			2	1				1
1.1	C	Triticum sp.	u	glume base	29,17	7			1			2													2												2		1					
1.1	C	Triticum sp.	u	rachis frg	12,50	3								1											1																			
1.1	C	Triticum sp.	u	testa frg	16,67	4			2								1																											
1.1	C	Triticum spelta	u	glume base	4,17	1																																						
1.1	C	Cerealia	u	culm frg	4,17	1																															2							
1.1	C	Cerealia	u	testa frg	20,83	5																	1		2											2				1			2	
1.1	C	Carthamus tinctorius	u	achene	16,67	4																										1						1					1	
1.1	C	Carthamus cf tinctorius	u	achene frg	4,17	1							1																															
1.1	C	Linum usitatissimum	u	seed/fruit	45,83	11			2								1	1							2	2			1				1		1	2	1			1	2			
1.1	C	Linum usitatissimum	u	capsule frg	58,33	14			2					1		3	2	1	2	2	2				3	3						1	1	2	2	2			2	2			1	2
1.1	C	Linum usitatissimum	u	fibres	8,33	2															1				2	2																		
1.1	C	Triticum dicoccum	u/c	spikelet fork	4,17	1																												1										

Tab. 3.2b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiquity %	ubiquity	LAV c197		LAV c132		LAV c133		LAV c168		LAV E1		LAV c98		LAV W04			LAV RP02			LAV c270
		sample name																							
		original vol / vol saturated in water (litres)					1,10	0,95	2,80	2,40	0,50	0,60	1,20	1,00	2,00	1,00	1,20	1,00	2,00	1,90		4,00	4,00		0,92
		fraction vol (ml)					200	140	550	260	180	25	280	120	360	160	240	60	550	200	700	800	1400	800	180
		subsample volume (ml)																			100		490	100	
							4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm (8 mm)	2 mm	0,35 mm	2 mm
FIELDS																									
cultivated plants																									
1.1	C	Triticum monococcum	c	spikelet fork	70,83	17					1									1			2		
1.1	C	Triticum monococcum	c	glume base	37,50	9															1		2	2	
1.1	C	Triticum monococcum	c	spikelet fork 2 grain	12,50	3																	1		
1.1	C	Triticum monococcum	c	grain	8,33	2																	1		
1.1	C	Triticum cf monococcum	c	glume base	4,17	1																	2		
1.1	C	Triticum cf monococcum	c	spikelet fork	8,33	2																			
1.1	C	Triticum cf monococcum	c	grain	4,17	1																			
1.1	C	Triticum dicoccum	c	spikelet fork	95,83	23		2	1	3		1		2				2	1	2	1		3	2	2
1.1	C	Triticum dicoccum	c	glume base	83,33	20	1	2	2	2	2										2		3	2	1
1.1	C	Triticum dicoccum	c	grain	54,17	13								2						1					
1.1	C	Triticum dicoccum	c	ear uppermost part	4,17	1																			
1.1	C	Triticum cf dicoccum	c	spikelet fork	37,50	9						1								2			2		
1.1	C	Triticum cf dicoccum	c	glume base	20,83	5																	1		
1.1	C	Triticum cf dicoccum	c	ear base	4,17	1																			
1.1	C	Triticum cf dicoccum	c	ear uppermost part	4,17	1																			
1.1	C	Triticum nn (new glume wheat)	c	spikelet fork	75,00	18				2				2				2					3	2	2
1.1	C	Triticum nn (new glume wheat)	c	glume base	33,33	8															1		1		
1.1	C	Triticum nn (new glume wheat)	c	grain	12,50	3												2		2					
1.1	C	Triticum cf nn (cf new glume wheat)	c	spikelet fork	33,33	8																	2		
1.1	C	Triticum cf nn (cf new glume wheat)	c	glume base	4,17	1																	2		
1.1	C	Triticum cf nn (cf new glume wheat)	c	grain	20,83	5																			
1.1	C	Triticum durum / T. turgidum	c	rachis	45,83	11					1														
1.1	C	Triticum aestivum / T. durum / T. turgidum	c	grain	33,33	8		2						2						2					
1.1	C	Triticum aestivum	c	rachis	8,33	2																			
1.1	C	Triticum cf aestivum	c	rachis	12,50	3		1																	
1.1	C	Triticum spelta	c	spikelet fork	20,83	5												1					2		
1.1	C	Triticum spelta	c	glume base	58,33	14			1	1													2	1	
1.1	C	Triticum spelta	c	ear uppermost part	8,33	2		1																	
1.1	C	Triticum spelta	c	ear base	4,17	1																	1		
1.1	C	Triticum spelta	c	grain	12,50	3																			
1.1	C	Triticum cf spelta	c	spikelet fork	4,17	1																			
1.1	C	Triticum monococcum / T. dicoccum	c	spikelet fork	25,00	6		2																	
1.1	C	Triticum monococcum / T. dicoccum	c	glume base	25,00	6																			
1.1	C	Triticum monococcum / T. nn	c	spikelet fork	4,17	1																			
1.1	C	Triticum dicoccum / T. spelta	c	glume base	25,00	6																			
1.1	C	Triticum dicoccum / T. spelta	c	ear uppermost part	4,17	1																			
1.1	C	Triticum dicoccum / T. spelta	c	spikelet fork	12,50	3																			
1.1	C	Triticum dicoccum / T. nn	c	spikelet fork	16,67	4																			
1.1	C	Triticum dicoccum / T. nn	c	glume base	4,17	1																			
1.1	C	Triticum dicoccum / T. durum / T. turgidum	c	spikelet fork	12,50	3																			
1.1	C	Triticum dicoccum / T. durum / T. turgidum	c	glume base	4,17	1																			
1.1	C	Triticum sp.	c	spikelet fork	50,00	12				2											2		2	1	
1.1	C	Triticum sp.	c	glume base	29,17	7															1				
1.1	C	Triticum sp.	c	rachis frg	33,33	8																	2	2	
1.1	C	Triticum sp.	c	ear uppermost part	8,33	2																			
1.1	C	Triticum sp.	c	grain	29,17	7																	2		
1.1	C	Triticum sp.	c	ear base	33,33	8																	2		
1.1	C	Triticum sp.	c	glume frg	4,17	1																			
1.1	C	Hordeum vulgare	c	spikelet fork	79,17	19		1		2								1			2		3		
1.1	C	Hordeum vulgare	c	grain	79,17	19	1	2		2		1		2						2			2		
1.1	C	Hordeum vulgare	c	rachis frg	54,17	13		1		2													2		
1.1	C	Cerealia	c	1st rachis segm. Frg	4,17	1																	2		

Tab. 3.2b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiquity %	ubiquity	LAV c197		LAV c132		LAV c133		LAV c168		LAV E1		LAV c98		LAV W04			LAV RP02			LAV c270
		original vol / vol saturated in water (litres)					1,10	0,95	2,80	2,40	0,50	0,60	1,20	1,00	2,00	1,00	1,20	1,00	2,00	1,90		4,00	4,00		0,92
		fraction vol (ml)					200	140	550	260	180	25	280	120	360	160	240	60	550	200	700	800	1400	800	180
		subsample volume (ml)																			100		490	100	
							4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm (8 mm)	2 mm	0,35 mm	2 mm
1.1	C	Cerealia	c	glume frg	54,17	13		2		1															
1.1	C	Cerealia	c	grain	87,50	21	1	2		2		2		2			1	2		3			2		
1.1	C	Cerealia	c	rachis	70,83	17		1		2								1					2		
1.1	C	Cerealia	c	stem	50,00	12				1				1									2		
1.1	C	Cerealia	c	glume base	16,67	4																			
1.1	C	Cerealia	c	embryo	8,33	2																		1	
1.1	C	Linum usitatissimum	c	seed/fruit	16,67	4															1				
1.1	C	Linum usitatissimum	c	capsule frg	4,17	1																			
1.1	C	Triticum dicoccum	u	spikelet fork	4,17	1																			
1.1	C	Triticum sp.	u	spikelet fork	66,67	16		2													1		4	4	1
1.1	C	Triticum sp.	u	glume base	29,17	7				2											2		4	4	
1.1	C	Triticum sp.	u	rachis frg	12,50	3																	2		
1.1	C	Triticum sp.	u	testa frg	16,67	4															3			3	
1.1	C	Triticum spelta	u	glume base	4,17	1																		2	
1.1	C	Cerealia	u	culm frg	4,17	1																			
1.1	C	Cerealia	u	testa frg	20,83	5																			
1.1	C	Carthamus tinctorius	u	achene	16,67	4								1											
1.1	C	Carthamus cf tinctorius	u	achene frg	4,17	1																			
1.1	C	Linum usitatissimum	u	seed/fruit	45,83	11				1											2		3	2	
1.1	C	Linum usitatissimum	u	capsule frg	58,33	14		2												1	3		4	3	1
1.1	C	Linum usitatissimum	u	fibres	8,33	2																			
1.1	C	Triticum dicoccum	u/c	spikelet fork	4,17	1																			

Tab. 3.2b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

		sample name					LAV c195 bis			LAV c95		LAV rr140		LAV c143			LAV rr115			LAV c169		LAV c135			LAV E2		LAV NN1			LAV rr114		LAV c136			LAV c258		LAV c134			LAV rr131		LAV c76		
		original vol / vol saturated in water (litres)					1,30	1,24		1,50	1,30	11,00	9,20	2,00	1,80		2,50	2,40		1,80	1,80	2,00	2,00		2,00	1,80	3,00	2,80		7,00	6,10	2,50	2,20		1,00	0,80	2,00	2,00		4,80	4,00	1,70	1,50	
		fraction vol (ml)					300	170	360	600	120	1740	640	520	200	440	600	250	530	450	130	370	170	460	980	280	940	560	240	1220	400	560	400	140	450	80	500	250	450	1500	300	190	100	480
		subsample volume (ml)							100							100			100					100					100					100					100					100
ecol grp	large ecol grp	taxon	preservation	remain type	ubiquity %	ubiquity	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm
winter crop weeds																																												
2.1	WW	cf Avena sp.	c	grain	4,17	1																									1													
2.1	WW	Fallopia convolvulus	c	seed/fruit	8,33	2																									1			2										
2.1	WW	Aphanes arvensis	u	seed/fruit	8,33	2																																	1					1
2.1 / 2.3	WW	Buglossoides arvensis	u	seed/fruit	4,17	1																																						
2.1	WW	Camelina sativa	u	seed	4,17	1																																						
2.1	WW	Camelina sativa	u	capsule frg	16,67	4														2					1	1																		
2.1	WW	Fallopia convolvulus	u	seed/fruit	75,00	18	1	1	1		1		3	2	1	2	2		2		1		2	2				2	2		2	2	1					2	2	2	2			2
2.1	WW	cf Fallopia convolvulus	u	seed/fruit	4,17	1												1																										
2.1	WW	Legousia hybrida / L. speculum veneris	u	seed/fruit	4,17	1																																	1					
2.1	WW	Scleranthus annus	u	seed/fruit	8,33	2																																	2					
2.1	WW	cf Sclerantus annuus	u	seed/fruit	4,17	1																																						
2.1	WW	Stachys annua	u	seed/fruit	41,67	10			1							2		1	1					1					2		2			2					1	2				1
2.1	WW	Torilis arvensis	u	seed/fruit	4,17	1																																						
2.1	WW	cf Torilis arvensis	u	seed/fruit	4,17	1								1																														
2.1	WW	Valerianella dentata	u	seed/fruit	75,00	18			2			2	2	2		3	1		3		2		1	3	1		2		3		2			2	1		2		3	2			1	2
2.1	WW	Valerianella rimosa	u	seed/fruit	4,17	1																																						
summer crop weeds / mostly annual ruderal																																												
2.2	SW	Aethusa cynapium	u	seed/fruit	4,17	1																																		1				
2.2	SW	Anagallis arvensis	u	seed/fruit	25,00	6								1		1								2										2					2	2				2
2.2	SW	Atriplex hastata	u	seed/fruit	4,17	1																																						
2.2	SW	Atriplex sp.	u	seed/fruit	8,33	2						1																																
2.2 / 2.4	SW	Capsella bursa-pastoris	u	seed/fruit	16,67	4			1							2								1																				
2.2 / 2.3 / 2.4	SW	Chenopodium album	u	seed/fruit	70,83	17			2	2		2	2	2		4	2	1	3			2		3	1		2		3	2		2		4	1		2		4	3	2			4
2.2	SW	Chenopodium filicifolium	u	seed/fruit	4,17	1																												1										
2.3 / 2.4 / 2.2	SW	Chenopodium sp.	u	seed/fruit	4,17	1																															1							
2.2	SW	Cirsium arvense	u	seed/fruit	4,17	1																												1										
2.2	SW	cf Eragrostis minor	u	seed/fruit	25,00	6			1							2			1					1										1										
2.2	SW	Fumaria officinalis	u	seed/fruit	4,17	1																									1													
2.2 / 2.3	SW	Heliotropium europaeum	u	seed/fruit	8,33	2																							1															
2.2	SW	Portulaca oleracea	u	seed/fruit	37,50	9			1							3			2					2					2					2					2					
2.2 / 5.1	SW	Solanum nigrum	u	seed/fruit	16,67	4								1																									3					
2.2 / 2.3	SW	Stellaria media	u	seed/fruit	8,33	2											1		1																				1					
2.2 / 2.3	SW	Viola arvensis / V. tricolor	u	seed/fruit	12,50	3										2																							2					2

Tab. 3.2b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiquity %	ubiquity	LAV c197		LAV c132		LAV c133		LAV c168		LAV E1		LAV c98		LAV W04			LAV RP02			LAV c270
		original vol / vol saturated in water (litres)					1,10	0,95	2,80	2,40	0,50	0,60	1,20	1,00	2,00	1,00	1,20	1,00	2,00	1,90		4,00	4,00		0,92
		fraction vol (ml)					200	140	550	260	180	25	280	120	360	160	240	60	550	200	700	800	1400	800	180
		subsample volume (ml)																			100		490	100	
							4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm (8 mm)	2 mm	0,35 mm	2 mm
winter crop weeds																									
2.1	WW	cf Avena sp.	c	grain	4,17	1																			
2.1	WW	Fallopia convolvulus	c	seed/fruit	8,33	2																			
2.1	WW	Aphanes arvensis	u	seed/fruit	8,33	2																			
2.1 / 2.3	WW	Buglossoides arvensis	u	seed/fruit	4,17	1																	1		
2.1	WW	Camelina sativa	u	seed	4,17	1																	1		
2.1	WW	Camelina sativa	u	capsule frg	16,67	4		1															1		
2.1	WW	Fallopia convolvulus	u	seed/fruit	75,00	18		1	2	2				1							2		2	2	
2.1	WW	cf Fallopia convolvulus	u	seed/fruit	4,17	1																			
2.1	WW	Legousia hybrida / L. speculum veneris	u	seed/fruit	4,17	1																			
2.1	WW	Scleranthus annus	u	seed/fruit	8,33	2																		2	
2.1	WW	cf Sclerantus annuus	u	seed/fruit	4,17	1																	1		
2.1	WW	Stachys annua	u	seed/fruit	41,67	10																			
2.1	WW	Torilis arvensis	u	seed/fruit	4,17	1																	2		
2.1	WW	cf Torilis arvensis	u	seed/fruit	4,17	1																			
2.1	WW	Valerianella dentata	u	seed/fruit	75,00	18		1	1	2											3		2	2	
2.1	WW	Valerianella rimosa	u	seed/fruit	4,17	1														1					
summer crop weeds / mostly annual ruderal																									
2.2	SW	Aethusa cynapium	u	seed/fruit	4,17	1																			
2.2	SW	Anagallis arvensis	u	seed/fruit	25,00	6																			
2.2	SW	Atriplex hastata	u	seed/fruit	4,17	1																	1		
2.2	SW	Atriplex sp.	u	seed/fruit	8,33	2								1											
2.2 / 2.4	SW	Capsella bursa-pastoris	u	seed/fruit	16,67	4															1				
2.2 / 2.3 / 2.4	SW	Chenopodium album	u	seed/fruit	70,83	17			1	2											3		2	3	
2.2	SW	Chenopodium filicifolium	u	seed/fruit	4,17	1																			
2.3 / 2.4 / 2.2	SW	Chenopodium sp.	u	seed/fruit	4,17	1																			
2.2	SW	Cirsium arvense	u	seed/fruit	4,17	1																			
2.2	SW	cf Eragrostis minor	u	seed/fruit	25,00	6																		2	
2.2	SW	Fumaria officinalis	u	seed/fruit	4,17	1																			
2.2 / 2.3	SW	Heliotropium europaeum	u	seed/fruit	8,33	2																		2	
2.2	SW	Portulaca oleracea	u	seed/fruit	37,50	9															2			2	
2.2 / 5.1	SW	Solanum nigrum	u	seed/fruit	16,67	4															2			1	
2.2 / 2.3	SW	Stellaria media	u	seed/fruit	8,33	2																			
2.2 / 2.3	SW	Viola arvensis / V. tricolor	u	seed/fruit	12,50	3																			

Tab. 3.2b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiquity %	ubiquity																																							
				sample name			LAV c195 bis			LAV c95		LAV rr140		LAV c143			LAV rr115			LAV c169		LAV c135			LAV E2		LAV NN1			LAV rr114		LAV c136			LAV c258		LAV c134			LAV rr131		LAV c76		
				original vol / vol saturated in water (litres)			1,30	1,24		1,50	1,30	11,00	9,20	2,00	1,80		2,50	2,40		1,80	1,80	2,00	2,00		2,00	1,80	3,00	2,80		7,00	6,10	2,50	2,20		1,00	0,80	2,00	2,00		4,80	4,00	1,70	1,50	
				fraction vol (ml)			300	170	360	600	120	1740	640	520	200	440	600	250	530	450	130	370	170	460	980	280	940	560	240	1220	400	560	400	140	450	80	500	250	450	1500	300	190	100	480
				subsample volume (ml)					100							100			100					100					100					100					100					100
							4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm
RUDERAL AND CROP FIELD UBIQUITARY SPECIES																																												
2.4	RU	Verbena officinalis	c	seed/fruit	4,17	1																																						
2.3	RU	Cuscuta sp.	u	seed/fruit	4,17	1													1																									
2.3	RU	Galeopsis sp.	u	seed/fruit	4,17	1																																						
2.3	RU	Polygonum persicaria	u	seed/fruit	50,00	12			1							3			2					2					3		1			3					2	2				2
2.4	RU	Anthemis tinctoria	u	seed/fruit	12,50	3										1																							1					1
2.4 / 6.1	RU	Arctium minus	u	seed/fruit	4,17	1																																						
2.4	RU	Carex hirta	u	seed/fruit	8,33	2																		2										1										
2.4	RU	Dipsacus fullonum	u	seed/fruit	4,17	1																																						1
2.4	RU	Lapsana communis	u	seed/fruit	8,33	2													2												1													
2.4	RU	Polygonum aviculare	u	seed/fruit	62,50	15	1		2			2	2	2			2	1	3				2	3	2		1	1	2	1	1			2			2		3	2	1			2
2.4 / 4.2	RU	Potentilla reptans	u	seed/fruit	45,83	11			2			1				3	1		2					2			1		2		1	1		2					3					
2.4	RU	Ranunculus acris / R. repens / R. bulbosus	u	seed/fruit	4,17	1																		2																				
2.4	RU	Ranunculus acris / R. repens / R. lanuginosus	u	seed/fruit	4,17	1										2																												
2.4	RU	Ranunculus cf acris	u	seed/fruit	4,17	1			1																																			
2.4	RU	Ranunculus repens	u	seed/fruit	8,33	2																	1										1											
2.4	RU	Sambucus ebulus	u	seed/fruit	25,00	6								1					1				1									1							1					
2.4	RU	Urtica dioica	u	seed/fruit	16,67	4			1							1																							1					2
2.4	RU	Verbena officinalis	u	seed/fruit	58,33	14			2			1	1	2		3	1		2					3	1				2				1	2			1	1	3	2				2
2.4 / 3. / 2.2	RU	Silene alba	u	seed/fruit	29,17	7			1							1			2					2					2					1										1
2.4 / 3. / 2.1	RU	Silene cf alba	u	seed/fruit	4,17	1											1																											

Tab. 3.2b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiquity %	ubiquity	LAV c197		LAV c132		LAV c133		LAV c168		LAV E1		LAV c98		LAV W04			LAV RP02			LAV c270
		original vol / vol saturated in water (litres)					1,10	0,95	2,80	2,40	0,50	0,60	1,20	1,00	2,00	1,00	1,20	1,00	2,00	1,90		4,00	4,00		0,92
		fraction vol (ml)					200	140	550	260	180	25	280	120	360	160	240	60	550	200	700	800	1400	800	180
		subsample volume (ml)																			100		490	100	
							4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm (8 mm)	2 mm	0,35 mm	2 mm
RUDERAL AND CROP FIELD UBIQUITARY SPECIES																									
2.4	RU	Verbena officinalis	c	seed/fruit	4,17	1																		1	
2.3	RU	Cuscuta sp.	u	seed/fruit	4,17	1																			
2.3	RU	Galeopsis sp.	u	seed/fruit	4,17	1																	1		
2.3	RU	Polygonum persicaria	u	seed/fruit	50,00	12															1			2	
2.4	RU	Anthemis tinctoria	u	seed/fruit	12,50	3																			
2.4 / 6.1	RU	Arctium minus	u	seed/fruit	4,17	1				1															
2.4	RU	Carex hirta	u	seed/fruit	8,33	2																			
2.4	RU	Dipsacus fullonum	u	seed/fruit	4,17	1																			
2.4	RU	Lapsana communis	u	seed/fruit	8,33	2																			
2.4	RU	Polygonum aviculare	u	seed/fruit	62,50	15			1	2				1									3	2	
2.4 / 4.2	RU	Potentilla reptans	u	seed/fruit	45,83	11															1		1	2	
2.4	RU	Ranunculus acris / R. repens / R. bulbosus	u	seed/fruit	4,17	1																			
2.4	RU	Ranunculus acris / R. repens / R. lanuginosus	u	seed/fruit	4,17	1																			
2.4	RU	Ranunculus cf acris	u	seed/fruit	4,17	1																			
2.4	RU	Ranunculus repens	u	seed/fruit	8,33	2																			
2.4	RU	Sambucus ebulus	u	seed/fruit	25,00	6															1				
2.4	RU	Urtica dioica	u	seed/fruit	16,67	4																			
2.4	RU	Verbena officinalis	u	seed/fruit	58,33	14				2											2		1	2	
2.4 / 3. / 2.2	RU	Silene alba	u	seed/fruit	29,17	7																			
2.4 / 3. / 2.1	RU	Silene cf alba	u	seed/fruit	4,17	1																			

Tab. 3.2b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiquity %	ubiquity	LAV c195 bis 4 mm	LAV c195 bis 2 mm	LAV c195 bis 0,35 mm	LAV c95 4 mm	LAV c95 2 mm	LAV rr140 4 mm	LAV rr140 2 mm	LAV c143 4 mm	LAV c143 2 mm	LAV c143 0,35 mm	LAV rr115 4 mm	LAV rr115 2 mm	LAV rr115 0,35 mm	LAV c169 4 mm	LAV c169 2 mm	LAV c135 4 mm	LAV c135 2 mm	LAV c135 0,35 mm	LAV E2 4 mm	LAV E2 2 mm	LAV NN1 4 mm	LAV NN1 2 mm	LAV NN1 0,35 mm	LAV rr114 4 mm	LAV rr114 2 mm	LAV c136 4 mm	LAV c136 2 mm	LAV c136 0,35 mm	LAV c258 4 mm	LAV c258 2 mm	LAV c134 4 mm	LAV c134 2 mm	LAV c134 0,35 mm	LAV rr131 4 mm	LAV rr131 2 mm	LAV c76 4 mm	LAV c76 2 mm	LAV c76 0,35 mm
		original vol / vol saturated in water (litres)					1,30	1,24		1,50	1,30	11,00	9,20	2,00	1,80		2,50	2,40		1,80	1,80	2,00	2,00		2,00	1,80	3,00	2,80		7,00	6,10	2,50	2,20		1,00	0,80	2,00	2,00		4,80	4,00	1,70	1,50	
		fraction vol (ml)					300	170	360	600	120	1740	640	520	200	440	600	250	530	450	130	370	170	460	980	280	940	560	240	1220	400	560	400	140	450	80	500	250	450	1500	300	190	100	480
		subsample volume (ml)							100							100			100					100					100					100					100					100
GRASSLAND: MEADOWS AND PASTURES																																												
4.1	MP	Teucrium chamaedrys	c	seed/fruit	8,33	2										1																		1										
2.1 / 2.2 / 3.1	MP	Ajuga chamaepytis	u	seed/fruit	16,67	4													1										1										2					1
3.1	MP	Arenaria serpyllifolia	u	seed/fruit	50,00	12	1		2							3	1		3					3					3					2					3	1				2
3.1	MP	Arenaria serpyllifolia	u	capsule	4,17	1																																						
3.1	MP	Cerastium arvense	u	seed/fruit	4,17	1																																						
3.1	MP	Carthamus cf lanatus	u	seed/fruit	8,33	2																						1																
3.1	MP	Daucus carota	u	seed/fruit	54,17	13			2			1				1			2					2					1		1			2					2	1				2
3.1	MP	Medicago minima	u	seed/fruit frg	12,50	3																						2		1	2									1	2			
3.1	MP	Nepeta cataria	u	seed/fruit	25,00	6										2			1										2					2										
3.1	MP	Pastinaca sativa	u	seed/fruit	4,17	1																																						
3.1	MP	Petrorhagia prolifera	u	seed/fruit	12,50	3													1																					1				
3.1	MP	Silene otites	u	seed/fruit	8,33	2																							1															
3.1	MP	Trifolium cf scabrum	u	seed/fruit	4,17	1																																						1
4.1	MP	Agropyron repens	u	seed/fruit	4,17	1																																1						
4.1	MP	Dianthus carthusianorum	u	seed/fruit	8,33	2			1																														1					
4.1	MP	Dianthus sp.	u	seed/fruit	8,33	2			1																															1				
4.1 / 6.1	MP	Linum cf catharticum	u	seed/fruit	4,17	1																																	1					
4.1	MP	Potentilla rupestris	u	seed/fruit	4,17	1																							1															
4.1	MP	Silene nutans	u	seed/fruit	20,83	5										2													1										1					
4.1	MP	Silene vulgaris	u	seed/fruit	12,50	3																												1					1					
4.1	MP	Teucrium chamaedrys	u	seed/fruit	62,50	15			1					2		2	2	1	2					2	2	1			2				1	2			1		3	2	1			2
4.1	MP	Thymus sp.	u	seed/fruit	4,17	1			1																																			
4.3	MP	Carex cf pallescens	u	seed/fruit	4,17	1													1																									
4.3	MP	Knautia arvensis	u	seed/fruit	29,17	7							1			1		1											2					2										1
4.3	MP	Petrorhagia saxifraga	u	seed/fruit	8,33	2																												1					1					
4.3	MP	Rumex acetosella	u	seed/fruit	45,83	11				1		1		2			2						1						1						1		1			2				
4.3	MP	Scabiosa columbaria	u	seed/fruit	12,50	3																						1										1						
4.3	MP	Scabiosa sp.	u	seed/fruit	8,33	2			1							2																												
4.3	MP	Viola cf canina	u	seed/fruit	4,17	1																																	1					
4.3 / 2.4	MP	Prunella vulgaris	u	seed/fruit	25,00	6			2					1		1																							1	2				2
4.3	MP	Trifolium sp	u	petal	8,33	2																																						

Tab. 3.2b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiquity %	ubiquity	LAV c197		LAV c132		LAV c133		LAV c168		LAV E1		LAV c98		LAV W04			LAV RP02			LAV c270
		sample name																							
		original vol / vol saturated in water			(litres)		1,10	0,95	2,80	2,40	0,50	0,60	1,20	1,00	2,00	1,00	1,20	1,00	2,00	1,90		4,00	4,00		0,92
		fraction vol (ml)					200	140	550	260	180	25	280	120	360	160	240	60	550	200	700	800	1400	800	180
		subsample volume (ml)																			100		490	100	
ecol grp	large ecol grp	taxon	preservation	remain type	ubiquity %	ubiquity	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm (8 mm)	2 mm	0,35 mm	2 mm
GRASSLAND: MEADOWS AND PASTURES																									
4.1	MP	Teucrium chamaedrys	c	seed/fruit	8,33	2																			
2.1 / 2.2 / 3.1	MP	Ajuga chamaepytis	u	seed/fruit	16,67	4																			
3.1	MP	Arenaria serpyllifolia	u	seed/fruit	50,00	12				1											3		3	3	
3.1	MP	Arenaria serpyllifolia	u	capsule	4,17	1																	1		
3.1	MP	Cerastium arvense	u	seed/fruit	4,17	1															1				
3.1	MP	Carthamus cf lanatus	u	seed/fruit	8,33	2				1															
3.1	MP	Daucus carota	u	seed/fruit	54,17	13															2			1	
3.1	MP	Medicago minima	u	seed/fruit frg	12,50	3																			
3.1	MP	Nepeta cataria	u	seed/fruit	25,00	6				1											1				
3.1	MP	Pastinaca sativa	u	seed/fruit	4,17	1												1							
3.1	MP	Petrorhagia prolifera	u	seed/fruit	12,50	3																		1	
3.1	MP	Silene otites	u	seed/fruit	8,33	2															1				
3.1	MP	Trifolium cf scabrum	u	seed/fruit	4,17	1																			
4.1	MP	Agropyron repens	u	seed/fruit	4,17	1																			
4.1	MP	Dianthus carthusianorum	u	seed/fruit	8,33	2																			
4.1	MP	Dianthus sp.	u	seed/fruit	8,33	2																			
4.1 / 6.1	MP	Linum cf catharticum	u	seed/fruit	4,17	1																			
4.1	MP	Potentilla rupestris	u	seed/fruit	4,17	1																			
4.1	MP	Silene nutans	u	seed/fruit	20,83	5															2			1	
4.1	MP	Silene vulgaris	u	seed/fruit	12,50	3																	1		
4.1	MP	Teucrium chamaedrys	u	seed/fruit	62,50	15	1		1					1							2		2	2	
4.1	MP	Thymus sp.	u	seed/fruit	4,17	1																			
4.3	MP	Carex cf pallescens	u	seed/fruit	4,17	1																			
4.3	MP	Knautia arvensis	u	seed/fruit	29,17	7				2															
4.3	MP	Petrorhagia saxifraga	u	seed/fruit	8,33	2																			
4.3	MP	Rumex acetosella	u	seed/fruit	45,83	11	1			2															
4.3	MP	Scabiosa columbaria	u	seed/fruit	12,50	3			1	1															
4.3	MP	Scabiosa sp.	u	seed/fruit	8,33	2																			
4.3	MP	Viola cf canina	u	seed/fruit	4,17	1																			
4.3 / 2.4	MP	Prunella vulgaris	u	seed/fruit	25,00	6																	1		
4.3	MP	Trifolium sp	u	petal	8,33	2															1		1		

Tab. 3.2b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiquity %	ubiquity	LAV c195 bis			LAV c95		LAV rr140		LAV c143			LAV rr115			LAV c169		LAV c135			LAV E2		LAV NN1			LAV rr114		LAV c136			LAV c258		LAV c134			LAV rr131		LAV c76		
		original vol / vol saturated in water (litres)					1,30	1,24		1,50	1,30	11,00	9,20	2,00	1,80		2,50	2,40		1,80	1,80	2,00	2,00		2,00	1,80	3,00	2,80		7,00	6,10	2,50	2,20		1,00	0,80	2,00	2,00		4,80	4,00	1,70	1,50	
		fraction vol (ml)					300	170	360	600	120	1740	640	520	200	440	600	250	530	450	130	370	170	460	980	280	940	560	240	1220	400	560	400	140	450	80	500	250	450	1500	300	190	100	480
		subsample volume (ml)							100							100			100					100					100					100					100					100
							4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm
WOODLAND, WOOD EDGES, CLEARINGS																																												
5.1	F	Agrimonia eupatoria	c	seed/fruit	4,17	1									1																													
5.1	F	cf Brachipodium sylvaticum	c	seed/fruit	4,17	1			1																																			
5.1	F	Corylus avellana	c	seed/fruit frg	4,17	1																						1																
5.1	F	Quercus sp.	c	seed/fruit	4,17	1																																		1				
5.1	F	Agrimonia eupatoria	u	seed/fruit	83,33	20	1	2	1			2	2	2	1	2	2	2			3	2	3	1	3	2		2				2	2			1	2	3		2	2		2	
5.1	F	cf Clematis vitalba	u	seed/fruit	4,17	1																																		1				
5.1	F	Clinopodium vulgare	u	seed/fruit	33,33	8			1							2			1					2					1															2
5.1	F	Cornus mas	u	stone	79,17	19	2			2		3		2			2			1		2			2		3	1		2		3					2	1		3		2	2	
5.1	F	Cornus sanguinea	u	stone	12,50	3	1						1																															
5.1	F	Corylus avellana	u	seed/fruit frg	83,33	20	2					3	2	2	2		2	2		1	2	3	2		2		3	1		2	2	2	2				2	2		2	2	2	2	
5.1	F	Crataegus cf laevigata	u	stone	4,17	1																																						
5.1	F	Crataegus monogyna	u	stone	33,33	8	2					2										1					2					1						2		2				
5.1	F	Crataegus cf monogyna	u	stone	4,17	1																			1																			
5.1	F	Crataegus sp.	u	stone	4,17	1																																						
5.1	F	Fagus sylvatica	u	seed/fruit	4,17	1																																						
5.1	F	Ficus carica	u	seed/fruit	62,50	15			1	1	1	2		2		2	1		2					2				1	2	1	2		1	3			2	2	3	2	1			2
5.1	F	Fragaria vesca	u	seed/fruit	70,83	17			3			2	2	3	2	4	3		4	2	2	1	2	4	2		2		4	2	2	1	2	4	2		2	1	4	3	2		2	3
5.1	F	Hypericum perforatum	u	seed/fruit	54,17	13			1							2			2					2					2					2					2	1				1
5.1	F	Ilex aquifolium	u	seed/fruit	4,17	1																																					1	
5.1	F	Ilex aquifolium	u	leaf frg	8,33	2																																						
5.1	F	Luzula cf luzuloides	u	seed/fruit	12,50	3																												1					1					
5.1	F	Luzula sp.	u	seed/fruit	8,33	2			1															1																				
5.1	F	Maloideae	u	pericarp frg	58,33	14		2	2				2	1			2	3	2	1	2	1	2		2	2	2									2	2	2		2	2			
5.1	F	Malus / Pyrus	u	seed/fruit	12,50	3			2				2																															
5.1	F	Malus / Sorbus	u	seed/fruit	4,17	1																																						
5.1	F	Malus sp.	u	seed/fruit	41,67	10	1	2							2			1		1	1						1	2							2	1		1						
5.1	F	Malus sylvestris	u	seed/fruit	16,67	4																2					1													1				
5.1	F	Origanum vulgare	u	seed/fruit	45,83	11			2				1			3	1		1					2					2					1					3					2
5.1 / 6.3	F	Physalis alkekengi	u	seed/fruit	79,17	19	1		2	2		2	2	1	2	3	2		2			1	2	2	2			1	1		1	2		2	1		1	1	2	2			1	2
5.1 / 6.3	F	cf Physalis alkekengi	u	seed/fruit	4,17	1					1																																	
5.1	F	Prunus sp.	u	seed/fruit frg	20,83	5				1		1						1																				1					1	
5.1	F	Prunus spinosa	u	stone	8,33	2	1																																	2				
5.1	F	Pyrus communis	u	seed/fruit	8,33	2															2																	2						
5.1	F	Pyrus pyraster	u	seed/fruit	25,00	6		2																			1	2			1												2	
5.1	F	Pyrus sp.	u	stalk frg	4,17	1																									1													
5.1	F	Pyrus sp.	u	stone cells	33,33	8							2						2										3					4					3					3
5.1	F	cf Pyrus	u	seed/fruit frg	4,17	1																																						
5.1	F	Quercus sp.	u	seed/fruit frg> 5mm	100,00	24	3	2	2	2	2	4	3	3	3	2	3	3	2	4	4	3	4		4	3	4	2	3	3		3	3		2	2	3	2	2	3	2	2	4	3
5.1	F	Quercus sp.	u	seed/fruit base	58,33	14							3		2			2			1		2					2			1		2					2	1		2		2	
5.1	F	Rosa sp.	u	seed/fruit	25,00	6																				1												2		1	1		2	1
5.1	F	Rosa / Rubus	u	prickle	25,00	6																							2					1					2					1
5.1	F	Rubus aggr. fruticosus	u	seed/fruit	100,00	24	2	3	3	2	3	4	4	3	4	3	3	4	4	2	3	3	4	4	3		3	4	4	3	4	3	3	4	2	3	4	4	4	4	4		2	3
5.1	F	Rubus cf idaeus	u	seed/fruit	8,33	2																							2					2										
5.1	F	Rumex conglomeratus	u	seed/fruit	4,17	1										1																												
5.1	F	Sambucus nigra	u	seed/fruit	8,33	2																									1							1						
5.1	F	cf Sorbus aria	u	seed/fruit	4,17	1																1																						
5.1	F	Stachys sylvatica	u	seed/fruit	4,17	1						1																																
5.1	F	Torilis japonica	u	seed/fruit	4,17	1										1																												
5.1	F	Vitis vinifera sub. sylvestris	u	fruit frg	4,17	1																									1													
5.1	F	Vitis vinifera sub. sylvestris	u	seed frg	12,50	3										2															3													2
5.1	F	Vitis vinifera sub. sylvestris	u	seed	95,83	23	1	2		2	3	3	3	2	3		3	3		2		3	3			2	3	3		4	3	3	3		2	2	2	3		3	3		2	

Tab. 3.2b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiquity %	ubiquity	LAV c197		LAV c132		LAV c133		LAV c168		LAV E1		LAV c98		LAV W04			LAV RP02			LAV c270
				sample name			c197		c132		c133		c168		E1		c98		W04			RP02			c270
				original vol / vol saturated in water (litres)			1,10	0,95	2,80	2,40	0,50	0,60	1,20	1,00	2,00	1,00	1,20	1,00	2,00	1,90		4,00	4,00		0,92
				fraction vol (ml)			200	140	550	260	180	25	280	120	360	160	240	60	550	200	700	800	1400	800	180
				subsample volume (ml)																	100		490	100	
							4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm (8 mm)	2 mm	0,35 mm	2 mm
WOODLAND, WOOD EDGES, CLEARINGS																									
5.1	F	Agrimonia eupatoria	c	seed/fruit	4,17	1																			
5.1	F	cf Brachipodium sylvaticum	c	seed/fruit	4,17	1																			
5.1	F	Corylus avellana	c	seed/fruit frg	4,17	1																			
5.1	F	Quercus sp.	c	seed/fruit	4,17	1																			
5.1	F	Agrimonia eupatoria	u	seed/fruit	83,33	20		2	2	3		1				1		1		2		1	3		
5.1	F	cf Clematis vitalba	u	seed/fruit	4,17	1																			
5.1	F	Clinopodium vulgare	u	seed/fruit	33,33	8															1		2		
5.1	F	Cornus mas	u	stone	79,17	19		1	2						2			1	2						
5.1	F	Cornus sanguinea	u	stone	12,50	3	1																		
5.1	F	Corylus avellana	u	seed/fruit frg	83,33	20	2		2	2	1	1	2		1	1	2	2	2	2					
5.1	F	Crataegus cf laevigata	u	stone	4,17	1		1																	
5.1	F	Crataegus monogyna	u	stone	33,33	8		2																	
5.1	F	Crataegus cf monogyna	u	stone	4,17	1																			
5.1	F	Crataegus sp.	u	stone	4,17	1	1																		
5.1	F	Fagus sylvatica	u	seed/fruit	4,17	1														1					
5.1	F	Ficus carica	u	seed/fruit	62,50	15		2													1		2		
5.1	F	Fragaria vesca	u	seed/fruit	70,83	17			2	3									1		4		3	4	
5.1	F	Hypericum perforatum	u	seed/fruit	54,17	13				2											2		1	2	1
5.1	F	Ilex aquifolium	u	seed/fruit	4,17	1																			
5.1	F	Ilex aquifolium	u	leaf frg	8,33	2				1														2	
5.1	F	Luzula cf luzuloides	u	seed/fruit	12,50	3															1				
5.1	F	Luzula sp.	u	seed/fruit	8,33	2																			
5.1	F	Maloideae	u	pericarp frg	58,33	14		2												3	2		3	2	
5.1	F	Malus / Pyrus	u	seed/fruit	12,50	3												1							
5.1	F	Malus / Sorbus	u	seed/fruit	4,17	1												2							
5.1	F	Malus sp.	u	seed/fruit	41,67	10	1													2			2		
5.1	F	Malus sylvestris	u	seed/fruit	16,67	4												2							
5.1	F	Origanum vulgare	u	seed/fruit	45,83	11															2			2	
5.1 / 6.3	F	Physalis alkekengi	u	seed/fruit	79,17	19		1		2				1							2			1	
5.1 / 6.3	F	cf Physalis alkekengi	u	seed/fruit	4,17	1																			
5.1	F	Prunus sp.	u	seed/fruit frg	20,83	5																			
5.1	F	Prunus spinosa	u	stone	8,33	2																			
5.1	F	Pyrus communis	u	seed/fruit	8,33	2																			
5.1	F	Pyrus pyraster	u	seed/fruit	25,00	6												2		1					
5.1	F	Pyrus sp.	u	stalk frg	4,17	1																			
5.1	F	Pyrus sp.	u	stone cells	33,33	8															3			2	
5.1	F	cf Pyrus	u	seed/fruit frg	4,17	1																	2		
5.1	F	Quercus sp.	u	seed/fruit frg> 5mm	100,00	24	3	4	3		1	1	2	2		2	2	2	3	3	2	3	4	3	2
5.1	F	Quercus sp.	u	seed/fruit base	58,33	14		2		3									2	2					
5.1	F	Rosa sp.	u	seed/fruit	25,00	6														1			1		
5.1	F	Rosa / Rubus	u	prickle	25,00	6															2			2	
5.1	F	Rubus aggr. fruticosus	u	seed/fruit	100,00	24	2	3	3	3		1	2	2		2		3	2	3	4		3	3	2
5.1	F	Rubus cf idaeus	u	seed/fruit	8,33	2																			
5.1	F	Rumex conglomeratus	u	seed/fruit	4,17	1																			
5.1	F	Sambucus nigra	u	seed/fruit	8,33	2																			
5.1	F	cf Sorbus aria	u	seed/fruit	4,17	1																			
5.1	F	Stachys sylvatica	u	seed/fruit	4,17	1																			
5.1	F	Torilis japonica	u	seed/fruit	4,17	1																			
5.1	F	Vitis vinifera sub. sylvestris	u	fruit frg	4,17	1																			
5.1	F	Vitis vinifera sub. sylvestris	u	seed frg	12,50	3																			
5.1	F	Vitis vinifera sub. sylvestris	u	seed	95,83	23	2	2	2	3	2	2	2	3	1	2	2	2	2	3			2		

Tab. 3.2b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiquity %	ubiquity	LAV c195 bis			LAV c95		LAV rr140		LAV c143			LAV rr115			LAV c169		LAV c135			LAV E2		LAV NN1			LAV rr114		LAV c136			LAV c258		LAV c134			LAV rr131		LAV c76		
		original vol / vol saturated in water (litres)					1,30	1,24		1,50	1,30	11,00	9,20	2,00	1,80		2,50	2,40		1,80	1,80	2,00	2,00		2,00	1,80	3,00	2,80		7,00	6,10	2,50	2,20		1,00	0,80	2,00	2,00		4,80	4,00	1,70	1,50	
		fraction vol (ml)					300	170	360	600	120	1740	640	520	200	440	600	250	530	450	130	370	170	460	980	280	940	560	240	1220	400	560	400	140	450	80	500	250	450	1500	300	190	100	480
		subsample volume (ml)							100							100			100					100					100					100					100					100
							4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm
LAKE SHORE VEGETATION																																												
6.1	LS	Carex cf muricata aggr.	u	seed/fruit	12,50	3									2													1															2
6.1	LS	Carex pseudocyperus	u	seed/fruit	4,17	1																						1															
6.1	LS	Hypericum tetrapterum	u	seed/fruit	8,33	2			1																			1															
6.1	LS	Lychnis flos-cuculi	u	seed/fruit	4,17	1																	1																				
6.1	LS	Lycopus europaeus	u	seed/fruit	50,00	12			2			1				2	2		2				1	2										2					2	1	2			1
6.1	LS	Lythrum cf salicaria	u	seed/fruit	8,33	2																																	1					
6.1	LS	Mentha aquatica / M. arvensis	u	seed/fruit	4,17	1																						1															
6.1	LS	Mentha spicata / M. suaveolens	u	seed/fruit	4,17	1									1																												
6.1	LS	Ranunculus sardous	u	seed/fruit	66,67	16			2			1	1			2	2		2	1			1	1	1		1		2					2	1			1	2	2				2
6.1	LS	Stachys officinalis	u	seed/fruit	4,17	1			1																																		
2.2 / 2.3 / 6.2	LS	Polygonum lapathifolium	u	seed/fruit	83,33	20	1		2	1			2	1					2	2	1	1	1	2	1		2	2	3	2	1	1		2	2		1		2	2	2		1	2
2.2 / 2.3 / 6.2	LS	Polygonum lapathifolium	u	perianth	4,17	1																					1																
6.2	LS	Bidens cernua	u	seed/fruit	8,33	2																													1								
6.2	LS	Cyperus flavescens	u	seed/fruit	41,67	10			2							2			1					2					2					2					2					1
6.2	LS	Polygonum hydropiper	u	seed/fruit	4,17	1																																					
6.2	LS	Polygonum minus	u	perianth	8,33	2													1										1															
6.2	LS	Rumex maritimus	u	perianth	83,33	20		2	2		2		2			1	2	1	1	2	3	1	2	2	2	2	1	2	2		1	1		2	2	2		2		2	3	1	1	
6.2	LS	Rumex maritimus	u	seed/fruit	29,17	7			1										1					2					2					1					2	1				
6.2	LS	Schoenoplectus gr supinus	u	seed/fruit	20,83	5					1	1					1																										
6.3	LS	Schoenoplectus cf mucronatus	u	seed/fruit	12,50	3										2			2															2										
6.3	LS	Schoenoplectus lacustris	u	seed/fruit	8,33	2																						1						2										
6.3	LS	Schoenoplectus tabernaemontani	u	seed/fruit	4,17	1																		1																				
6.2	LS	Scirpus radicans	u	seed/fruit	54,17	13			2							2	1		2	2				2					2						2		1		2					1
6.1 / 6.2	LS	Ranunculus sceleratus	u	seed/fruit	66,67	16	1		2							2	2		2	1				1	1				2	1				2				1	2	1	2			2
6.3	LS	Alisma plantago-aquatica	u	seed/fruit	8,33	2			1																																		
6.1	LS	Carex flava	u	seed/fruit	4,17	1																																					
6.3	LS	Carex riparia	u	seed/fruit	8,33	2																						1		1													
6.3	LS	Cyperus glomeratus	u	seed/fruit	29,17	7			2							2			2												1													2
6.3	LS	Phalaris arundinacea	u	seed/fruit	12,50	3																												2										
6.3	LS	Schoenoplectus sp	u	seed/fruit	4,17	1																																					
6.3	LS	Typha latifolia / T. angustifolia	u	seed/fruit	25,00	6			2							1								1					2															1
AQUATICS																																												
7.1	A	Ceratophyllum demersum	u	seed/fruit	95,83	23	2	2		1	2	3	3	2	2	1	2	2		2	2	1	2	1	2	2	2	3	2	2	2	1	2		2	2	2	2		2	2		1	
7.1	A	Ceratophyllum submersum	u	seed/fruit	16,67	4					1									1																								
7.1	A	Ceratophyllum sp.	u	seed/fruit	8,33	2																																						
7.1	A	Characeae	u	seed/fruit	50,00	12								1		2			2	2				2					2					1					2					2
7.1	A	Lemna minor	u	seed/fruit	4,17	1			1																																		
7.1	A	Myriophyllum spicatum	u	seed/fruit	37,50	9						1		1	2	2	1		2						1		1							2					2		1			
7.1	A	Myriophyllum sp.	u	leaf fragm	4,17	1																					1																
7.1	A	Najas marina	u	seed/fruit	12,50	3															2																						
7.1	A	Nuphar lutea	u	seed/fruit	20,83	5		1					1					1																				2						
7.1	A	Nymphaea alba	u	seed/fruit	37,50	9						1				2				2						1													1					2
7.1	A	cf Nymphaea	u	seed/fruit	4,17	1				1																																	
7.1	A	Nymphaea sp.	u	seed/fruit	12,50	3																					1																	
7.1	A	Potamogeton natans	u	seed/fruit	50,00	12				2	3		2			1					2							1						1	1	2			2					1
7.1	A	Potamogeton sp.	u	seed/fruit	41,67	10						2							1	2			1			1							2			2								
7.1	A	Ranunculus subgen. Batrachium	u	seed/fruit	4,17	1																																	2					

Tab. 3.2b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiquity %	ubiquity	LAV c197		LAV c132		LAV c133		LAV c168		LAV E1		LAV c98		LAV W04			LAV RP02			LAV c270
		sample name					c197		c132		c133		c168		E1		c98		W04			RP02			c270
		original vol / vol saturated in water (litres)					1,10	0,95	2,80	2,40	0,50	0,60	1,20	1,00	2,00	1,00	1,20	1,00	2,00	1,90		4,00	4,00		0,92
		fraction vol (ml)					200	140	550	260	180	25	280	120	360	160	240	60	550	200	700	800	1400	800	180
		subsample volume (ml)																			100		490	100	
							4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm (8 mm)	2 mm	0,35 mm	2 mm
LAKE SHORE VEGETATION																									
6.1	LS	Carex cf muricata aggr.	u	seed/fruit	12,50	3																			
6.1	LS	Carex pseudocyperus	u	seed/fruit	4,17	1																			
6.1	LS	Hypericum tetrapterum	u	seed/fruit	8,33	2																			
6.1	LS	Lychnis flos-cuculi	u	seed/fruit	4,17	1																			
6.1	LS	Lycopus europaeus	u	seed/fruit	50,00	12				2											2			2	
6.1	LS	Lythrum cf salicaria	u	seed/fruit	8,33	2															1				
6.1	LS	Mentha aquatica / M. arvensis	u	seed/fruit	4,17	1																			
6.1	LS	Mentha spicata / M. suaveolens	u	seed/fruit	4,17	1																			
6.1	LS	Ranunculus sardous	u	seed/fruit	66,67	16				2										1	1		2	1	
6.1	LS	Stachys officinalis	u	seed/fruit	4,17	1																			
2.2 / 2.3 / 6.2	LS	Polygonum lapathifolium	u	seed/fruit	83,33	20				1							1				2	1	3	2	2
2.2 / 2.3 / 6.2	LS	Polygonum lapathifolium	u	perianth	4,17	1																			
6.2	LS	Bidens cernua	u	seed/fruit	8,33	2																	1		
6.2	LS	Cyperus flavescens	u	seed/fruit	41,67	10															2			2	
6.2	LS	Polygonum hydropiper	u	seed/fruit	4,17	1				2															
6.2	LS	Polygonum minus	u	perianth	8,33	2																			
6.2	LS	Rumex maritimus	u	perianth	83,33	20				2								2		2			3	1	2
6.2	LS	Rumex maritimus	u	seed/fruit	29,17	7																			
6.2	LS	Schoenoplectus gr supinus	u	seed/fruit	20,83	5				2															1
6.3	LS	Schoenoplectus cf mucronatus	u	seed/fruit	12,50	3																			
6.3	LS	Schoenoplectus lacustris	u	seed/fruit	8,33	2																			
6.3	LS	Schoenoplectus tabernaemontani	u	seed/fruit	4,17	1																			
6.2	LS	Scirpus radicans	u	seed/fruit	54,17	13				1											4		2	2	3
6.1 / 6.2	LS	Ranunculus sceleratus	u	seed/fruit	66,67	16				2						1					1			2	
6.3	LS	Alisma plantago-aquatica	u	seed/fruit	8,33	2															2				
6.1	LS	Carex flava	u	seed/fruit	4,17	1															1				
6.3	LS	Carex riparia	u	seed/fruit	8,33	2																			
6.3	LS	Cyperus glomeratus	u	seed/fruit	29,17	7															3			2	
6.3	LS	Phalaris arundinacea	u	seed/fruit	12,50	3															1			1	
6.3	LS	Schoenoplectus sp	u	seed/fruit	4,17	1																	2		
6.3	LS	Typha latifolia / T. angustifolia	u	seed/fruit	25,00	6															2				
AQUATICS																									
7.1	A	Ceratophyllum demersum	u	seed/fruit	95,83	23	2	2	2	2		2	1			2	2	2	3	3		2	3		
7.1	A	Ceratophyllum submersum	u	seed/fruit	16,67	4														2					2
7.1	A	Ceratophyllum sp.	u	seed/fruit	8,33	2															1				1
7.1	A	Characeae	u	seed/fruit	50,00	12				1											4			3	3
7.1	A	Lemna minor	u	seed/fruit	4,17	1																			
7.1	A	Myriophyllum spicatum	u	seed/fruit	37,50	9															2				
7.1	A	Myriophyllum sp.	u	leaf fragm	4,17	1																			
7.1	A	Najas marina	u	seed/fruit	12,50	3															2				2
7.1	A	Nuphar lutea	u	seed/fruit	20,83	5														1					
7.1	A	Nymphaea alba	u	seed/fruit	37,50	9															3		1	1	1
7.1	A	cf Nymphaea	u	seed/fruit	4,17	1																			
7.1	A	Nymphaea sp.	u	seed/fruit	12,50	3				1													2		
7.1	A	Potamogeton natans	u	seed/fruit	50,00	12														3	2			1	4
7.1	A	Potamogeton sp.	u	seed/fruit	41,67	10												1	1	2			2	2	
7.1	A	Ranunculus subgen. Batrachium	u	seed/fruit	4,17	1																			

Tab. 3.2b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiquity %	ubiquity	LAV c195 bis			LAV c95		LAV rr140		LAV c143			LAV rr115			LAV c169		LAV c135			LAV E2		LAV NN1			LAV rr114		LAV c136			LAV c258		LAV c134			LAV rr131		LAV c76		
		original vol / vol saturated in water (litres)					1,30	1,24		1,50	1,30	11,00	9,20	2,00	1,80		2,50	2,40		1,80	1,80	2,00	2,00		2,00	1,80	3,00	2,80		7,00	6,10	2,50	2,20		1,00	0,80	2,00	2,00		4,80	4,00	1,70	1,50	
		fraction vol (ml)					300	170	360	600	120	1740	640	520	200	440	600	250	530	450	130	370	170	460	980	280	940	560	240	1220	400	560	400	140	450	80	500	250	450	1500	300	190	100	480
		subsample volume (ml)							100							100			100					100					100					100					100					100
							4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm
VARIA																																												
0.	VA	Bromus sp.	c	seed/fruit	4,17	1																		1																				
0.	VA	Poaceae	c	seed/fruit	20,83	5							2						1		1							2	1									1	1					
0.	VA	undet.	c	seed/fruit	16,67	4					2		2			2																							1					
0.	VA	Ajuga sp.	u	seed/fruit	4,17	1										1																												
0	VA	Asteraceae	u	seed/fruit	8,33	2						1																																1
0.	VA	Brassicaceae	u	seed/fruit	33,33	8			2							2	1							1															2					2
0.	VA	Bromus sp.	u	seed/fruit	8,33	2																		2															1					
0.	VA	Campanulaceae	u	seed/fruit	4,17	1																							1															
0.	VA	Campanula sp.	u	seed/fruit	4,17	1																																						
0.	VA	Carduus sp.	u	seed/fruit	4,17	1																																						1
0.	VA	Carex bicarpellate	u	seed/fruit	25,00	6			1																				1				2	1						2				
0.	VA	Carex tricarpellate	u	seed/fruit	45,83	11		1			1			2		2		1					1		1				2				1							2	1			
0.	VA	Carex sp.	u	utriculus	12,50	3							1							1																			2					
0.	VA	cf Carthamus	u	achene fragm	4,17	1																																						1
0.	VA	Caryophyllaceae	u	seed/fruit	8,33	2									1																													
0.	VA	Cerastium sp.	u	seed/fruit	20,83	5			2										2					2															2					2
0.	VA	Cyperaceae	u	seed/fruit	20,83	5																					1					1								1				
0.	VA	cf Dipsacaceae	u	seed/fruit	4,17	1																																		1				
0.	VA	Dianthus / petrorhagia	u	seed/fruit	4,17	1										1																												
0.	VA	Epilobium sp.	u	seed/fruit	4,17	1			1																																			
0.	VA	Fabaceae	u	pod fragm	8,33	2																																						
0.	VA	cf Fabaceae	u	seed/fruit	4,17	1																						1																
0.	VA	Knautia sp.	u	seed/fruit	12,50	3			2																														2					
0.	VA	Lamiaceae	u	seed/fruit	8,33	2																						1																
0.	VA	Linum sp.	u	seed/fruit	8,33	2			1				1																															
0.	VA	Mentha sp.	u	seed/fruit	8,33	2											1																											
5. / 4.3 = 0.	VA	Phyteuma spicatum / orbiculare	u	seed/fruit	8,33	2										1																						1						
0.	VA	Poa sp.	u	seed/fruit	4,17	1			1																																			
0.	VA	Poaceae	u	seed/fruit	58,33	14				1	1		2			2	2	1	2		2					2	1		1		1			1				1						1
0.	VA	Polygonaceae	u	seed/fruit	12,50	3							2																				2											
0.	VA	Polygonum sp.	u	seed/fruit	8,33	2																			1	1																		
0.	VA	Potentilla sp.	u	seed/fruit	16,67	4								2		1	1																							3	1			
0.	VA	cf Potentilla	u	seed/fruit	4,17	1																																						
0.	VA	Ranunculus sp.	u	seed/fruit	8,33	2												1																					1					
0.	VA	Rumex sp.	u	seed/fruit	16,67	4		1											1					1																	2			
0.	VA	Sambucus sp.	u	seed/fruit	8,33	2																																						
0.	VA	Solanaceae	u	seed/fruit	4,17	1																																						
0.	VA	Solanum sp.	u	seed/fruit	4,17	1																		1																				
0.	VA	Stachys sp.	u	seed/fruit	12,50	3																		1					1	1														
0.	VA	Stellaria sp.	u	seed/fruit	4,17	1										1																												
0.	VA	Teucrium sp.	u	seed/fruit	12,50	3						1																				1												
0.	VA	undet.	u	seed/fruit	54,17	13			2					2	1				1					2	1	1						2	2	2				2	1	2			2	
other finds																																												
		Pteridophyta leaf fragments	u		12,50	3																													1									2
		insect remains			95,83	23	2	2	2	2	2	3	2	2	1	3	2	2	2	2	1	2	2	2	3	3	3	3	3	2	2	2	2	2	1	2	2	2		3	3		2	2
		fly puparia			87,50	21		2	2	1	2	2	3	2	2	3	2	2	2	2	2	2	3	2	1	3		3	2		3		3	2	2	2	1	3	2	2	3			2
		bone fragments			83,33	20		1			2	3	3	3	2	5%	2	2			2	3	3		2		3	2		3	2	3	3				3	2		3	2	2	3	
		bones small animals			41,67	10				1	1	2	2	1	1			1					1				2			2	2							1						
		fish bones			66,67	16						2	2		2		1	2			1		2			1	1	2		2	2	2	2							2	3			
		fish vertebrae			66,67	16			1			1	1	1	2	1					1		1			1	2	2			2	1	2				1			1	2		2	
		fish scale			87,50	21		2	2		2	2	3	1	2	2	2	3	1		1		2			3	2	2	1	1	2	2	2				1	2	2	1	2		1	2

Tab. 3.2b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiquity %	ubiquity	LAV c197		LAV c132		LAV c133		LAV c168		LAV E1		LAV c98		LAV W04			LAV RP02			LAV c270
		sample name					c197		c132		c133		c168		E1		c98		W04			RP02			c270
		original vol / vol saturated in water (litres)					1,10	0,95	2,80	2,40	0,50	0,60	1,20	1,00	2,00	1,00	1,20	1,00	2,00	1,90		4,00	4,00		0,92
		fraction vol (ml)					200	140	550	260	180	25	280	120	360	160	240	60	550	200	700	800	1400	800	180
		subsample volume (ml)																			100		490	100	
							4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm (8 mm)	2 mm	0,35 mm	2 mm
VARIA																									
0.	VA	Bromus sp.	c	seed/fruit	4,17	1																			
0.	VA	Poaceae	c	seed/fruit	20,83	5																			
0.	VA	undet.	c	seed/fruit	16,67	4																			
0.	VA	Ajuga sp.	u	seed/fruit	4,17	1																			
0	VA	Asteraceae	u	seed/fruit	8,33	2																			
0.	VA	Brassicaceae	u	seed/fruit	33,33	8															2		3	2	
0.	VA	Bromus sp.	u	seed/fruit	8,33	2																			
0.	VA	Campanulaceae	u	seed/fruit	4,17	1																			
0.	VA	Campanula sp.	u	seed/fruit	4,17	1																		2	
0.	VA	Carduus sp.	u	seed/fruit	4,17	1																			
0.	VA	Carex bicarpellate	u	seed/fruit	25,00	6				1													1		
0.	VA	Carex tricarpellate	u	seed/fruit	45,83	11				2													2		
0.	VA	Carex sp.	u	utriculus	12,50	3																			
0.	VA	cf Carthamus	u	achene fragm	4,17	1																			
0.	VA	Caryophyllaceae	u	seed/fruit	8,33	2																	1		
0.	VA	Cerastium sp.	u	seed/fruit	20,83	5																			
0.	VA	Cyperaceae	u	seed/fruit	20,83	5															1		1		
0.	VA	cf Dipsacaceae	u	seed/fruit	4,17	1																			
0.	VA	Dianthus / petrorhagia	u	seed/fruit	4,17	1																			
0.	VA	Epilobium sp.	u	seed/fruit	4,17	1																			
0.	VA	Fabaceae	u	pod fragm	8,33	2															1			1	
0.	VA	cf Fabaceae	u	seed/fruit	4,17	1																			
0.	VA	Knautia sp.	u	seed/fruit	12,50	3																		1	
0.	VA	Lamiaceae	u	seed/fruit	8,33	2																	1		
0.	VA	Linum sp.	u	seed/fruit	8,33	2																			
0.	VA	Mentha sp.	u	seed/fruit	8,33	2																	1		
5. / 4.3 = 0.	VA	Phyteuma spicatum / orbiculare	u	seed/fruit	8,33	2																			
0.	VA	Poa sp.	u	seed/fruit	4,17	1																			
0.	VA	Poaceae	u	seed/fruit	58,33	14														1	1		2	2	2
0.	VA	Polygonaceae	u	seed/fruit	12,50	3																	2		
0.	VA	Polygonum sp.	u	seed/fruit	8,33	2															2				
0.	VA	Potentilla sp.	u	seed/fruit	16,67	4																			1
0.	VA	cf Potentilla	u	seed/fruit	4,17	1																	3		
0.	VA	Ranunculus sp.	u	seed/fruit	8,33	2																			
0.	VA	Rumex sp.	u	seed/fruit	16,67	4																			
0.	VA	Sambucus sp.	u	seed/fruit	8,33	2																	1		1
0.	VA	Solanaceae	u	seed/fruit	4,17	1																	2		
0.	VA	Solanum sp.	u	seed/fruit	4,17	1																			
0.	VA	Stachys sp.	u	seed/fruit	12,50	3																			
0.	VA	Stellaria sp.	u	seed/fruit	4,17	1																			
0.	VA	Teucrium sp.	u	seed/fruit	12,50	3				1															
0.	VA	undet.	u	seed/fruit	54,17	13								2						2	2			2	2
other finds																									
		Pteridophyta leaf fragments	u		12,50	3															2				
		insect remains			95,83	23		1	2	3		1		1		1	2	1	1	2	3			2	
		fly puparia			87,50	21	1	2		2		1		2						1	2			2	
		bone fragments			83,33	20	2	2	2	3			2	2	2	2	2		2	2					
		bones small animals			41,67	10						1				1									
		fish bones			66,67	16				2		2		1		1	2				2				
		fish vertebrae			66,67	16		1		2							1							1	
		fish scale			87,50	21		2		2		1		2		1			1	3	2			1	

Tab. 3.2b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	sample name		LAV c195 bis			LAV c95		LAV rr140		LAV c143			LAV rr115			LAV c169		LAV c135			LAV E2		LAV NN1			LAV rr114		LAV c136			LAV c258		LAV c134			LAV rr131		LAV c76		
					original vol / vol saturated in water (litres)		1,30	1,24		1,50	1,30	11,00	9,20	2,00	1,80		2,50	2,40		1,80	1,80	2,00	2,00		2,00	1,80	3,00	2,80		7,00	6,10	2,50	2,20		1,00	0,80	2,00	2,00		4,80	4,00	1,70	1,50	
					fraction vol (ml)		300	170	360	600	120	1740	640	520	200	440	600	250	530	450	130	370	170	460	980	280	940	560	240	1220	400	560	400	140	450	80	500	250	450	1500	300	190	100	480
					subsample volume (ml)				100							100			100					100					100					100					100					100
ecol grp	large ecol grp	taxon	preservation	remain type	ubiquity %	ubiquity	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm
		molluscs			33,33	8					1									1	1	1	1			1									2	3			1					
		charcoal	c		100,00	24	10%	5%	10%	80%	60%	10%	10%	10%	30%	10%	10%	10%	10%	20%	5%	15%	20%	10%	5%	5%	5%	20%	10%	40%	20%	20%	10%	20%	90%	50%	5%	5%	5%	10%	10%	10%	5%	
		wood unc.	u		100,00	24	20%	40%	30%	5%		40%	60%	40%	20%	30%	20%	40%	30%		50%	35%	50%	40%	45%	50%	50%	50%	60%	10%	30%	50%	60%	40%	5%	10%	80%	60%	50%	50%	50%	30%	30%	70%
		twigs with bark unc.	u		100,00	24	25%	10%	5%	2	5%	5%		10%		5%	10%	10%	5%	20%	10%	5%	5%	5%	15%	10%	20%	10%		10%		5%	5%		5%	10%	5%	5%	5%	10%	20%	10%	5%	15%
		twigs unc.	u		75,00	18	35%	5%	5%			10%		10%	10%	5%	10%		5%	40%	5%		5%	5%	25%	10%	15%			5%		5%	5%				5%	10%		10%		25%		15%
		bark	u		91,67	22	5%	20%		5%		20%	30%	20%		20%	5%	20%	10%	10%	30%	45%	20%		5%	20%	10%	20%	30%	35%	50%	20%	20%	40%			5%	20%	40%	20%	20%	25%	20%	
		thorns	u		50,00	12		1	2						1	1	1	2		1	2			1	2	3		2	1						2	1	1			1	1			
		leaf fragments	u		54,17	13	2	1	2			2	1			1		2		2	2				3	3									1		1			2	1			
		leaf fragments	c		8,33	2															2																							
		epidermis fragm.	u		45,83	11	1				2	1	2				1	2		2	2					3												1						
		bud	u		91,67	22		2	2		2	2	3	1	2	2	2	2	2	1	2	1		2	2	3	2	3	2		3		2	2	2		2	3	3	2	3		2	2
		bud scale	u		79,17	19	2	1	2	1	2	3	3		2	2	2	2	1	2				2	3	2	1	2	2	1	3		3	1		1	1	2	2	3	2			2
		moss	u		95,83	23	2	3	2	2	3	3	3	3	3		2	2		3	3	2			3	3	3	3			2	2	3		4	30%	3	2		3	2		2	
		rhizome	u		8,33	2																																		1	1			
		root	u		12,50	3	2			2		1																																
		Amphibian / reptile vertebra			4,17	1						1																																
		goat/sheep coprolite	u		62,50	15		2				1					2								2						1					1		2		2	1	2	2	1
		herbaceous stem	u		79,17	19	5%	1	30%	2	3	2	2	3	2	5%	1	2	20%	3	3	2	2	35%	3	3	1			2		2					3	2		2	2		2	
		dung fragments	u		8,33	2	3																		3	2																		
		aggregates			50,00	12		20%	20%	10%	30%				40%	20%		20%	20%					5%		5%																	40%	
		stalk	u		4,17	1						1																																
		stalk base	u		20,83	5						1	1				1			2														1										
		mammal tooth			4,17	1																																		1				
		mammal emimandible			4,17	1																																		1				
		carnivore tooth (corona)			4,17	1											1																											
		carbonized dung	c		25,00	6														2	2						2			1		1					1							
		mouse escrements	u		25,00	6							2		2			2								1		2										2						
		cf insect remains			8,33	2																																		2				
		catkin			4,17	1																																			1			
		anther			8,33	2			1																																			
		undeterminable remains			16,67	4											1															1	1							2				

Tab. 3.2b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiquity %	ubiquity	LAV c197		LAV c132		LAV c133		LAV c168		LAV E1		LAV c98		LAV W04			LAV RP02			LAV c270
		sample name																							
		original vol / vol saturated in water			(litres)		1,10	0,95	2,80	2,40	0,50	0,60	1,20	1,00	2,00	1,00	1,20	1,00	2,00	1,90		4,00	4,00		0,92
		fraction vol (ml)					200	140	550	260	180	25	280	120	360	160	240	60	550	200	700	800	1400	800	180
		subsample volume (ml)																			100		490	100	
							4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm (8 mm)	2 mm	0,35 mm	2 mm
		molluscs			33,33	8														2					2
		charcoal	c		100,00	24	10%	10%	20%	20%	5%	25%	20%	20%	45%	30%	20%	10%	20%	10%	10%			10%	5%
		wood unc.	u		100,00	24	60%	60%	30%	50%	75%	60%	60%	60%	35%	20%	10%	50%	40%	40%	30%	60%	60%	20%	10%
		twigs with bark unc.	u		100,00	24	10%	10%	10%			5%		5%	5%	5%	5%	10%	10%	10%		5%	10%		5%
		twigs unc.	u		75,00	18	10%	5%	10%									10%	10%	10%		20%	20%		
		bark	u		91,67	22	10%	10%	30%	30%	20%	10%	30%	15%		5%	50%	20%		10%	10%	15%	10%	10%	
		thorns	u		50,00	12														1			3		
		leaf fragments	u		54,17	13		2												1	3		2	3	1
		leaf fragments	c		8,33	2						1													
		epidermis fragm.	u		45,83	11						1						1		1					2
		bud	u		91,67	22	2	2	2	2		2		2				2		2	1		3	2	
		bud scale	u		79,17	19		2		2										2	1		3	2	
		moss	u		95,83	23	2	3	2	3		2		2			3	3	2	3	3			3	10%
		rhizome	u		8,33	2											1								
		root	u		12,50	3																			
		Amphibian / reptile vertebra			4,17	1																			
		goat/sheep coprolite	u		62,50	15	1			1			2		2	1			2	2					2
		herbaceous stem	u		79,17	19		3	2	3							2			2					1
		dung fragments	u		8,33	2																			
		aggregates			50,00	12		5%							15%	40%			20%	20%	50%			60%	70%
		stalk	u		4,17	1																			
		stalk base	u		20,83	5																	2	1	
		mammal tooth			4,17	1																			
		mammal emimandible			4,17	1																			
		carnivore tooth (corona)			4,17	1																			
		carbonized dung	c		25,00	6									1										
		mouse escrements	u		25,00	6																			
		cf insect remains			8,33	2																	3		
		catkin			4,17	1																			
		anther			8,33	2															1				
		undeterminable remains			16,67	4							1												

Tab. 3.3 – Results (n. of remains) of the fully analysed samples of the MBA layers from Sector D of Lavagnone (13 samples). Also ubiquity values are shown.

13 samples

total volume 56,3 litres
total remains (extrapolated) = 162501
total remains (identified) = 10111
total remains identified for statistic analysis = 10926
mean concentration (n. remains / litre) = 2838,3

ecol grp	large ecol grp	taxon	pres	remain type	n. tot	ubiq %	ubiq	LAV c4025	LAV c4034	LAV c4061	LAV c4063	LAV c4064	LAV c4065	LAV c4069	LAV c4072	LAV c4073	LAV c4074	LAV c4075	LAV c4076	LAV c4078
							volume saturated in water (l)	3,8	3,5	3,5	4,0	4,5	4,5	4,5	5,0	6,0	4,5	4,5	4,0	4,0
							concentration (n. remains/l)	**4977,8618**	**2543,4**	**4038,9143**	**1182,5125**	**1581,3333**	**2577,1111**	**1533,4333**	**7261,4**	**3536,7875**	**2627,6**	**1407,0667**	**2039,5625**	**1590,34**
							n. remains	18915,9	8901,9	14136,2	4730,05	7116	11597	6900,45	36307	21220,7	11824,2	6331,8	8158,25	6361,36
FIELDS																		
cultivated plants																		
1.1	C	Triticum monococcum	c	spikelet fork	17419	100,00	13	3626	1237,2	1276	249,6	600	2482	392	3282	1314,8	1800	260	63,2	836,2
1.1	C	Triticum monococcum	c	glume base	2012,4	84,62	11	609,5	176,6	279	41,6	15	85	84	126	311,4	160	0	0	124,3
1.1	C	Triticum monococcum	c	spikelet fork 2 grain	32	7,69	1	0	0	0	0	0	0	0	0	0	32	0	0	0
1.1	C	Triticum monococcum	c	grain	147	84,62	11	33	25,4	5	0	2	7	0	15	44,6	9	1	4	1
1.1	C	Triticum dicoccum	c	spikelet fork	4666	100,00	13	372	150,8	328	166,4	362	682	84	94	278,8	390	342	1048,4	367,6
1.1	C	Triticum dicoccum	c	glume base	2652,3	100,00	13	270	38,2	250	156	255	170	84	420	138,4	289	40	383,5	158,2
1.1	C	Triticum dicoccum	c	grain	275	100,00	13	7	6	17	2	11	30	4	35	93	33	10	11	16
1.1	C	Triticum nn (new glume wheat)	c	spikelet fork	23665,8	100,00	13	2704	1676,4	1284	384,4	758	2428	966	4990	1591,6	3464	484	1649,8	1285,6
1.1	C	Triticum nn (new glume wheat)	c	glume base	7865,2	100,00	13	1588	4	561	228,8	300	850	168	2184	415,2	864	40	198,9	463,3
1.1	C	Triticum nn (new glume wheat)	c	grain	62	46,15	6	12	7	0	0	1	0	0	0	22	18	0	0	2
1.1	C	Triticum cf nn (cf new glume wheat)	c	grain	49	61,54	8	0	9	4	2	0	7	3	4	0	0	14	6	0
1.1	C	Triticum durum / T. turgidum	c	rachis	11,3	7,69	1	0	0	0	0	0	0	0	0	0	0	0	0	11,3
1.1	C	Triticum spelta	c	glume base	11,3	7,69	1	0	0	0	0	0	0	0	0	0	0	0	0	11,3
1.1	C	Triticum cf spelta	c	glume base	1	7,69	1	0	0	1	0	0	0	0	0	0	0	0	0	0
1.1	C	Triticum spelta	c	grain	1	7,69	1	0	1	0	0	0	0	0	0	0	0	0	0	0
1.1	C	Triticum cf spelta	c	grain	12	38,46	5	1	0	0	1	0	1	0	0	3	0	6	0	0
1.1	C	Triticum cf aestivum	c	rachis	6	7,69	1	0	0	0	0	0	0	0	0	0	0	0	6	0
1.1	C	Triticum aestivum / T. durum / T. turgidum	c	grain	4	15,38	2	0	0	0	0	0	0	1	0	0	0	0	3	0
1.1	C	Triticum dicoccum / T. nn (new glume wheat)	c	spikelet fork	966,4	38,46	5	0	0	0	0	0	340	168	336	0	32	0	0	90,4
1.1	C	Triticum dicoccum / T. nn (new glume wheat)	c	glume base	434,3	30,77	4	0	0	0	0	0	0	42	252	0	16	0	0	124,3
1.1	C	Triticum dicoccum / T. nn (new glume wheat)	c	grain	3	7,69	1	0	0	0	0	0	0	0	0	3	0	0	0	0
1.1	C	Triticum monococcum / T. nn	c	spikelet fork	2954,8	61,54	8	0	156,8	558	0	0	238	84	1512	0	0	124	214,2	67,8
1.1	C	Triticum monococcum / T. nn	c	glume base	1327,6	46,15	6	0	287,2	248	0	0	68	0	630	0	0	0	15,3	79,1
1.1	C	Triticum monococcum / T. dicoccum	c	spikelet fork	2	7,69	1	0	0	0	0	0	0	0	0	2	0	0	0	0
1.1	C	Triticum sp.	c	spikelet fork	5322,4	100,00	13	540	1095,6	4	62,4	480	1156	282	168	207,6	832	40	183,6	271,2
1.1	C	Triticum sp.	c	rachis frg	1003,3	100,00	13	247,5	24,8	1	31,2	15	85	15	84	276,8	32	70	30,6	90,4
1.1	C	Triticum sp.	c	ear uppermost part	1567,8	76,92	10	339	63,6	130	0	60	170	112	420	0	192	20	61,2	0
1.1	C	Triticum sp.	c	glume base	4661,1	92,31	12	1179	0	372	93,6	105	374	168	630	449,8	512	390	229,5	158,2
1.1	C	Triticum sp.	c	grain	41,4	53,85	7	0	12,4	0	0	0	17	2	0	4	2	1	3	0
1.1	C	Triticum / Hordeum	c	grain	164	15,38	2	102	62	0	0	0	0	0	0	0	0	0	0	0
1.1	C	Hordeum vulgare	c	grain	154	92,31	12	24	21	8	0	2	22	2	10	38	4	7	9	7
1.1	C	Hordeum vulgare	c	rachis frg	312,4	38,46	5	0	0	62	62,4	30	0	0	126	0	32	0	0	0
1.1	C	Hordeum vulgare	c	spikelet fork	28	15,38	2	0	0	0	8	0	0	0	0	0	0	20	0	0
1.1	C	Panicum miliaceum	c	grain	681,1	92,31	12	158,5	12,4	2	0	30	85	56	168	42,6	80	20	15,3	11,3
1.1	C	Panicum miliaceum	c	glume base	235,2	38,46	5	0	12,4	0	10,4	0	0	0	42	138,4	32	0	0	0
1.1	C	Cerealia	c	grain	241	100,00	13	18	17	62	1	1	51	19	29	1	1	18	1	22
1.1	C	Cerealia	c	rachis frg	54,2	15,38	2	0	37,2	0	0	0	17	0	0	0	0	0	0	0
1.1	C	Cerealia	c	spikelet	99,2	7,69	1	0	99,2	0	0	0	0	0	0	0	0	0	0	0
1.1	C	Vicia faba var. minor	c	seed	7	30,77	4	0	0	0	0	0	0	0	4	1	1	0	1	0

Tab. 3.3 - continued

13 samples					sample name			LAV c4025	LAV c4034	LAV c4061	LAV c4063	LAV c4064	LAV c4065	LAV c4069	LAV c4072	LAV c4073	LAV c4074	LAV c4075	LAV c4076	LAV c4078
1.1	C	Triticum monococcum	u	spikelet fork	86	15,38	2	0	0	0	0	0	0	0	84	2	0	0	0	0
1.1	C	Triticum dicoccum	u	spikelet fork	26,8	15,38	2	0	24,8	2	0	0	0	0	0	0	0	0	0	0
1.1	C	Triticum nn (new glume wheat)	u	spikelet fork	237	23,08	3	135	0	0	0	0	0	0	84	18	0	0	0	0
1.1	C	Triticum cf nn (cf new glume wheat)	u	spikelet fork	88	15,38	2	0	0	4	0	0	0	0	84	0	0	0	0	0
1.1	C	Triticum sp.	u	glume base	650,2	23,08	3	0	546,2	62	0	0	0	0	42	0	0	0	0	0
1.1	C	Triticum sp.	u	spikelet fork	176	23,08	3	0	0	124	0	0	0	0	0	0	32	20	0	0
1.1	C	Triticum sp.	u	grain	4	23,08	3	0	1	0	0	2	0	1	0	0	0	0	0	0
1.1	C	Cerealia	u	spikelet	2	7,69	1	0	0	0	0	0	0	0	0	2	0	0	0	0
1.1	C	Panicum miliaceum	u	glume base	796,8	53,85	7	0	24,8	403	0	0	0	0	126	138,4	32	50	0	22,6
1.1	C	Panicum miliaceum	u	glume	100	38,46	5	0	12,4	1	0	0	0	0	42	34,6	0	10	0	0
1.1	C	Hordeum vulgare	u/c	grain	1	7,69	1	0	0	0	0	0	0	0	0	0	0	1	0	0
1.1	C	Triticum cf nn (cf new glume wheat)	u/c	grain	2	7,69	1	0	0	0	0	0	0	0	0	0	0	2	0	0
1.1	C	Triticum dicoccum	u/c	grain	2	7,69	1	0	0	0	0	0	0	0	0	0	0	2	0	0

Tab. 3.3 - continued

13 samples					sample name			LAV c4025	LAV c4034	LAV c4061	LAV c4063	LAV c4064	LAV c4065	LAV c4069	LAV c4072	LAV c4073	LAV c4074	LAV c4075	LAV c4076	LAV c4078
winter crop weeds																				
2.1	WW	Avena sp.	c	grain	3	7,69	1	0	0	0	0	0	0	0	3	0	0	0	0	0
2.1 / 2.3	WW	Lathyrus cf aphaca	c	seed/fruit	4	15,38	2	0	0	3	0	0	1	0	0	0	0	0	0	0
2.1	WW	Scleranthus annuus	c	seed/fruit	16	7,69	1	0	0	0	0	0	0	0	0	0	16	0	0	0
2.1 / 2.3	WW	Vicia cf angustifolia	c	seed	1	7,69	1	0	1	0	0	0	0	0	0	0	0	0	0	0
2.1	WW	Aphanes arvensis	u	seed/fruit	513,2	38,46	5	0	0	124	0	0	0	0	294	69,2	16	10	0	0
2.1	WW	Fallopia convolvulus	u	seed/fruit	179,7	46,15	6	22,5	37,2	65	10,4	0	0	0	0	34,6	0	10	0	0
2.1	WW	Legousia hybrida / L. speculum veneris	u	seed/fruit	1781,6	46,15	6	270	173,6	403	0	0	17	0	798	0	0	120	0	0
2.1	WW	Papaver argemone	u	seed/fruit	164,4	30,77	4	0	12,4	93	0	0	17	0	42	0	0	0	0	0
2.1	WW	Papaver sp.	u	seed/fruit	27,7	15,38	2	0	12,4	0	0	0	0	0	0	0	0	0	15,3	0
2.1	WW	Stachys annua	u	seed/fruit	336,5	53,85	7	0	12,4	62	52	90	17	0	0	69,2	0	0	0	33,9
2.1	WW	Valerianella dentata	u	seed/fruit	987,2	61,54	8	180	86,8	155	20,8	0	0	0	420	34,6	80	10	0	0
2.1 / 2.3	WW	Valerianella locusta	u	seed/fruit	22,5	7,69	1	22,5	0	0	0	0	0	0	0	0	0	0	0	0
2.1	WW	Valerianella rimosa	u	seed/fruit	22,5	7,69	1	22,5	0	0	0	0	0	0	0	0	0	0	0	0
summer crop weeds / mostly annual ruderal																				
2.2	SW	Setaria viridis / S. verticillata	c	grain	52	15,38	2	0	0	0	0	0	0	0	42	0	0	10	0	0
2.2	SW	Anagallis arvensis	u	seed/fruit	80,3	23,08	3	45	0	0	0	0	0	0	0	0	0	20	15,3	0
2.2	SW	Anagallis arvensis / A. foemina	u	seed/fruit	235,8	30,77	4	0	0	0	20,8	30	17	0	168	0	0	0	0	0
2.2	SW	Anagallis sp.	u	seed/fruit	14	7,69	1	0	0	0	0	0	0	14	0	0	0	0	0	0
2.2	SW	Atriplex sp.	u	seed/fruit	15,3	7,69	1	0	0	0	0	0	0	0	0	0	0	0	15,3	0
2.2 / 2.3 / 2.4	SW	Chenopodium album	u	seed/fruit	4883,1	100,00	13	226	337,8	779	426,4	105	119	98	1470	865	80	210	76,5	90,4
2.2	SW	Euphorbia helioscopia	u	seed/fruit	85,4	23,08	3	0	12,4	31	0	0	0	0	42	0	0	0	0	0
2.2	SW	Fumaria officinalis	u	seed/fruit	1	7,69	1	1	0	0	0	0	0	0	0	0	0	0	0	0
2.2	SW	Fumaria cf officinalis	u	seed/fruit	74	23,08	3	0	0	0	0	15	17	0	42	0	0	0	0	0
2.2 / 2.3	SW	Heliotropium europaeum	u	seed/fruit	197,2	46,15	6	22,5	24,8	62	0	0	0	0	42	34,6	0	0	0	11,3
2.2	SW	Lamium amplexicaule	u	seed/fruit	159,4	38,46	5	0	0	0	10,4	15	68	0	0	0	16	50	0	0
2.2	SW	Lamium cf amplexicaule	u	seed/fruit	83,2	15,38	2	0	0	0	0	0	0	14	0	69,2	0	0	0	0
2.2	SW	Lamium purpureum	u	seed/fruit	53,3	15,38	2	0	0	0	0	0	0	42	0	0	0	0	0	11,3
2.2	SW	Portulaca oleracea	u	seed/fruit	23875,8	100,00	13	1800	570,4	2889	468	210	663	266	9324	5224,6	320	1420	336,6	384,2
2.2 / 5.1	SW	Solanum nigrum	u	seed/fruit	31	7,69	1	0	0	31	0	0	0	0	0	0	0	0	0	0
2.2 / 2.3	SW	Stellaria media	u	seed/fruit	80	23,08	3	45	0	0	0	15	0	0	0	0	0	20	0	0
2.2 / 2.3	SW	Stellaria neglecta / media	u	seed/fruit	17	7,69	1	0	0	0	0	0	17	0	0	0	0	0	0	0

Tab. 3.3 - continued

13 samples						sample name		LAV c4025	LAV c4034	LAV c4061	LAV c4063	LAV c4064	LAV c4065	LAV c4069	LAV c4072	LAV c4073	LAV c4074	LAV c4075	LAV c4076	LAV c4078
RUDERAL AND CROP FIELD UBIQUITARY SPECIES																				
2.4	RU	cf Bromus sterilis	c	grain frg	12,4	7,69	1	0	12,4	0	0	0	0	0	0	0	0	0	0	0
2.4	RU	Bromus sterilis / B. tectorum	c	grain	1	7,69	1	1	0	0	0	0	0	0	0	0	0	0	0	0
2.4 / 4.2	RU	Potentilla reptans	c	seed/fruit	11,3	7,69	1	0	0	0	0	0	0	0	0	0	0	0	0	11,3
2.3	RU	Cuscuta sp.	u	seed/fruit	96,6	15,38	2	0	0	62	0	0	0	0	0	34,6	0	0	0	0
2.3	RU	cf Cuscuta	u	seed/fruit	84	7,69	1	0	0	0	0	0	0	0	84	0	0	0	0	0
2.3	RU	Polycnemum arvense / P. majus	u	seed/fruit	42,3	15,38	2	0	0	31	0	0	0	0	0	0	0	0	0	11,3
2.3	RU	Polycnemum sp.	u	seed/fruit	30	15,38	2	0	0	0	0	0	0	14	0	0	16	0	0	0
2.3	RU	Polygonum persicaria	u	seed/fruit	20	7,69	1	0	0	0	0	0	0	0	0	0	0	20	0	0
2.3	RU	Stellaria pallida	u	seed/fruit	16	7,69	1	0	0	0	0	0	0	0	0	0	16	0	0	0
2.3	RU	Stellaria cf pallida	u	seed/fruit	34,6	7,69	1	0	0	0	0	0	0	0	0	34,6	0	0	0	0
2.4	RU	Ajuga reptans	u	seed/fruit	24,8	7,69	1	0	24,8	0	0	0	0	0	0	0	0	0	0	0
2.4 / 6.	RU	Arctium minus / A. nemorosum	u	seed/fruit	1	7,69	1	0	0	0	1	0	0	0	0	0	0	0	0	0
2.4	RU	Bromus sterilis	u	grain	1	7,69	1	0	0	0	0	0	0	0	0	0	1	0	0	0
2.4	RU	Carex hirta	u	seed/fruit	49,6	15,38	2	0	0	0	0	15	0	0	0	34,6	0	0	0	0
2.4	RU	Plantago major s.l.	u	seed/fruit	42	7,69	1	0	0	0	0	0	0	0	42	0	0	0	0	0
2.4	RU	Polygonum aviculare	u	seed/fruit	313,2	38,46	5	0	49,6	0	31,2	0	0	0	84	138,4	0	10	0	0
2.4 / 4.2	RU	Potentilla reptans	u	seed/fruit	3095,3	84,62	11	382,5	101,2	465	62,4	30	0	0	1764	173	48	20	15,3	33,9
2.4	RU	Ranunculus repens	u	seed/fruit	84	7,69	1	0	0	0	0	0	0	0	84	0	0	0	0	0
2.4	RU	Ranunculus cf repens	u	seed/fruit	49,6	15,38	2	0	0	0	0	15	0	0	0	34,6	0	0	0	0
2.4	RU	Sambucus ebulus	u	seed/fruit	268,5	46,15	6	0	0	0	20,8	30	0	84	0	34,6	0	0	76,5	22,6
2.4	RU	Urtica dioica	u	seed/fruit	1765,1	76,92	10	45	12,4	0	41,6	0	187	70	0	968,8	64	240	45,9	90,4
2.4	RU	cf Urtica dioica	u	seed/fruit	15	7,69	1	0	0	0	0	15	0	0	0	0	0	0	0	0
2.4	RU	Verbena officinalis	u	seed/fruit	1208,3	69,23	9	67,5	63	187	62,4	15	17	28	630	138,4	0	0	0	0

Tab. 3.3 - continued

13 samples					sample name			LAV c4025	LAV c4034	LAV c4061	LAV c4063	LAV c4064	LAV c4065	LAV c4069	LAV c4072	LAV c4073	LAV c4074	LAV c4075	LAV c4076	LAV c4078
GRASSLAND: MEADOWS AND PASTURES																				
2.1 / 2.2 / 3.1	MP	Ajuga chamaepytis	c	seed/fruit	11,3	7,69	1	0	0	0	0	0	0	0	0	0	0	0	0	11,3
4.1	MP	Teucrium chamaedrys	c	seed/fruit	14	7,69	1	0	0	0	0	0	0	14	0	0	0	0	0	0
4.2	MP	Plantago lanceolata	c	seed/fruit	42	7,69	1	0	0	0	0	0	0	0	42	0	0	0	0	0
4.2	MP	Plantago cf lanceolata	c	seed/fruit	25,8	7,69	1	0	25,8	0	0	0	0	0	0	0	0	0	0	0
4.3	MP	Bromus cf hordeaceus	c	grain	16	7,69	1	0	0	0	0	0	0	0	0	0	16	0	0	0
4.3	MP	Phleum pratense	c	seed/fruit	20,8	7,69	1	0	0	0	20,8	0	0	0	0	0	0	0	0	0
4.3	MP	Rumex acetosa	c	seed/fruit	22,5	7,69	1	22,5	0	0	0	0	0	0	0	0	0	0	0	0
2.1 / 2.2 / 3.1	MP	Ajuga chamaepytis	u	seed/fruit	257	69,23	9	0	1	31	20,8	15	34	14	84	34,6	0	0	0	22,6
3.1	MP	Arenaria serpyllifolia	u	seed/fruit	1146,7	69,23	9	90	12,4	155	41,6	0	0	0	210	484,4	32	110	0	11,3
3.1	MP	Carthamus cf lanatus	u	seed/fruit	1	7,69	1	0	0	1	0	0	0	0	0	0	0	0	0	0
3.1	MP	Cerastium arvensis / C. fontanum	u	seed/fruit	14	7,69	1	0	0	0	0	0	0	14	0	0	0	0	0	0
3.1	MP	Daucus carota	u	seed/fruit	121,2	46,15	6	0	24,8	0	20,8	15	0	0	0	34,6	16	10	0	0
3.1	MP	Medicago minima	u	pod ornament.	169,9	46,15	6	78,5	44,4	20	0	0	0	0	1	0	16	10	0	0
3.1	MP	Onopordum acanthium	u	seed/fruit	17	15,38	2	0	0	0	0	0	0	0	1	0	16	0	0	0
3.1	MP	Orlaya grandiflora	u	seed/fruit	35,6	15,38	2	0	0	1	0	0	0	0	0	34,6	0	0	0	0
3.1	MP	Petrorhagia prolifera	u	seed/fruit	89,6	23,08	3	45	0	0	0	0	0	0	0	34,6	0	10	0	0
4.1	MP	Ajuga genevensis	u	seed/fruit	24,4	15,38	2	0	0	0	10,4	0	0	14	0	0	0	0	0	0
4.1 / 6.1	MP	Linum cf catharticum	u	seed/fruit	34,6	7,69	1	0	0	0	0	0	0	0	0	34,6	0	0	0	0
4.1	MP	Sanguisorba minor	u	seed/fruit	10	7,69	1	0	0	0	0	0	0	0	0	0	0	10	0	0
4.1	MP	Teucrium chamaedrys	u	seed/fruit	25	15,38	2	0	0	0	0	15	0	0	0	0	0	10	0	0
4.3	MP	Stellaria palustris	u	seed/fruit	30	15,38	2	0	0	0	0	0	0	14	0	0	16	0	0	0
4.3	MP	Trifolium sp.	u	petal	42	7,69	1	0	0	0	0	0	0	0	42	0	0	0	0	0
4.3	MP	Trifolium sp.	u	calix	10	7,69	1	0	0	0	0	0	0	0	0	0	0	10	0	0

Tab. 3.3 - continued

13 samples				sample name				LAV c4025	LAV c4034	LAV c4061	LAV c4063	LAV c4064	LAV c4065	LAV c4069	LAV c4072	LAV c4073	LAV c4074	LAV c4075	LAV c4076	LAV c4078
WOODLAND, WOOD EDGES, CLEARINGS																				
5.1	F	Corylus avellana	c	seed/fruit frg	3,5	23,08	3	0	0	3,2	0	0	0	0,2	0	0	0,1	0	0	0
5.1	F	Quercus sp.	c	cupule	3	23,08	3	1	0	0	0	0	1	0	1	0	0	0	0	0
5.1	F	Quercus sp.	c	acorn base	1	7,69	1	0	0	0	0	0	0	0	0	0	1	0	0	0
5.1	F	Quercus sp.	c	acorn	1	7,69	1	0	1	0	0	0	0	0	0	0	0	0	0	0
5.1	F	Quercus sp.	c	pericarp frg > 5mm	1	7,69	1	0	0	0	0	0	0	0	0	0	1	0	0	0
5.1	F	Vitis vinifera sub. sylvestris	c	seed/fruit	1	7,69	1	0	0	0	0	0	0	1	0	0	0	0	0	0
5.1	F	Agrimonia eupatoria	u	seed/fruit	1	7,69	1	0	0	0	0	0	0	0	0	1	0	0	0	0
5.1	F	Carex cf strigosa	u	seed/fruit	84	7,69	1	0	0	0	0	0	0	0	84	0	0	0	0	0
5.1	F	Carpinus betulus	u	seed/fruit	1	7,69	1	0	0	0	0	1	0	0	0	0	0	0	0	0
5.1	F	cf Carpinus betulus	u	seed/fruit	11,3	7,69	1	0	0	0	0	0	0	0	0	0	0	0	0	11,3
5.1	F	Cornus mas	u	stone	277	100,00	13	1	123	15	1	1	17	1	102	6	7	1	1	1
5.1	F	Cornus sanguinea	u	stone	19	46,15	6	1	8	0	0	0	0	0	6	2	1	1	0	0
5.1	F	Corylus avellana	u	seed/fruit frg	147,58	84,62	11	22,375	43,5	8	0,25	0	0	0,25	70	0,125	2,1	0,4	0,15	0,43
5.1	F	Ficus carica	u	seed/fruit	747,3	76,92	10	45	87,8	94	10,4	15	34	0	336	103,8	0	10	0	11,3
5.1	F	Fragaria vesca	u	seed/fruit	1221,9	61,54	8	202,5	198,4	186	0	0	0	0	420	138,4	0	50	15,3	11,3
5.1	F	Hypericum perforatum	u	seed/fruit	820,6	69,23	9	0	0	93	52	0	17	42	126	311,4	48	70	61,2	0
5.1	F	cf Lonicera alpigena	u	seed/fruit	1	7,69	1	0	0	0	0	0	0	0	0	1	0	0	0	0
5.1	F	Maloideae	u	pericarp <1/4 frg	93	7,69	1	0	0	93	0	0	0	0	0	0	0	0	0	0
5.1	F	Origanum vulgare	u	seed/fruit	15,3	7,69	1	0	0	0	0	0	0	0	0	0	0	0	15,3	0
5.1 / 6.3	F	Physalis alkekengi	u	seed/fruit	40,1	15,38	2	0	24,8	0	0	0	0	0	0	0	0	0	15,3	0
5.1	F	Prunus spinosa	u	stone	10	38,46	5	1	5	1	0	0	0	0	2	1	0	0	0	0
5.1	F	Prunus cf spinosa	u	stone	1	7,69	1	0	0	0	1	0	0	0	0	0	0	0	0	0
5.1	F	Prunus sp.	u	seed/fruit	55,3	30,77	4	1	0	0	0	0	1	0	42	0	0	0	0	11,3
5.1	F	Pyrus sp.	u	calyx tube remnant	25	30,77	4	0	0	2	0	0	17	0	5	1	0	0	0	0
5.1	F	Quercus sp.	u	acorn base	236	61,54	8	40	77	41	0	0	0	1	70	3	2	2	0	0
5.1	F	Quercus sp.	u	pericarp frg > 5mm	81,53	46,15	6	0	1	24	0	0	0	0	49	2	0	4,4	0	1,13
5.1	F	Quercus sp.	u	cupule	27	69,23	9	0	0	1	2	0	1	1	3	1	16	1	0	1
5.1	F	Rosa sp.	u	seed/fruit	7	23,08	3	0	3	1	0	0	0	0	3	0	0	0	0	0
5.1	F	Rubus aggr. fruticosus	u	seed/fruit	3792,8	100,00	13	121,5	127	93	457,6	855	170	561	212	244,2	48	181	371,2	351,3
5.1	F	Rubus cf idaeus	u	seed/fruit	90,4	15,38	2	0	0	0	10,4	0	0	0	0	0	80	0	0	0
5.1	F	Rubus sp.	u	seed/fruit	106,2	23,08	3	0	0	0	0	0	17	0	0	69,2	0	20	0	0
5.1	F	Rumex conglomeratus	u	seed/fruit	42	7,69	1	0	0	0	0	0	0	0	42	0	0	0	0	0
5.1	F	Salix sp.	u	seed/fruit	57,6	46,15	6	0	0	4	0	1	1	14	0	36,6	1	0	0	0
5.1	F	Sambucus nigra	u	seed/fruit	36,6	23,08	3	0	0	0	0	0	0	0	0	0	0	10	15,3	11,3
5.1	F	Vitis vinifera sub. sylvestris	u	seed/fruit	75,3	84,62	11	1	2	1	10,4	1	0	0	4	41,6	1	1	1	11,3
5.1	F	Vitis sp.	u	tendril frg	1	7,69	1	1	0	0	0	0	0	0	0	0	0	0	0	0
5.1	F	Vitis vinifera sub. sylvestris	u/c	seed/fruit	1	7,69	1	0	0	0	0	0	0	0	0	0	0	0	1	0

Tab. 3.3 - continued

13 samples					sample name			LAV c4025	LAV c4034	LAV c4061	LAV c4063	LAV c4064	LAV c4065	LAV c4069	LAV c4072	LAV c4073	LAV c4074	LAV c4075	LAV c4076	LAV c4078
LAKE SHORE VEGETATION																				
6.1	LS	Bromus racemosus	c	grain	2	7,69	1	0	0	2	0	0	0	0	0	0	0	0	0	0
6.1	LS	Carex cf distans	u	seed/fruit	16	7,69	1	0	0	0	0	0	0	0	0	0	16	0	0	0
6.1	LS	Carex cf flava	u	seed/fruit	359,6	23,08	3	0	0	31	0	0	0	0	294	34,6	0	0	0	0
6.1	LS	Carex cf tomentosa	u	seed/fruit	15	7,69	1	0	0	0	0	15	0	0	0	0	0	0	0	0
6.1	LS	Carex flacca	u	seed/fruit	25,3	15,38	2	0	0	0	0	0	0	0	0	0	0	10	15,3	0
6.1	LS	Carex cf muricata aggr.	u	seed/fruit	73	15,38	2	0	0	31	0	0	0	0	42	0	0	0	0	0
6.1	LS	Lychnis flos-cuculi	u	seed/fruit	118,5	46,15	6	22,5	0	0	10,4	0	17	14	0	0	32	0	0	22,6
6.1	LS	Lycopus europaeus	u	seed/fruit	102,7	30,77	4	22,5	0	1	0	0	0	0	0	69,2	0	10	0	0
6.1	LS	Mentha spicata / M. suaveolens	u	seed/fruit	163,9	38,46	5	67,5	0	31	20,8	0	0	0	0	34,6	0	10	0	0
6.1	LS	Ranunculus sardous	u	seed/fruit	75,6	23,08	3	0	0	31	0	0	0	0	0	34,6	0	10	0	0
6.1	LS	Ranunculus cf sardous	u	seed/fruit	42	7,69	1	0	0	0	0	0	0	0	42	0	0	0	0	0
6.2	LS	Cyperus flavescens	u	seed/fruit	379,1	84,62	11	45	0	31	20,8	15	17	28	0	138,4	16	30	15,3	22,6
6.2	LS	cf Myosoton aquaticum	u	seed/fruit	34,6	7,69	1	0	0	0	0	0	0	0	0	34,6	0	0	0	0
2.2 / 2.3 / 6.2	LS	Polygonum lapathifolium	u	seed/fruit	252,2	30,77	4	0	12,4	0	0	0	0	0	126	103,8	0	10	0	0
2.2 / 2.3 / 6.2	LS	Polygonum lapathifolium	u	perianth	14	7,69	1	0	0	0	0	0	0	14	0	0	0	0	0	0
6.1 / 6.2	LS	Ranunculus sceleratus	u	seed/fruit	9615,9	100,00	13	247,5	37,2	31	790,4	2340	136	1960	126	1211	64	350	2142	180,8
6.2	LS	Rumex maritimus	u	seed/fruit	2165,5	76,92	10	0	0	1	124,8	15	17	210	0	830,4	176	550	15,3	226
6.2	LS	Rumex maritimus	u	perianth	452,6	23,08	3	0	0	124	0	0	0	0	0	208,6	0	120	0	0
6.2	LS	Scirpus radicans	u	seed/fruit	1705,1	92,31	12	22,5	12,4	62	20,8	0	34	98	84	1245,6	32	10	61,2	22,6
6.3	LS	Alisma plantago-aquatica	u	seed/fruit	87,3	23,08	3	0	0	0	0	0	0	0	42	0	0	30	15,3	0
6.3	LS	Caldesia parnassifolia	u	seed/fruit	45	7,69	1	45	0	0	0	0	0	0	0	0	0	0	0	0
6.3	LS	Carex cf riparia	u	seed/fruit	109,3	23,08	3	0	0	0	0	0	0	14	84	0	0	0	0	11,3
6.3	LS	Cyperus glomeratus	u	seed/fruit	49,9	23,08	3	22,5	12,4	0	0	15	0	0	0	0	0	0	0	0
6.3	LS	Cyperus cf glomeratus	u	seed/fruit	34,6	7,69	1	0	0	0	0	0	0	0	0	34,6	0	0	0	0
6.3	LS	Schoenoplectus cf mucronatus	u	seed/fruit	231,2	30,77	4	0	12,4	31	0	0	0	0	84	103,8	0	0	0	0
6.3	LS	Schoenoplectus lacustris	u	seed/fruit	1141,8	46,15	6	90	0	187	0	0	17	0	756	69,2	0	0	0	22,6
6.3	LS	Schoenoplectus tabernaemontani	u	seed/fruit	3	15,38	2	0	1	0	0	0	0	0	2	0	0	0	0	0
6.3	LS	Sparganium erectum	u	seed/fruit	2	7,69	1	0	0	0	0	0	0	0	2	0	0	0	0	0
6.3	LS	Typha latifolia/ T. angustifolia	u	seed/fruit	25,7	15,38	2	0	0	0	10,4	0	0	0	0	0	0	0	15,3	0
6.1	LS	Ranunculus sardous	u/c	seed/fruit	12,4	7,69	1	0	12,4	0	0	0	0	0	0	0	0	0	0	0
AQUATICS																				
7.1	A	Ceratophyllum demersum	u	seed/fruit	68,3	84,62	11	3	6	2	0	2	0	14	6	14	1	8	1	11,3
7.1	A	Ceratophyllum submersum	u	seed/fruit	3	23,08	3	0	0	1	0	1	0	0	0	0	0	0	1	0
7.1	A	Ceratophyllum sp.	u	seed/fruit	36,3	23,08	3	0	0	0	0	15	0	0	0	0	0	10	0	11,3
7.1	A	Characeae	u	seed/fruit	4402,5	92,31	12	1687,5	0	93	52	30	255	224	84	103,8	1088	200	336,6	248,6
7.1	A	Lemna minor	u	seed/fruit	686,8	69,23	9	0	0	31	41,6	30	0	84	126	207,6	96	40	30,6	0
7.1	A	Myriophyllum spicatum	u	seed/fruit	277,8	15,38	2	0	0	1	0	0	0	0	0	276,8	0	0	0	0
7.1	A	Myriophyllum sp.	u	seed/fruit	15,3	7,69	1	0	0	0	0	0	0	0	0	0	0	0	15,3	0
7.1	A	Najas minor	u	seed/fruit	22,5	7,69	1	22,5	0	0	0	0	0	0	0	0	0	0	0	0
7.1	A	Potamogeton sp.	u	seed/fruit	62,2	30,77	4	22,5	12,4	0	0	0	0	0	0	0	16	0	0	11,3
7.1	A	Ranunculus subgen. Batrachium	u	seed/fruit	57	23,08	3	0	12,4	0	0	0	0	0	0	34,6	0	10	0	0

Tab. 3.3 - continued

13 samples					sample name			LAV c4025	LAV c4034	LAV c4061	LAV c4063	LAV c4064	LAV c4065	LAV c4069	LAV c4072	LAV c4073	LAV c4074	LAV c4075	LAV c4076	LAV c4078
VARIA																				
0.	VA	Fabaceae	c	seed	50	30,77	4	3	3	0	0	0	0	0	43	0	1	0	0	0
0.	VA	Galium sp.	c	seed/fruit	1	7,69	1	0	0	0	0	0	0	0	1	0	0	0	0	0
0.	VA	Poaceae	c	grain	622,4	53,85	7	162,5	0	33	52	0	68	0	84	207,6	0	0	15,3	0
0.	VA	Setaria sp.	c	grain	184,5	30,77	4	70,5	12,4	0	41,6	60	0	0	0	0	0	0	0	0
0.	VA	cf Setaria	c	grain	16	7,69	1	0	0	0	0	0	0	0	0	0	16	0	0	0
0.	VA	undet.	c	seed/fruit	482,4	53,85	7	271	0	0	10,4	0	0	70	126	0	2	0	3	0
0.	VA	Ajuga reptans / A. genevensis	u	seed/fruit	2	7,69	1	0	2	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Apiaceae	u	seed/fruit	64,5	15,38	2	22,5	0	0	0	0	0	0	42	0	0	0	0	0
0.	VA	Brassicaceae	u	seed/fruit	348,2	15,38	2	0	0	279	0	0	0	0	0	69,2	0	0	0	0
0.	VA	Campanula sp.	u	seed/fruit	67,5	7,69	1	67,5	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Campanulaceae	u	seed/fruit	460,4	15,38	2	0	0	0	0	0	0	0	0	415,2	0	0	0	45,2
0.	VA	Carex sp.	u	seed/fruit	247	23,08	3	0	0	62	0	0	17	0	168	0	0	0	0	0
0.	VA	Carex tricarpellate	u	seed/fruit	325,3	15,38	2	113,5	211,8	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Caryophyllaceae	u	seed/fruit	99,3	23,08	3	0	0	0	0	0	0	0	0	0	64	20	15,3	0
0.	VA	Cerastium sp.	u	seed/fruit	69,9	23,08	3	0	0	0	0	0	0	0	0	34,6	0	20	15,3	0
0.	VA	Chenopodiaceae	u	seed/fruit	16	7,69	1	0	0	0	0	0	0	0	0	0	16	0	0	0
0.	VA	Cyperus sp.	u	seed/fruit	22,6	7,69	1	0	0	0	0	0	0	0	0	0	0	0	0	22,6
0.	VA	cf Cyperus	u	seed/fruit	34	7,69	1	0	0	0	0	0	34	0	0	0	0	0	0	0
0.	VA	Cyperaceae	u	seed/fruit	12,4	23,08	3	1	1	0	10,4	0	0	0	0	0	0	0	0	0
0.	VA	Fabaceae	u	flower part	31	7,69	1	0	0	31	0	0	0	0	0	0	0	0	0	0
0.	VA	Hypericum sp	u	seed/fruit	27,7	15,38	2	0	12,4	0	0	0	0	0	0	0	0	0	15,3	0
0.	VA	Juncus sp.	u	seed/fruit	12,4	7,69	1	0	12,4	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Lamiaceae	u	seed/fruit	30,6	7,69	1	0	0	0	0	0	0	0	0	0	0	0	30,6	0
0.	VA	Lamium sp.	u	seed/fruit	42	7,69	1	0	0	0	0	0	0	0	42	0	0	0	0	0
0.	VA	Linum sp	u	seed	15,3	7,69	1	0	0	0	0	0	0	0	0	0	0	0	15,3	0
0.	VA	Mentha sp.	u	seed/fruit	42	7,69	1	0	0	0	0	0	0	0	42	0	0	0	0	0
0.	VA	Petrorhagia / Dianthus	u	seed/fruit	10	7,69	1	0	0	0	0	0	0	0	0	0	0	10	0	0
0.	VA	Phyteuma spicatum / P. orbiculare	u	seed/fruit	20,8	7,69	1	0	0	0	20,8	0	0	0	0	0	0	0	0	0
0.	VA	Poaceae	u	grain	101	23,08	3	0	0	31	0	30	0	0	0	0	0	40	0	0
0.	VA	Potentilla sp.	u	seed/fruit	221	30,77	4	0	74,4	0	0	0	0	14	0	0	0	110	0	22,6
0.	VA	Ranunculus sp.	u	seed/fruit	16	7,69	1	0	0	0	0	0	0	0	0	0	16	0	0	0
0.	VA	Rumex sp.	u	seed/fruit	47	15,38	2	0	12,4	0	0	0	0	0	0	34,6	0	0	0	0
0.	VA	Rumex sp.	u	perianth	69,2	7,69	1	0	0	0	0	0	0	0	0	69,2	0	0	0	0
0.	VA	Scirpus sp.	u	seed/fruit	79,6	15,38	2	0	0	0	10,4	0	0	0	0	69,2	0	0	0	0
0.	VA	cf Scirpus	u	seed/fruit	83,5	15,38	2	67,5	0	0	0	0	0	0	0	0	16	0	0	0
0.	VA	Scirpus / Cyperus	u	seed/fruit	62	7,69	1	0	0	62	0	0	0	0	0	0	0	0	0	0
0.	VA	Silene sp.	u	seed/fruit	30,6	7,69	1	0	0	0	0	0	0	0	0	0	0	0	30,6	0
0.	VA	Stachys sp.	u	seed/fruit	93,8	30,77	4	22,5	0	0	0	0	0	14	42	0	0	0	15,3	0
0.	VA	Stellaria sp.	u	seed/fruit	10,4	7,69	1	0	0	0	10,4	0	0	0	0	0	0	0	0	0
0.	VA	Torilis sp.	u	seed/fruit	15,3	7,69	1	0	0	0	0	0	0	0	0	0	0	0	15,3	0
0.	VA	undet.	u	seed/fruit	2339,5	92,31	12	1	232,2	558	93,6	0	153	84	462	276,8	272	40	76,5	90,4
0.	VA	cf Viola	u	seed/fruit	69,2	7,69	1	0	0	0	0	0	0	0	0	69,2	0	0	0	0
0.	VA	Teucrium sp.	u/c	seed/fruit	15,3	7,69	1	0	0	0	0	0	0	0	0	0	0	0	15,3	0

Tab. 3.4 – Lavagnone: list of cereal taxa and their presence in the two age contexts.

	EBA (24 samples)	MBA (13 samples)
Triticum monoccoum L. (einkorn)	x	x
Tricum dicoccum Sch. (emmer)	x	x
Triticum nn (“new glume wheat”)	x	x
Triticum durum Desf. / *T. turgidum* L. (tetraploid naked wheat)	x	x
Triticum aestivum L. (bread wheat, hexaploid naked wheat)	x	x
Triticum spelta (spelt)	x	x
Hordeum vulgare L. (six-row barley)	x	x
Panicum miliaceum L. (broomcorn millet)		x

Tab. 3.5 – Number of remains (left) and ubiquity (% of the samples; right) of the cereal taxa and the remain types (differentiated by preservation) in the two age contexts: a) Early Bronze Age; b) Middle Bronze Age. This overview on cereal finds does not consider the intermediate morphotypes (see Chap. 3.3.1), included on the contrary in the Fig. 3.2b.

LAVAGNONE

	EBA 11 samples **n of remains**			
taxa	charred chaff	charred grains	uncharred chaff	testa frg
Triticum dicoccum	2389	6	0	0
Triticum nn (new glume wheat)	1216	12	0	0
Hordeum vulgare	1156	65	0	0
Cerealia	1004	128	0	3
Triticum sp.	911	57	3737	838
Triticum monococcum	281	5	0	0
Triticum durum / T. turgidum	117	0	0	0
Triticum spelta	87	1	0	0
Triticum aestivum	29	0	0	0
Triticum aestivum / T. durum / T. turgidum	0	4	0	0
Panicum miliaceum	0	0	0	0
tot	7190	278	3737	841

	EBA 24 samples **% ubiquity**			
taxa	charred chaff	charred grains	uncharred chaff	testa frg
Triticum dicoccum	95,8	54,2	4,2	0
Triticum nn (new glume wheat)	83,3	33	0	0
Hordeum vulgare	79,2	79,2	0	0
Cerealia	70,8	87,5	46	20,8
Triticum monococcum	70,8	13	0	0
Triticum spelta	66,7	12,5	4,2	0
Triticum sp.	58,3	29,2	41,7	16,7
Triticum durum / T. turgidum	45,8	0	0	0
Triticum aestivum	20,8	0	0	0
Triticum aestivum / T. durum / T. turgidum	0,0	33,3	0	0
Panicum miliaceum	0	0	0	0

	MBA 13 samples **n of remains**			
taxa	charred chaff	charred grains	uncharred chaff	testa frg
Triticum nn (new glume wheat)	31531	111	325	0
Triticum monococcum	19463	147	86	0
Triticum sp.	12555	41	826	4
Triticum dicoccum	7318	275	27	0
Panicum miliaceum	235	681	797	1
Hordeum vulgare	340	154	0	0
Cerealia	153	241	4	0
Triticum spelta	12	13	0	0
Triticum durum / T. turgidum	11	0	0	0
Triticum aestivum	6	0	0	0
Triticum aestivum / T. durum / T. turgidum	0	4	0	0
tot	71626	1668	2065	5

	MBA 13 samples **% ubiquity**			
taxa	charred chaff	charred grains	uncharred chaff	testa frg
Triticum monococcum	100	84,6	15,4	0
Triticum dicoccum	100	100	15,4	0
Triticum nn (new glume wheat)	100	7,7	30,8	0
Triticum sp.	100	53,8	38,5	15,4
Hordeum vulgare	46,2	92,3	0	0
Panicum miliaceum	38,5	92,3	53,8	0
Cerealia	15,4	100	7,7	0
Triticum durum / T. turgidum	7,7	0	0	0
Triticum aestivum	7,7	0	0	0
Triticum spelta	7,7	46,2	0	0
Triticum aestivum / T. durum / T. turgidum	0	15,4	0	0

Tab. 4.1 – Synthetic table of plant macrofossil analysis of the core LAV37 (Lavagnone, Sector D). Number of remains in 100 ml of sediment for each age period (raw data in Appendix 6b). For the explanation of the ecological groups see tab. 2.4 and chap. 2.8.

				sample age							
taxa	ecol grp	type of remain	preser-vation	MBA (23)	EBA II (15)	EBA I C (3)	EBA I B (2)	EBA I A (4)	Chal (15)	Neol (26)	**total n. remains**
FIELDS											
cultivated plants											
Hordeum vulgare	1.1	grain	c	2,08	1,04	--	--	1,04	--	--	**4,17**
Triticum sp.	1.1	chaff	c	424,92	176,86	2,78	13,54	26,95	--	--	**645,06**
Panicum miliaceum	1.1	seed/fruit	unc	1941,57	17,82	--	--	7,51	--	--	**1966,90**
Panicum / Setaria	1.1	seed/fruit	unc	12,50	--	1,04	--	--	--	--	**13,54**
Triticum sp.	1.1	chaff	unc	620,94	268,04	4,86	26,56	16,37	--	--	**936,78**
Triticum sp.	1.1	testa frg	unc	636,50	450,64	0,87	9,90	46,66	--	--	**1144,56**
CEREALIA	1.1	chaff	unc	2,08	--	--	--	--	--	--	**2,08**
Linum usitatissimum (fragm)	1.1	seed/fruit	unc	109,84	39,98	--	7,29	9,86	--	--	**166,97**
winter crop weeds											
Aphanes arvensis	2.1	seed/fruit	unc	61,63	2,08	0,87	--	--	--	--	**64,58**
Camelina sativa	2.1	seed/fruit	unc	7,97	1,04	--	--	1,04	--	--	**10,05**
Fallopia convolvulus	2.1	seed/fruit	unc	16,37	10,42	0,87	--	--	--	--	**27,65**
Legousia sp.	2.1	seed/fruit	unc	101,60	--	--	--	--	--	--	**101,60**
Papaver argemone	2.1	seed/fruit	unc	4,69	--	--	--	--	--	--	**4,69**
Papaver dubium	2.1	seed/fruit	unc	1,04	--	--	--	--	--	--	**1,04**
Scleranthus annuus	2.1	seed/fruit	unc	6,25	1,04	--	--	--	--	--	**7,29**
Stachys annua	2.1	seed/fruit	unc	10,10	9,59	--	--	--	--	--	**19,69**
Torilis arvensis	2.1	seed/fruit	unc	--	1,04	--	--	--	--	--	**1,04**
Valerianella dentata	2.1	seed/fruit	unc	29,42	10,83	0,87	--	--	--	--	**41,13**
Valerianella dentata / V. rimosa	2.1	seed/fruit	unc	8,33	--	--	--	--	--	--	**8,33**
Valerianella rimosa	2.1	seed/fruit	unc	--	--	0,87	--	--	--	--	**0,87**
summer crop weeds / mostly annual ruderal											
Anagallis arvensis	2.2	seed/fruit	unc	12,50	18,65	--	--	--	--	--	**31,15**
Atriplex hastata	2.2	seed/fruit	unc	3,13	--	--	--	--	--	--	**3,13**
Capsella bursa-pastoris	2.2	seed/fruit	unc	1,04	--	--	--	--	--	--	**1,04**
Chenopodium album	2.2	seed/fruit	unc	268,13	217,92	5,22	--	1,04	1,42	5,26	**498,98**
Chenopodium cf glaucum	2.2	seed/fruit	unc	2,08	--	--	--	--	--	--	**2,08**
Chenopodium sp.	2.2	seed/fruit	unc	1,04	2,60	--	--	--	--	--	**3,65**
cf Digitaria ischaemum	2.2	seed/fruit	unc	--	--	0,87	--	--	--	--	**0,87**
Lamium cfr amplexicaule	2.2	seed/fruit	unc	9,38	--	--	--	--	--	--	**9,38**
Lamium purpureum	2.2	seed/fruit	unc	1,04	1,04	--	--	--	--	--	**2,08**
Picris hieracioides	2.2	seed/fruit	unc	6,98	3,54	--	--	--	--	--	**10,52**
Malva sylvestris	2.2	seed/fruit	unc	2,08	1,04	--	--	--	--	--	**3,13**
Portulaca oleracea	2.2	seed/fruit	unc	829,53	16,25	0,87	--	14,94	0,88	--	**862,47**
Setaria viridis	2.2	seed/fruit	unc	1,04	--	--	--	--	--	--	**1,04**
Solanum nigrum	2.2	seed/fruit	unc	15,78	10,10	--	6,25	1,04	--	--	**33,17**
Stellaria media	2.2	seed/fruit	unc	65,52	2,64	--	--	--	--	--	**68,16**
Viola arvensis / V. tricolor	2.2	seed/fruit	unc	4,38	2,64	--	--	--	--	--	**7,02**
RUDERAL AND CROP FIELD UBIQUITARY SPECIES											
cf Brassica rapa	2.3	seed/fruit	unc	1,04	--	--	--	--	--	--	**1,04**
Digitaria sanguinalis	2.3	seed/fruit	unc	2,08	--	--	--	--	--	--	**2,08**
Matricaria chamomilla	2.3	seed/fruit	unc	3,54	--	--	--	--	--	--	**3,54**
Polycnemum arvense	2.3	seed/fruit	unc	3,65	--	--	--	--	--	--	**3,65**
Polygonum persicaria	2.3	seed/fruit	unc	9,38	2,08	2,95	1,04	--	--	--	**15,45**
Ballota nigra	2.4	seed/fruit	unc	1,04	1,04	--	--	--	--	--	**2,08**
cf Ballota nigra	2.4	seed/fruit	unc	1,04	--	--	--	--	--	--	**1,04**
Carex hirta	2.4	seed/fruit	unc	3,13	1,04	1,04	--	--	--	--	**5,21**
cf Conium maculatum	2.4	seed/fruit	unc	1,04	--	--	--	--	--	--	**1,04**
Dipsacus follonum	2.4	seed/fruit	unc	--	1,04	--	--	--	--	--	**1,04**
Lapsana communis	2.4	seed/fruit	unc	15,00	--	--	--	--	--	--	**15,00**
Melissa officinalis	2.4	seed/fruit	unc	1,04	--	--	--	--	--	--	**1,04**

Tab. 4.1 - continued

taxa	ecol grp	type of remain	preser-vation	MBA (23)	EBA II (15)	EBA I C (3)	EBA I B (2)	EBA I A (4)	Chal (15)	Neol (26)	total n. remains
Plantago major	2.4	seed/fruit	unc	5,73	2,50	--	--	--	--	--	**8,23**
Polygonum aviculare	2.4	seed/fruit	unc	33,77	18,86	2,61	--	--	--	--	**55,24**
Potentilla reptans	2.4	seed/fruit	unc	12,92	1,04	--	6,25	--	--	--	**20,21**
Ranunculus acer	2.4	seed/fruit	unc	--	1,04	--	--	--	--	--	**1,04**
Ranunculus repens / R. bulbosus	2.4	seed/fruit	unc	--	1,04	--	--	--	--	--	**1,04**
Rumex crispus	2.4	seed/fruit	unc	--	1,04	--	--	--	--	--	**1,04**
Sambucus ebulus	2.4	seed/fruit	unc	2,08	3,13	1,04	--	1,04	--	1,18	**8,47**
Urtica dioica	2.4	seed/fruit	unc	76,87	20,14	--	--	--	--	--	**97,02**
Verbena officinalis	2.4	seed/fruit	unc	99,47	51,29	2,61	--	--	--	--	**153,37**
GRASSLAND, MEADOWS AND PASTURES											
Agropyron cfr repens	3.1	seed/fruit	unc	0,74	--	--	--	--	--	--	**0,74**
Ajuga chamaepitys	3.1	seed/fruit	unc	8,03	1,15	--	--	--	--	--	**9,18**
Arenaria serpyllifolia	3.1	seed/fruit	unc	333,88	46,50	--	--	--	--	--	**380,37**
Cichorium intybus	3.1	seed/fruit	unc	1,04	5,31	--	--	--	--	--	**6,35**
Daucus carota	3.1	seed/fruit	unc	4,58	6,25	0,87	--	--	--	--	**11,70**
Medicago sp.	3.1	seed/fruit	unc	11,67	--	--	--	--	--	--	**11,67**
cf Medicago minima	3.1	seed/fruit	unc	--	1,04	--	--	--	--	--	**1,04**
Nepeta cataria	3.1	seed/fruit	unc	6,46	--	1,74	--	--	--	--	**8,20**
Onopordum acanthum	3.1	seed/fruit	unc	1,04	--	--	--	--	--	--	**1,04**
cf Orlaya grandiflora (fragm)	3.1	seed/fruit	unc	5,73	1,04	--	--	--	--	--	**6,77**
Pastinaca sativa	3.1	seed/fruit	unc	1,04	--	--	--	--	--	--	**1,04**
Petrorhagia prolifera	3.1	seed/fruit	unc	12,50	5,42	--	--	--	--	--	**17,92**
Silene otites	3.1	seed/fruit	unc	1,04	--	--	--	--	--	--	**1,04**
Verbascum sp.	3.1	seed/fruit	unc	3,54	--	--	--	--	--	--	**3,54**
Acinos arvensis	4.1	seed/fruit	unc	14,58	7,19	--	--	--	--	--	**21,77**
Arabis cfr hirsuta	4.1	seed/fruit	unc	2,60	--	--	--	--	--	--	**2,60**
cf Campanula rapunculus	4.1	seed/fruit	unc	2,08	3,65	--	--	--	--	--	**5,73**
Centaurea cf jacea	4.1	seed/fruit	unc	1,04	--	--	--	--	--	--	**1,04**
Linum catharticum	4.1	seed/fruit	unc	16,56	1,04	--	--	--	--	--	**17,60**
Linum tenuifolium	4.1	seed/fruit	unc	10,42	1,04	--	--	--	--	--	**11,46**
Potentilla rupestris	4.1	seed/fruit	unc	1,04	--	--	--	--	--	--	**1,04**
Silene nutans	4.1	seed/fruit	unc	1,04	1,04	--	--	--	--	--	**2,08**
Stachys alopecuros	4.1	seed/fruit	unc	4,17	--	--	--	--	--	--	**4,17**
Stachys recta	4.1	seed/fruit	unc	--	3,13	--	--	--	--	--	**3,13**
Teucrium chamaedrys	4.1	seed/fruit	unc	17,71	8,54	--	--	--	--	0,88	**27,13**
Thymus sp.	4.1	seed/fruit	unc	--	2,08	--	--	--	--	--	**2,08**
Bromus hordeaceus	4.3	seed/fruit	unc	3,13	--	--	--	--	--	--	**3,13**
Carex cf pallescens	4.3	seed/fruit	unc	2,08	--	--	--	--	--	--	**2,08**
Prunella vulgaris	4.3	seed/fruit	unc	13,54	2,50	--	--	--	--	--	**16,04**
cf Prunella vulgaris	4.3	seed/fruit	unc	--	3,65	--	--	--	--	--	**3,65**
Rumex acetosella	4.3	seed/fruit	unc	--	6,25	--	--	--	--	--	**6,25**
FOREST, FOREST EDGES, CLEARINGS											
Agrimonia eupatoria	5.1	seed/fruit	unc	5,21	3,13	--	1,04	1,72	--	--	**11,10**
Betula sp.	5.1	seed/fruit	unc	--	1,04	0,87	--	--	7,36	5,31	**14,58**
Cornus mas	5.1	seed/fruit	unc	5,21	11,46	--	--	--	--	--	**16,67**
Corylus avellana	5.1	seed/fruit	unc	1,04	1,04	--	--	--	--	--	**2,08**
Ficus carica	5.1	seed/fruit	unc	7,29	18,86	2,61	--	--	--	--	**28,76**
Fragaria vesca	5.1	seed/fruit	unc	180,35	167,81	1,74	9,90	8,97	--	--	**368,78**
Hypericum perforatum	5.1	seed/fruit	unc	235,12	147,31	2,61	--	4,69	0,88	--	**390,61**
Luzula sylvatica	5.1	seed/fruit	unc	5,21	--	--	--	--	--	--	**5,21**
Maloidaea pericarp (fragm <1/4)	5.1	seed/fruit	unc	150,99	144,39	1,91	3,13	2,77	--	--	**303,18**
Malus / Pyrus	5.1	seed/fruit	unc	--	2,08	--	--	--	--	--	**2,08**
Origanum vulgare	5.1	seed/fruit	unc	42,53	15,10	0,87	--	3,65	--	--	**62,15**
Physalis alkekengi	5.1	seed/fruit	unc	14,79	--	--	--	1,72	--	--	**16,52**
Prunus sp.	5.1	seed/fruit	unc	--	1,04	--	--	--	--	--	**1,04**
Pyrus sp.	5.1	stones	unc	109,14	235,23	--	--	--	--	--	**344,37**
Quercus sp.	5.1	seed/fruit	unc	503,56	339,73	1,04	6,25	22,96	--	--	**873,54**
Rosa / Rubus	5.1	prickles	unc	28,02	12,19	--	3,65	3,65	--	--	**47,50**
Rubus caesius	5.1	seed/fruit	unc	3,13	1,04	--	--	--	--	--	**4,17**

Tab. 4.1 - continued

taxa	ecol grp	type of remain	preser-vation	MBA (23)	EBA II (15)	EBA I C (3)	EBA I B (2)	EBA I A (4)	Chal (15)	Neol (26)	total n. remains
Rubus gr fruticosus	5.1	seed/fruit	unc	75,74	28,23	2,08	1,04	7,19	--	2,84	**117,12**
Rubus idaeaus	5.1	seed/fruit	unc	4,17	--	--	--	--	--	--	**4,17**
Rumex cf sanguineus	5.1	seed/fruit	unc	1,04	2,08	--	--	--	--	--	**3,13**
Sambucus nigra	5.1	seed/fruit	unc	2,08	--	--	--	--	--	--	**2,08**
Torilis japonica	5.1	seed/fruit	unc	--	3,33	--	--	--	--	--	**3,33**
Viola riviniana / V. reichenbachiana	5.1	seed/fruit	unc	3,13	--	--	--	--	--	--	**3,13**
Vitis vinifera sbsp.sylvestris	5.1	seed/fruit	unc	3,13	5,32	--	--	--	--	--	**8,44**
LAKE SHORE VEGETATION											
Carex cf panicea	6.1	seed/fruit	unc	1,04	--	--	--	--	--	--	**1,04**
Cirsium cf palustre	6.1	seed/fruit	unc	--	1,04	--	--	--	--	--	**1,04**
Eupatorium sp.	6.1	seed/fruit	unc	5,21	--	--	--	--	--	--	**5,21**
Lychnis flos-cuculi	6.1	seed/fruit	unc	5,73	--	--	--	--	--	--	**5,73**
Lycopus europaeus	6.1	seed/fruit	unc	26,32	6,25	3,48	--	12,50	15,99	2,19	**66,73**
Lythrum cfr salicaria	6.1	seed/fruit	unc	11,46	3,65	6,77	3,65	1,04	2,95	12,01	**41,52**
Mentha spicata / M. suaveolens	6.1	seed/fruit	unc	65,42	18,02	--	--	--	--	--	**83,44**
Ranunculus sardous	6.1	seed/fruit	unc	23,36	4,17	--	--	--	--	--	**27,52**
Ranunculus cf sardous	6.1	seed/fruit	unc	--	2,60	--	--	--	--	--	**2,60**
Stachys officinalis	6.1	seed/fruit	unc	5,83	3,33	--	--	--	--	--	**9,17**
Viola palustris	6.1	seed/fruit	unc	2,29	--	--	--	--	--	--	**2,29**
Apium repens	6.2	seed/fruit	unc	--	2,60	--	--	--	--	--	**2,60**
Bidens cernua	6.2	seed/fruit	unc	--	15,10	40,98	3,65	--	--	--	**59,73**
Cyperus flavescens	6.2	seed/fruit	unc	88,75	46,46	4,35	13,54	22,36	138,35	59,36	**373,17**
Polygonum hydropiper	6.2	seed/fruit	unc	16,67	6,25	0,87	--	--	--	--	**23,79**
Polygonum lapathifolium	6.2	seed/fruit	unc	36,46	49,39	14,95	3,13	4,68	7,02	1,67	**117,30**
Ranunculus sceleratus	6.2	seed/fruit	unc	3904,26	1160,14	3171,27	68,75	95,74	2,06	4,76	**8406,99**
Rumex maritimus	6.2	fruit/perian.	unc	2865,01	1024,23	1906,96	46,88	38,84	--	2,35	**5884,27**
Rumex cf palustris	6.2	seed/fruit	unc	10,40	12,82	--	--	--	--	--	**23,23**
Scirpus radicans	6.2	seed/fruit	unc	1173,42	5208,75	1037,94	404,69	338,67	397,01	2,06	**8562,53**
Alisma plantago aquatica	6.3	seed/fruit	unc	9,58	1,04	7,64	--	11,98	5,32	2,06	**37,62**
Carex riparia / C. vesicaria	6.3	seed/fruit	unc	5,21	--	--	--	--	--	--	**5,21**
Cyperus glomeratus	6.3	seed/fruit	unc	99,05	34,62	103,32	103,13	55,46	63,04	11,02	**469,63**
Eleocharis palustris	6.3	seed/fruit	unc	5,21	--	--	--	--	--	--	**5,21**
Oenanthe aquatica	6.3	seed/fruit	unc	1,04	--	--	--	--	--	--	**1,04**
cf Phragmites australis	6.3	seed/fruit	unc	--	--	--	--	1,04	--	--	**1,04**
Schoenoplectus tabaernemontani	6.3	seed/fruit	unc	4,17	1,04	--	--	1,72	--	--	**6,93**
cf Schoenoplectus mucronatus	6.3	seed/fruit	unc	6,67	--	0,87	--	--	--	--	**7,54**
Typha latifolia / T. angustifolia	6.3	seed/fruit	unc	36,77	99,73	51,40	6,25	24,53	13,29	--	**231,97**
AQUATICS											
Ceratophyllum demersum	7.1	seed/fruit	unc	34,57	27,19	15,98	17,71	17,66	--	29,62	**142,73**
CHARACEAE	7.1	oogons	unc	30,94	16,60	8,51	57,81	720,25	2553,66	785,08	**4172,85**
cf Elatine	7.1	seed/fruit	unc	--	--	--	--	--	0,71	--	**0,71**
Lemna cf minor	7.1	seed/fruit	unc	91,04	156,32	27,29	3,65	--	--	--	**278,30**
Myriophyllum spicatum	7.1	seed/fruit	unc	139,60	49,26	4,35	2,08	1,30	1,18	8,07	**205,83**
Najas flexilis	7.1	seed/fruit	unc	--	--	--	--	--	0,59	28,01	**28,60**
Najas marina	7.1	seed/fruit	unc	--	--	--	--	1,04	6,13	129,56	**136,74**
Nuphar sp.	7.1	seed/fruit	unc	--	1,04	--	--	--	0,88	--	**1,93**
Nymphaea alba	7.1	seed/fruit	unc	2,08	1,04	--	--	--	14,28	14,53	**31,93**
Nymphaea sp. (fragm)	7.1	seed/fruit	unc	18,54	3,65	0,87	3,65	35,88	17,75	2,35	**82,69**
Potamogenton natans	7.1	seed/fruit	unc	31,49	11,57	--	1,04	4,68	111,01	294,54	**454,33**
Ranunculus aquatilis	7.1	seed/fruit	unc	1,04	--	--	--	--	--	--	**1,04**
Ranunculus cf aquatilis	7.1	seed/fruit	unc	21,42	2,29	--	--	--	1,01	--	**24,73**
Ranunculus cf gr batrachium	7.1	seed/fruit	unc	130,15	8,85	8,16	--	1,04	--	--	**148,21**
Trapa sp. (fragm)	7.1	seed/fruit	unc	1,04	--	--	--	--	--	5,90	**6,94**
VARIA											
APIACEAE	0.	seed/fruit	unc	6,88	--	--	--	--	--	--	**6,88**
Aster sp.	0.	seed/fruit	unc	1,04	--	--	--	--	--	--	**1,04**
ASTERACEAE	0.	seed/fruit	unc	24,90	1,04	--	3,65	--	--	--	**29,58**
Brassicaceae	0.	seed/fruit	unc	500,83	18,75	--	3,65	--	--	--	**523,23**

Tab. 4.1 - continued

taxa	ecol grp	type of remain	preser-vation	MBA (23)	EBA II (15)	EBA I C (3)	EBA I B (2)	EBA I A (4)	Chal (15)	Neol (26)	**total n. remains**
Bromus sp.	0.	seed/fruit	unc	29,48	5,10	--	--	--	--	--	**34,58**
Carex sp.	0.	seed/fruit	unc	8,85	55,73	1,04	--	--	3,01	--	**68,64**
Carex cf flacca / C. flava	0.	seed/fruit	unc	--	1,04	--	--	--	--	--	**1,04**
CARYOPHYLLACEAE	0.	seed/fruit	unc	11,56	4,17	--	--	--	--	--	**15,73**
Centaurea sp.	0.	seed/fruit	unc	--	3,33	--	--	--	--	--	**3,33**
Cerastium sp.	0.	seed/fruit	unc	142,63	10,83	--	6,25	3,65	--	--	**163,36**
Cuscuta arvensis / C. campestris	0.	seed/fruit	unc	28,13	1,04	--	--	--	--	--	**29,17**
CYPERACEAE	0.	seed/fruit	unc	4,17	--	--	--	--	5,71	4,32	**14,20**
Dianthus sp.	0.	seed/fruit	unc	1,04	--	--	--	--	--	--	**1,04**
Dianthus / Petrorhagia	0.	seed/fruit	unc	4,69	--	--	--	--	--	--	**4,69**
Epilobium sp.	0.	seed/fruit	unc	3,54	4,90	--	--	7,29	6,38	1,90	**24,00**
FABACEAE	0.	seed/fruit	unc	18,65	3,65	--	--	--	--	--	**22,29**
Inula sp.	0.	seed/fruit	unc	2,60	--	--	--	--	--	--	**2,60**
Lamiaceae	0.	seed/fruit	unc	18,42	8,02	--	--	--	--	--	**26,44**
Linum sp.	0.	seed/fruit	unc	49,17	9,79	--	1,04	--	--	--	**60,00**
Phyteuma sp.	0.	seed/fruit	unc	--	4,69	0,87	--	--	--	--	**5,56**
POACEAE	0.	seed/fruit	unc	175,83	23,00	7,29	--	--	--	--	**206,12**
POLYGONACEAE	0.	seed/fruit	unc	7,29	3,13	1,04	--	--	--	--	**11,46**
Polygonum sp.	0.	seed/fruit	unc	4,17	3,13	1,04	--	2,77	--	--	**11,10**
Potentilla sp.	0.	seed/fruit	unc	14,85	--	--	--	--	--	1,18	**16,02**
Ranunculus sp.	0.	seed/fruit	unc	2,08	1,04	--	--	--	--	--	**3,13**
ROSACEAE	0.	seed/fruit	unc	--	4,38	--	--	--	--	--	**4,38**
cf Scabiosa	0.	seed/fruit	unc	2,08	1,04	--	--	--	--	--	**3,13**
cf Scrophularia	0.	seed/fruit	unc	--	1,04	--	--	--	--	--	**1,04**
Setaria sp.	0.	seed/fruit	unc	66,25	3,33	--	--	--	--	--	**69,58**
Stellaria sp.	0.	seed/fruit	unc	3,13	--	--	--	--	--	--	**3,13**
Trifolium sp.	0.	petal fragm	unc	27,81	14,79	--	--	--	--	--	**42,60**
Anther			unc	20,63	9,79	--	29,17	--	--	--	**59,58**
Bud			unc	23,36	18,86	--	--	--	--	--	**42,21**
Bud scales			unc	57,87	25,00	--	3,13	--	--	--	**86,00**
Leaf fragments			unc	53,13	19,79	--	--	3,81	--	--	**76,72**
Charcoal >0,5mm (sieve fraction 0,35mm)		wood	c	2390,80	1505,46	26,24	13,54	138,93	2,01	2,90	**4079,88**
Charcoal >0,5mm (sieve fraction 1mm)		wood	c	693,38	486,42	1,04	10,42	67,02	--	--	**1258,27**
Indeterminata		seed/fruit	unc	278,24	67,81	7,81	22,40	7,45	2,13	3,43	**389,27**
MOLLUSC (shell and operculum)				48,96	11,78	1,04	--	2,60	91,15	15,93	**171,46**
cultivated plants = **1.1**				3750,45	954,38	9,55	57,29	108,39	--	--	**4880,06**
winter crop weeds on carbonatic-rich soils = **2.1**				247,40	36,05	3,48	--	1,04	--	--	**287,97**
summer crop weeds / mostly annual ruderals = **2.2**				1223,64	276,43	6,96	6,25	17,02	2,30	5,26	**1537,87**
ruderal anc crop fields ubiquitary species = **2.3**				19,69	2,08	--	--	--	--	--	**25,77**
ruderal and nitrophilous communities, dry orchards = **2.4**				253,14	103,21	7,30	--	1,04	--	1,18	**372,12**
dry fallow on carbonatic-rich soils, regolithic soils = **3**				391,29	66,71	2,61	--	--	--	--	**460,61**
dry pastures with summer water deficit = **4.1**				71,25	27,71	--	--	--	--	0,88	**99,84**
drained pastures without a summer water deficit = **4.2**				--	--	--	--	--	--	--	**-**
pastures (indistinct) = **4.3**				18,75	12,40	--	--	--	--	--	**31,15**
forest, forest edges, clearing = **5.1**				1380,88	1140,41	13,73	25,00	57,31	8,25	8,15	**2633,73**
wet terrestrial herbs communities = **6.1**				146,66	39,06	10,25	3,65	13,54	18,94	14,20	**246,29**
low, frequently flooded mud flats = **6.2**				8094,97	7525,75	6177,32	540,63	500,29	544,44	70,21	**23453,61**
flooded or waterlogged littorl zone = **6.3**				167,69	136,43	163,23	109,38	94,73	81,65	13,08	**766,20**
open waters > 0.8 m = **7.1**				501,93	277,81	65,16	85,94	781,85	2707,20	1297,66	**5717,55**
varia = **0**				1160,07	186,96	11,29	14,58	13,70	15,10	7,39	**1409,09**

Tab. 5.1 – Macroremains data from stratigraphic samples of section 98 – Lavagnone, Sector A (number of remains).

			sample name	B2/03	B2/07	B2/09	B2/11	B2/12	B2/13	B2/14	B1/02	B1/04
			volume (ml)	400	440	180	110	500	240	400	350	300
FIELDS		taxon	remain type									
cultivated plants												
1.1	C	Cerealia	spikelete fork (uncarb)	166	228,24	18		149,72	10	358		6
1.1	C	Cerealia	glumes fragm. (uncarb)		6	1		9,98		12		
1.1	C	Cerealia	glume base (uncarb)	31,5	133,64	1		124,46	2	244	1	13
1.1	C	Cerealia	rachis (uncarb)	23,5	2			3,66				
1.1	C	Cerealia	stem (uncarb)		1,66							
1.1	C	Cerealia	spikelet fork (carb)	49				10			2	
1.1	C	Cerealia	glume base (carb)	18						1		
1.1	C	Cerealia	rachis fragm (carb)	13,5			1					
1.1	C	Cerealia	grain (carb)			1	1	1			2	
1.1	C	Hordeum vulgare (uncarb)	spikelet fork		12,64							
1.1	C	Hordeum vulgare (carb)	spikelet fork	56	1,66			27,28	2	2		4
1.1	C	Linum usitatissimum	seed	27	38,58			25,28		72	5	8
1.1	C	Linum usitatissimum	capsule	59,5	87,84	1		71,88	2	70	33	3
1.1	C	Linum usitatissimum	fibre	103,5	1	2		4,66	3	37	4	2
1.1	C	Triticum sp. (uncarb)	spikelet fork	171								
1.1	C	Triticum sp. (uncarb)	glume base	9								
1.1	C	Triticum sp. (uncarb)	testa	4,5	3,66			4,66		4	4	2
1.1	C	Triticum sp. (carb)	spikelet fork	2	8	8			2	6	16	8
1.1	C	Triticum sp. (carb)	glume base		7						4	2
1.1	C	Triticum sp. (carb)	rachis		5						8	2
1.1	C	Triticum sp. (carb)	glume		1							2
winter crop weeds												
2.1	WW	Camelina sativa	capsule	4,5	1			1			1	
2.1	WW	Fallopia convolvulus	seed/fruit					5,32		4	6	2
2.1	WW	Scleranthus annuus	seed/fruit	4,5				2,66		12		
2.1	WW	cfr Scleranthus annuus	seed/fruit					1				2
2.1	WW	cfr Scleranthus	seed/fruit		1							
2.1	WW	Stachys annua	seed/fruit					1				
2.1	WW	Stachys cfr annua	seed/fruit								4	
2.1	WW	Torilis arvensis	seed/fruit	4,5	2,66			2		8		
2.1	WW	Valerianella dentata	seed/fruit	31,5	9,3			23,28			16	9
summer crop weeds / mostly annual ruderal												
2.2	SW	Chenopodium album	seed/fruit	19	11,3			7,32		4	24	12
2.2	SW	Chenopodium sp.	seed/fruit					2,66				
2.2	SW	cf Malva sylvestris	mericarp					2,66				
2.2	SW	Picris hieracioides	seed/fruit		3,32						4	
2.2	SW	Portulaca oleracea	seed/fruit	4,5				1		12		
2.2/5.1	SW	Solanum nigrum	seed/fruit	9				115,1	1	28	28	10
RUDERAL AND CROP FIELD UBIQUITARY SPECIES												
2.3	RU	Polygonum persicaria	seed/fruit							12	12	2
2.4	RU	Anthemis tinctoria	seed/fruit	9	3,66							
2.4	RU	Lapsana communis	seed/fruit								4	
2.4	RU	Polygonim aviculare	seed/fruit	14,5	10,96			4,66			4	6
2.4	RU	Ranunculus cfr bulbosus	seed/fruit		1							
2.4	RU	Sambucus ebulus	seed/fruit					1				
2.4	RU	Urtica dioica	seed/fruit	4,5							4	
2.4	RU	Verbena officinalis	seed/fruit	4,5	5,98			27,94		28	28	10
2.4	RU	Sonchus asper	seed/fruit	4,5								
2.4	RU	Sonchus oleraceus	seed/fruit	4,5				1				2
2.4/4.2	RU	Potentilla reptans	seed/fruit	4,5							4	2
GRASSLAND, MEADOWS AND PASTURES												
3.1	MP	Arenaria serpyllifolia	seed/fruit	76,5	31,26			37,24		8	12	20
3.1	MP	Arenaria serpyllifolia	capsule	4,5	1							
3.1	MP	Daucus carota	seed/fruit	13,5				5,32			12	4
3.1	MP	Nepeta cataria	seed/fruit	4,5								
3.1	MP	Petrorhagia saxifraga	seed/fruit					2,66		4		
4.1	MP	Silene cf nutans	seed/fruit							4		
4.1	MP	Teucrium chamaedrys	seed/fruit					2				2
4.1/4.3	MP	Dianthus carthusianorum	seed/fruit					2,66				
4.3	MP	Calamintha sp.	seed/fruit		1,66							
4.3	MP	Petrorhagia prolifera	seed/fruit					3,66				
4.3	MP	Rumex acetosella	seed/fruit		1					4	8	
4.3	MP	Stellaria graminea/palustris	seed/fruit	4,5								

			sample name	B2/03	B2/07	B2/09	B2/11	B2/12	B2/13	B2/14	B1/02	B1/04
4.3	MP	Trifolium pratense	calix					1				
4.3	MP	Achillea millefolium	seed/fruit					2,66				2
4.3	MP	Crepis biennis / froelichiana	seed/fruit				2				4	
4.3	MP	Poa pratensis	seed/fruit		1							
4.3/2.4	MP	Prunella vulgaris	seed/fruit							4		2
FOREST, FOREST EDGES, CLEARINGS												
5.1	F	Agrimonia eupatoria	seed/fruit	8,5	8		1	7,66	4	8	7	4
5.1	F	Campanula cf trachelium	seed/fruit		1							
5.1	F	Clinopodium vulgare	seed/fruit		1,66							
5.1	F	cfr Clinopodium vulgare	seed/fruit								4	
5.1	F	Cornus mas	seed/fruit				1	3			1	
5.1	F	Corylus avellana	seed/fruit				1		1			
5.1	F	cfr Corylus avellana	seed/fruit								4	
5.1	F	Crataegus sp.	seed/fruit				1					
5.1	F	Ficus carica	seed/fruit									2
5.1	F	Fragaria vesca	seed/fruit	67,5	64,78		1	75,52		69	112	22
5.1	F	Hypericum perforatum	seed/fruit	9	6,64			12,64		20	8	2
5.1	F	Ilex aquifolium	leaf fragments		3,66	1	1			4	4	15
5.1	F	Knautia cf drymeia	seed/fruit							4		
5.1	F	Lamiastrum galeobdolon	seed/fruit									2
5.1	F	Maloideae pericarp	seed/fruit	6,5	4			5,66	4	8		6
5.1	F	Malus cfr sylvestris	seed/fruit								2	
5.1	F	Malus sp.	seed/fruit			1		1		1	4	
5.1	F	Malus sylvestris	seed/fruit									2
5.1	F	Malus/Pyrus	seed/fruit		2,66			4,66	1	4		
5.1	F	Origanum vulgare	seed/fruit	31,5	7,64			21,28		4	20	22
5.1	F	cf Origanum vulgare	seed/fruit								4	
5.1	F	Physalis alkekengi	seed/fruit	4,5	16,62			7,98		4		
5.1	F	Pyrus cfr communis	seed/fruit								3	3
5.1	F	Pyrus communis	seed/fruit	1			1				4	
5.1	F	Pyrus sp.	seed/fruit					1		1		
5.1	F	cfr Pyrus	seed/fruit	1		3						
5.1	F	Quercus sp.	seed/fruit (cm2)	10	5	4	3	23	2	5	5	2
5.1	F	Quercus sp.	base					5			2	1
5.1	F	Rubus fruticosus	seed/fruit	41	11,96			42,26		5	89	41
5.1	F	Solanum dulcamara	seed/fruit		1							
5.1	F	Stachys sylvatica	seed/fruit	4,5								
5.1	F	Torilis japonica	seed/fruit	4,5	1,66							
5.1	F	Vitis vinifera sub. sylvestris	seed/fruit	3		1		6			3	2
LAKE SHORE VEGETATION												
6.1	LS	Epilobium parviflorum	seed/fruit		4,66							
6.1	LS	Lycopus europaeus	seed/fruit		3,32			2,66			8	10
6.1	LS	Mentha aquatica	seed/fruit								4	
6.1	LS	Mentha arvensis	seed/fruit		1							
6.1	LS	cf Mentha arvensis	seed/fruit								4	
6.1	LS	Mentha spicata / suaveolens	seed/fruit								12	
6.1	LS	Ranunculus sardous	seed/fruit	4,5	1,66			6,32				2
6.2	LS	Myosoton aquaticum	seed/fruit	4,5	1,66							
6.2	LS	Rumex maritimus	perianth	1	2			2			32	16
6.2	LS	Rumex maritimus	seed/fruit	1							8	12
6.2	LS	Scirpus radicans	seed/fruit	99	21,92			40,24		68	160	76
6.1/6.2	LS	Ranunculus sceleratus	seed/fruit	13,5	4,32			5,32		4	186	80
2.2/2.3/6.2	LS	Polygonum lapathifolium	seed/fruit	10	1			2,66			16	6
6.3	LS	Alisma plantagp-aquatica	seed/fruit									4
6.3	LS	Cyperus cfr glomeratus	seed/fruit	36	4,98			2,66		4	32	32
6.3	LS	Juncus sp.	seed/fruit							4		
6.3	LS	Schoenoplectus cf supinus	seed/fruit					5,32				
6.3	LS	Schoenoplectus sp.	seed/fruit							4		
6.3	LS	Typha latifolia/angustifolia	seed/fruit	18	17,6			3,66		20	40	12
6.3	LS	cfr Oenanthe aquatica	seed/fruit					2,66				
AQUATICS												
7.1	A	Ceratophyllum demersum	seed/fruit	4	1		2	6	2	4	3	
7.1	A	Characeae	oogons	63	5,98			21,28		12	4	2
7.1	A	Lemna minor	seed/fruit	4,5	1						12	4
7.1	A	Myriophyllum spicatum	seed/fruit							4		
7.1	A	Nymphaea alba	seed/fruit					3,66				
7.1	A	Nymphaea sp.	seed/fruit	4,5				2,66				
7.1	A	Nymphaeaceae	seed/fruit							4	4	
7.1	A	Potamogeton natans	seed/fruit						1			
7.1	A	Potamogeton sp.	seed/fruit									

			sample name	B2/03	B2/07	B2/09	B2/11	B2/12	B2/13	B2/14	B1/02	B1/04
VARIA												
0.	VA	Apiaceae	seed/fruit	4,5								
0.	VA	Asteraceae	seed/fruit		1,66							
0.	VA	Brassicaceae	seed/fruit	13,5	12,62			56,2		28		8
0.	VA	Carex bicarpellate	seed/fruit	13,5	7,64			15,96		20	36	10
0.	VA	Carex sp.	otricello	4,5	1,66			2,66		4	12	
0.	VA	Caryophyllaceae	seed/fruit					1				
0.	VA	Cerastium sp.	seed/fruit	18	3,32			7,98		12	4	10
0.	VA	Cyperaceae	seed/fruit	4,5								
0.	VA	Dianthus sp.	seed/fruit							4		
0.	VA	Fabaceae	pod fragm.	5,5		1		2,66	1	4	4	
0.	VA	Hypericum sp.	seed/fruit	4,5								
0.	VA	cfr Poaceae	seed/fruit		4							
0.	VA	Poaceae	seed/fruit	55	9,64			27,64		36	24	8
0.	VA	Polygonum sp.	seed/fruit		1,66			1		4	4	
0.	VA	Potentilla sp.	seed/fruit	31,5	1			4				
0.	VA	Ranunculus sp	seed/fruit								8	
0.	VA	Rosa sp.	seed/fruit		1							
0.	VA	Sambucus sp.	seed/fruit					2,66				
0.	VA	Silene sp.	seed/fruit					3,66		4	4	
0.	VA	Solananceae	seed/fruit	4,5				2,66		4		
0.	VA	Stachys sp	seed/fruit							4	4	
0.	VA	cfr Stachys	seed/fruit					1				
0.	VA	Trifolium sp.	petal		1,66			8,98				8
0.	VA	Crepis sp.	seed/fruit				2				4	
0.	VA	Knautia drymeia/arvensis	seed/fruit					2,66				
0.	VA	knautia sp	seed/fruit								4	8
0.	VA	Scabiosa sp.	seed/fruit					5,32				2

Tab. 5.2 – Macroremains analysis of small ruminants' coprolites found in sediment samples of section 98 – Sector A (number of remains and ubiquities).

		MACROREMAINS (>0.5 mm)																						MICROREMAINS (<0.5 mm)							
		Trees/Shrubs					Herbs				Cultiv. plants	Ferns/Mosses				Varia															
sediment sample name	coprolite name (n= 14)	*Rosa/Rubus* prickle	*Rubus* sp. (fragm fruit)	*Quercus* sp. epidermis	*Quercus* sp. pericarp	cf. *Hedera helix* epidermis	Caryophyllaceae fruits/seeds	Cyperaceae fruit	*Juncus* cf. *compressus*	*Poa palustris*	*Triticum* sp. testa	Pteridophyta epidermis	Pteridophyta sporangium	Bryophyta leaf	Bryophyta stem	undet. seed/fruit fragm	leaf fragment	small "stone"	epidermis with stomata	prickle	insect	charcoal	Fungi spore	*Triticum* sp. testa	Cyperaceae/ Poaceae epidermis	Pteridophyta leaf	Bryophyta leaf	epidermis	epidermis + stomata	Pteridophyta spore	Pteridophyta sporangium
	ubiquity (%)	50	21,43	14,29	7,14	7,14	7,14	7,14	7,14	7,14	35,71	7,14	7,14	14,29	14,29	57,14	42,86	42,86	21,43	21,43	21,43	21,43	7,14	7,14	7,14	7,14	50	92,86	57,14	7,14	7,14
	ubiquity (n. samples)	7	3	2	1	1	1	1	1	1	5	1	1	2	2	8	6	6	3	3	3	3	1	1	1	1	7	13	8	1	1
B2/12	**LAV9**		24				2									8	3		1	3								vn	s		
B2/12	**LAV10**			1												2	3		3						1			vn	n		
B2/12	**LAV11**										1						5											n	1		
B2/12	**LAV12**	2	1					1			1					1	4	+	1	4	3						1	n			
B2/12	**LAV13**	1			48									4		18	1			1							s	n	1		
B2/12	**LAV14**		2	6		1					2	1	1			12		++				1	1					vn	n		
B2/18	**LAV15**	1							1									+			1							n	s	2	
B2/07	**LAV30**										3					1	9					1		1			s	n	s		
B2/07	**LAV41**	1												1	2											s	n	vn			
B1/02	**LAV43**															1		+++ (qz)			1						s	n			
B1/02	**LAV44**	1								1												1					3	n	2		
B1/02	**LAV45**	1													2			+++										s			1
B2/03	**LAV46**																	+++									s				
B2/03	**LAV47**	2									1					2												3			

1,2,3 pieces; s: sporadic > 3; n: numerous > 10; vn: very numerous > 20

Tab. 5.3 – List of the plant taxa of pollen and macroremains from the sediment samples of section 98 – Lavagnone, Sector A.

Pollen	macroremains
ACERACEAE	
Acer	
ALISMATACEAE	
	Alisma plantago-aquatica
APIACEAE / UMBELLIFERAE	
Umbelliferae	Apiaceae
	Torilis arvensis
	Torilis japonica
	Daucus carota
	cf Oenanthe aquatica
AQUIFOLIACEAE	
	Ilex aquifolium
ARALIACEAE	
Hedera	
ASTERACEAE	
	Asteraceae
Anthemis type	Anthemis tinctoria
Artemisia	
Aster type	
Centaurea nigra type	
Centaurea scabiosa	
Cirsium	
Cichorioideae	
	Picris hieracioides
	Crepis sp.
	Crepis biennis/froelichiana
	Sonchus asper
	Sonchus oleraceus
	Lapsana communis
	Achillea millefolium
BETULACEAE	
Alnus	
Betula	
BORAGINACEAE	
Boraginaceae	
Pulmonaria obscura	
BRASSICACEAE / CRUCIFERAE	
Cruciferae	Brassicaceae
	Camelina sativa
CAMPANULACEAE	
Campanulaceae	
Phyteuma	
	Campanula cf trachelium
CANNABACEAE	
Cannabis/Humulus	
CAPRIFOLIACEAE	
	Sambucus sp.
	Sambucus ebulus
CARYOPHYLLACEAE	
Caryophyllaceae	Caryophyllaceae
	Arenaria serpyllifolia
	Cerastium sp.
	Dianthus carthusianorum
	Dianthus sp.
	Myosoton aquaticum
	Petrorhagia prolifera
	Petrorhagia saxifraga
	Scleranthus annuus
	Silene sp.
	Silene cf nutans
	Stellaria graminea/palustris
CERATOPHYLLACEAE	
	Ceratophyllum demersum
CHENOPODIACEAE	
	Chenopodium sp.
	Chenopodium album
CISTACEAE	
Helianthemum	
CONVOLVULACEAE	
Cuscuta	
CORNACEAE	
Cornus mas	Cornus mas
CORYLACEAE	
Carpinus betulus	
Corylus	Corylus avellana
Ostrya carpinifolia	
CRASSULACEAE	
Sedum	
CYPERACEAE	
Cyperaceae	Cyperaceae
	Carex sp.
	Cyperus cfr glomeratus
	Schoenoplectus cf supinus
	Schoenoplectus sp.
	Scirpus radicans
DIPSACEAE	
Knautia	knautia sp
	Knautia arvensis
	Knautia cf drymeia
Scabiosa	Scabiosa sp.
ERICACEAE	
Ericaceae	
EUPHORBIACEAE	
Euphorbia	
FABACEAE	
Fabaceae	Fabaceae
Astragalus	
Lotus	
Trifolium	Trifolium sp.
	Trifolium pratense
FAGACEAE	
Fagus	
Castanea	
Quercus	Quercus sp.
Quercus ilex	
GERANIACEAE	
Geranium	
GUTTIFERAE	
	Hypericum perforatum
Hypericum	Hypericum sp.
HALORAGACEAE	
Myriophillum verticillatum	
	Myriophyllum spicatum
JUNCACEAE	
	Juncus sp.
LAMIACEAE / LABIATAE	
Labiatae	
Mentha type	Mentha spicata / suaveolens
	Mentha aquatica
	cf Mentha arvensis
Lamium	
	Calamintha sp.
	Clinopodium vulgare
	Lamiastrum galeobdolon
	Lycopus europaeus
	Nepeta cataria
	Origanum vulgare
	Prunella vulgaris
	Stachys sp
	Stachys annua
	Stachys sylvatica
	Teucrium chamaedrys
LEMNACEAE	
	Lemna minor
LILIACEAE	
Asphodelus	
Liliaceae	
LINACEAE	
Linum catharticum	
Linum usitatissimum	Linum usitatissimum
MALVACEAE	
Malvaceae	cf Malva sylvestris
MORACEAE	
	Ficus carica
NYMPHAEACEAE	
Nymphaea	Nymphaea sp.
	Nymphaea alba
	Nymphaeaceae
OLEACEAE	
Fraxinus excelsior	
Fraxinus ornus	
ONAGRACEAE	
	Epilobium parviflorum
POACEAE / GRAMINEAE	
Gramineae	Poaceae
	Poa pratensis
Cerealia	Cerealia
	Triticum sp.
	Hordeum vulgare
PINACEAE	
Pinus sylvestris/mugo	
Abies alba	
Picea abies	
Larix	
PLANTAGINACEAE	
Plantaginaceae	
Plantago coronopus	
Plantago maritima	
Plantago lanceolata	
Plantago major	
Plantago media	
POLYGALACEAE	
Polygala vulgaris type	
POLYGONACEAE	
Polygonaceae	
	Polygonum sp.
	Polygonum lapathifolium
Polygonum aviculare	Polygonim aviculare
Polygonum persicaria	Polygonum persicaria
Polygonum scoparium	
Poligonum viviparum	
Fallopia cfr. dumetorum	
	Fallopia convolvulus
Rumex	Rumex acetosella
	Rumex maritimus
PORTULACACEAE	
	Portulaca oleracea
POTAMOGETONACEAE	
Potamogeton	Potamogeton natans
PRIMULACEAE	
Primulaceae	
Primula farinosa	
RANUNCULACEAE	
Ranunculaceae	Ranunculus cfr bulbosus
	Ranunculus sardous
	Ranunculus sceleratus
	Ranunculus sp
Thalictrum	
RHAMNACEAE	
Frangula alnus	
ROSACEAE	
Rosaceae	Agrimonia eupatoria
	Crataegus sp.
	Fragaria vesca
	Maloideae pericarp
	Malus sp.
	Malus sylvestris
	Malus/Pyrus
	Pyrus communis
	Pyrus sp.
	Rosa sp.
	Rubus fruticosus
Filipendula	
Potentilla	Potentilla sp.
	Potentilla reptans
RUBIACEAE	
Galium type	
SALICACEAE	
Populus	
Salix	
SAXIFRAGACEAE	
Saxifraga	
SCROPHULARIACEAE	
Scrophulariaceae	
SOLANACEAE	
Solanum nigrum	Solanum nigrum
	Solanum dulcamara
	Physalis alkekengi
	Solananceae
SPARGANIACEAE	
Sparganium	
TAXACEAE	
Taxus	
TILIACEAE	
Tilia	
TYPHACEAE	
Typha	Typha latifolia/angustifolia
ULMACEAE	
Ulmus	
URTICACEAE	
Urtica	Urtica dioica
VALERIANACEAE	
Valerianella dentata	Valerianella dentata
VERBENACEAE	
Verbena	Verbena officinalis
VITACEAE	
Vitis	Vitis vinifera sub. sylvestris

Tab. 6.1 – Number of taxa according to type of preservation recorded in the 38 surface samples of Lucone D (13 from the 1st settlement phase and 25 from the 2nd one).

	charred	*slightly charred*	*waterlogged*	total
1st settlement phase samples	27	3	115	123
2nd settlement phase samples	21	2	91	95
All samples (1st phase + 2nd phase)	30	3	141	146

Tab. 6.2 – Number of charred (c), uncharred (u) and slightly charred (u/c) taxa and total number of taxa (tot) in each ecological group in the first settlement phase (A), in the second settlement phase (B) and in the total amount of samples (C). For the explanation of the ecological groups see tab. 2.4 and chap. 2.8.

A

1st phase		tot	c	u	u/c
	tot	123	27	115	3
C	**1.1**	**9**	**8**	**5**	**3**
WW	**2.1**	**8**	**3**	**7**	**0**
SW	**2.2**	**14**	**2**	**14**	**0**
RU	**2.3, 2.4**	**17**	**3**	**17**	**0**
RU	2.3	3	0	3	0
RU	2.4	14	3	14	0
MP	**3.1, 4.1, 4.2, 4.3**	**19**	**2**	**18**	**0**
MP	3.1	7	1	7	0
MP	4.1	6	0	6	0
MP	4.2	0	0	0	0
MP	4.3	6	1	5	0
F	**5.1**	**30**	**7**	**30**	**0**
LS	**6.1, 6.2, 6.3**	**16**	**1**	**15**	**0**
LS	6.1	7	0	7	0
LS	6.2	6	1	5	0
LS	6.3	3	0	3	0
A	**7.1**	**5**	**0**	**5**	**0**
VA	**0.**	**5**	**1**	**4**	**0**

B

2nd phase		tot	c	u	u/c
	tot	95	21	91	2
C	**1.1**	**9**	**8**	**7**	**2**
WW	**2.1**	**6**	**2**	**5**	**0**
SW	**2.2**	**6**	**0**	**6**	**0**
RU	**2.3, 2.4**	**9**	**0**	**9**	**0**
RU	2.3	1	0	1	0
RU	2.4	8	0	8	0
MP	**3.1, 4.1, 4.2, 4.3**	**15**	**1**	**15**	**0**
MP	3.1	6	1	6	0
MP	4.1	4	0	4	0
MP	4.2	0	0	0	0
MP	4.3	5	0	5	0
F	**5.1**	**28**	**9**	**27**	**0**
LS	**6.1, 6.2, 6.3**	**12**	**0**	**12**	**0**
LS	6.1	6	0	6	0
LS	6.2	4	0	4	0
LS	6.3	2	0	2	0
A	**7.1**	**4**	**0**	**4**	**0**
VA	**0.**	**6**	**1**	**6**	**0**

C

1st and 2nd phases		tot	c	u	u/c
	tot	146	30	141	3
C	**1.1**	**9**	**8**	**8**	**3**
WW	**2.1**	**9**	**3**	**8**	**0**
SW	**2.2**	**14**	**2**	**14**	**0**
RU	**2.3, 2.4**	**19**	**3**	**19**	**0**
RU	2.3	3	0	3	0
RU	2.4	16	3	16	0
MP	**3.1, 4.1, 4.2, 4.3**	**26**	**2**	**25**	**0**
MP	3.1	8	1	8	0
MP	4.1	8	0	8	0
MP	4.2	0	0	0	0
MP	4.3	10	1	9	0
F	**5.1**	**36**	**10**	**35**	**0**
LS	**6.1, 6.2, 6.3**	**20**	**1**	**20**	**0**
LS	6.1	10	0	10	0
LS	6.2	6	1	6	0
LS	6.3	4	0	4	0
A	**7.1**	**6**	**0**	**6**	**0**
VA	**0.**	**7**	**1**	**6**	**0**

Tab. 6.3a – Results (n. of remains) of the full analysis of the first settlement phase samples from the Lucone D site (8 samples). Also ubiquity values are shown.

total volume 38,5 litres
total remains (extrapolated) = 215410
total remains (identified) = 18252
total remains identified for statistic analysis = 17614
mean concentration (n. remains / litre) = 4733,45

ecol grp	large ecol grp	taxon	pres.	remain type	ubiq n.smpl 1st ph	ubiq n.smpl 2nd ph	ubiq tot	n. remain 1st ph	n remain 2nd ph	n. remain tot	LUC c 1	LUC c 34	LUC c 46	LUC c 51	LUC c 58	LUC c 63	LUC c 107	LUC c 113
										sample name	LUC c 1	LUC c 34	LUC c 46	LUC c 51	LUC c 58	LUC c 63	LUC c 107	LUC c 113
										vol saturated in water (l)	7,00	2,00	7,00	3,50	7,00	1,00	7,00	4,00
										concentration	**15978,143**	**986**	**1197,4286**	**1407,1429**	**838,34286**	**343**	**4534,1714**	**12583,375**
										n. remains	111847	1972	8382	4925	5868,4	343	31739,2	50333,5
FIELDS																		
cultivated plants																		
1.	C	Triticum monococcum	c	spikelet fork	8	13	**21**	2416	3509	**5924,8**	1542	9,4	154	216	251,6	2	199,2	42
1.	C	Triticum monococcum	c	glume base	4	9	**13**	2247	1507	**3754,1**	1901	0	241,5	0	53,6	0	0	51
1.	C	Triticum monococcum	c	grain	4	2	**6**	71	26,6	**97,6**	34	0	7	15	15	0	0	0
1.	C	Triticum dicoccum	c	spikelet fork	8	13	**21**	8301	10995	**19295,3**	5982	281	14	826	597,6	6	384	210
1.	C	Triticum dicoccum	c	glume base	8	13	**21**	4902	5059	**9960,6**	3649	105,6	119	368	350	3	28	279,5
1.	C	Triticum dicoccum	c	ear uppermost part	0	1	**1**	0	2	**2**	0	0	0	0	0	0	0	0
1.	C	Triticum dicoccum	c	grain	7	11	**18**	392,5	61,4	**453,9**	226	6	112	5	17	0	16	10,5
1.	C	Triticum nn (new glume wheat)	c	spikelet fork	8	14	**22**	8100	19757	**27857,2**	4036	239,6	980	912	1358,4	4	360	210
1.	C	Triticum cf nn (cf new glume wheat)	c	spikelet fork	0	1	**1**	0	45,6	**45,6**	0	0	0	0	0	0	0	0
1.	C	Triticum nn (new glume wheat)	c	spikelet fork with grains	1	1	**2**	86	24	**110**	0	0	86	0	0	0	0	0
1.	C	Triticum nn (new glume wheat)	c	glume base	8	13	**21**	2202	5039	**7240,6**	779	18,5	568	78	447,2	1	20	290
1.	C	Triticum nn (new glume wheat)	c	grain	4	3	**7**	926	41	**967**	319	0	579	0	24	0	4	0
1.	C	Triticum durum / T. turgidum	c	rachis	1	4	**5**	35	112,7	**147,7**	0	0	0	35	0	0	0	0
1.	C	cf Triticum durum / T. turgidum	c	rachis	0	1	**1**	0	130,8	**130,8**	0	0	0	0	0	0	0	0
1.	C	Triticum aestivum / T. durum / T. turgidum	c	rachis	0	3	**3**	0	9	**9**	0	0	0	0	0	0	0	0
1.	C	cf Triticum aestivum / T. durum / T. turgidum	c	rachis	0	1	**1**	0	3	**3**	0	0	0	0	0	0	0	0
1.	C	Triticum aestivum / T. durum / T turgidum	c	grain	3	5	**8**	19	8	**27**	7	0	0	4	0	0	8	0
1.	C	cf Triticum aestivum / T durum / T. turgidum	c	grain	0	1	**1**	0	3	**3**	0	0	0	0	0	0	0	0
1.	C	Triticum spelta	c	spikelet fork	0	1	**1**	0	1	**1**	0	0	0	0	0	0	0	0
1.	C	Triticum spelta	c	glume base	3	7	**10**	43,4	472,4	**515,8**	7	7,4	0	29	0	0	0	0
1.	C	Triticum cf spelta	c	glume base	1	1	**2**	1	1	**2**	0	0	0	0	1	0	0	0
1.	C	Triticum spelta	c	grain	1	2	**3**	41	5	**46**	41	0	0	0	0	0	0	0
1.	C	Triticum cf spelta	c	grain	1	1	**2**	5	2	**7**	0	0	0	0	5	0	0	0
1.	C	Triticum aestivum	c	rachis	1	1	**2**	8	18	**26**	8	0	0	0	0	0	0	0
1.	C	Triticum cf aestivum	c	rachis	2	1	**3**	100	44,5	**144,5**	0	0	0	98	2	0	0	0
1.	C	Triticum monococcum / T. nn	c	spikelet fork	6	6	**12**	238,6	425,8	**664,4**	4	4	84	0	59,6	0	24	63
1.	C	Triticum monococcum / T. nn	c	glume base	2	4	**6**	38,6	562,6	**601,2**	0	0	28	0	10,6	0	0	0
1.	C	Triticum monococcum / T. dicoccum	c	spikelet fork	1	6	**7**	786	141	**927**	786	0	0	0	0	0	0	0
1.	C	Triticum monococcum / T. dicoccum	c	glume base	1	1	**2**	33	5	**38**	0	0	0	0	33	0	0	0
1.	C	Triticum dicoccum / T. nn (new glume wheat)	c	spikelet fork	6	13	**19**	427	2839	**3265,8**	104	2	242	14	58	0	0	7
1.	C	Triticum dicoccum / T. nn (new glume wheat)	c	spikelet fork with grains	1	0	**1**	4	0	**4**	0	0	4	0	0	0	0	0
1.	C	Triticum dicoccum / T. nn (new glume wheat)	c	glume base	3	6	**9**	108	572,4	**680,4**	7	0	98	0	3	0	0	0
1.	C	Triticum dicoccum / T. nn (new glume wheat)	c	grain	0	1	**1**	0	4	**4**	0	0	0	0	0	0	0	0

Tab. 6.3a - continued

								sample name			LUC c 1	LUC c 34	LUC c 46	LUC c 51	LUC c 58	LUC c 63	LUC c 107	LUC c 113
1.	c	Triticum sp.	c	spikelet fork	7	14	**21**	2320	7157	**9477,4**	1678	0	224	30	115,2	2	229,2	42
1.	c	Triticum sp.	c	glume base	8	11	**19**	3358	3871	**7228,7**	1147	14,8	217	21	80,4	1	1722,4	154
1.	c	Triticum sp.	c	glume	1	1	**2**	0	0	**0**	0	0	0	0	0	0	0	0
1.	c	Triticum sp.	c	rachis	5	9	**14**	520,5	1002	**1522,5**	7	14,8	73,5	0	67,2	0	358	0
1.	c	Triticum sp.	c	ear uppermost part	6	7	**13**	216	612,4	**828,4**	10	2	28	84	90	2	0	0
1.	c	Triticum sp.	c	grain	4	8	**12**	397,5	16	**413,5**	380	0	6	0	0	0	8	3,5
1.	c	Hordeum vulgare	c	spikelet fork	7	13	**20**	3261	4755	**8016,6**	2346	35,6	112	142	206,4	0	398,4	21
1.	c	Hordeum vulgare	c	spikelet fork with grains	1	0	**1**	2	0	**2**	0	0	2	0	0	0	0	0
1.	c	Hordeum vulgare	c	rachis	4	3	**7**	112,4	78,2	**190,6**	29	0	14	0	61,4	0	8	0
1.	c	Hordeum vulgare	c	grain	7	12	**19**	760	269,1	**1029,1**	441	4	257	5	42	0	4	7
1.	c	cf Hordeum	c	grain	0	1	**1**	0	0	**0**	0	0	0	0	0	0	0	0
1.	c	Cerealia	c	glume	1	4	**5**	0	0	**0**	0	0	0	0	0	0	0	0
1.	c	Cerealia	c	grain	6	12	**18**	364,5	68,9	**433,4**	0	4	313	20	20	0	4	3,5
1.	c	Cerealia	c	embryo	2	0	**2**	0	0	**0**	0	0	0	0	0	0	0	0
1.	c	Cerealia	c	rachis	3	2	**5**	1787	74	**1861**	1717	0	63	7	0	0	0	0
1.	c	Cerealia	c	culm	2	1	**3**	0	0	**0**	0	0	0	0	0	0	0	0
1.	c	Linum usitatissimum	c	seed/fruit	5	1	**6**	21081	9	**21090**	19463	0	1195	7	411	0	5	0
1.	c	Linum usitatissimum	c	capsule	2	0	**2**	33	0	**33**	33	0	0	0	0	0	0	0
1.	c	Triticum dicoccum	u	spikelet fork	2	3	**5**	22	57,2	**79,2**	0	0	0	14	0	0	8	0
1.	c	Triticum nn (new glume wheat)	u	spikelet fork	0	4	**4**	0	165,6	**165,6**	0	0	0	0	0	0	0	0
1.	c	Triticum nn (new glume wheat)	u	glume base	1	1	**2**	7	1810	**1816,6**	0	0	7	0	0	0	0	0
1.	c	Triticum durum / T. turgidum	u	spikeletfork	1	0	**1**	7	0	**7**	0	0	0	0	0	0	0	7
1.	c	Triticum aestivum	u	rachis	0	2	**2**	0	6,4	**6,4**	0	0	0	0	0	0	0	0
1.	c	Triticum spelta	u	glume base	0	1	**1**	0	7,4	**7,4**	0	0	0	0	0	0	0	0
1.	c	Triticum dicoccum / T. spelta	u	glume base	0	1	**1**	0	31,2	**31,2**	0	0	0	0	0	0	0	0
1.	c	Triticum sp.	u	ear frg	0	1	**1**	0	1	**1**	0	0	0	0	0	0	0	0
1.	c	Triticum sp.	u	spikelet fork	3	3	**6**	7163	5021	**12184,2**	6856	0	21	0	0	0	286,4	0
1.	c	Triticum sp.	u	glume base	3	4	**7**	3273	2497	**5770**	1903	0	0	0	0	0	1217,2	153
1.	c	Triticum sp.	u	rachis	1	1	**2**	1	1	**2**	1	0	0	0	0	0	0	0
1.	c	Triticum sp.	u	testa	3	5	**8**	0	0	**0**	0	0	0	0	0	0	0	0
1.	c	Hordeum vulgare	u	spikelet	0	1	**1**	0	87,2	**87,2**	0	0	0	0	0	0	0	0
1.	c	Cerealia	u	glume base	1	3	**4**	7	455,6	**462,6**	0	0	0	0	0	0	7	0
1.	c	Cerealia	u	spikelet fork	2	3	**5**	26	1843	**1869,2**	0	0	0	0	0	0	22	4
1.	c	Cerealia	u	rachis	1	0	**1**	0	0	**0**	0	0	0	0	0	0	0	0
1.	c	Carthamus tinctorius	u	seed/fruit	1	3	**4**	4	3	**7**	0	0	0	0	0	0	4	0
1.	c	Carthamus cf tinctorius	u	seed/fruit	1	4	**5**	1	59,1	**60,1**	1	0	0	0	0	0	0	0
1.	c	Linum usitatissimum	u	seed/fruit	4	5	**9**	490	692	**1182**	391	7,4	0	0	0	0	82,6	9
1.	c	Linum usitatissimum	u	capsule	4	5	**9**	3009	669	**3677,9**	2679	0	10,5	0	0	0	298,4	21
1.	c	Linum usitatissimum	u	fibres	2	5	**7**	0	0	**0**	0	0	0	0	0	0	0	0
1.	c	Triticum dicoccum	u/c	spikelet fork	1	2	**3**	21	4	**25**	0	0	0	0	0	0	0	21
1.	c	Triticum sp.	u/c	grain	0	1	**1**	0	1	**1**	0	0	0	0	0	0	0	0
1.	c	Cerealia	u/c	grain	0	1	**1**	0	1	**1**	0	0	0	0	0	0	0	0
1.	c	cf Linum usitatissimum	u/c	seed/fruit	1	0	**1**	2	0	**2**	2	0	0	0	0	0	0	0

Tab. 6.3a - continued

											LUC c 1	LUC c 34	LUC c 46	LUC c 51	LUC c 58	LUC c 63	LUC c 107	LUC c 113
								sample name										
winter crop weeds																		
2.1	ww	Avena sp.	c	grain	1	2	**3**	4	6	**10**	0	0	0	0	0	0	4	0
2.1	ww	Fallopia convolvulus	c	seed/fruit	1	1	**2**	3,7	1	**4,7**	0	3,7	0	0	0	0	0	0
2.1	ww	Valerianella dentata	c	seed/fruit	1	0	**1**	10,5	0	**10,5**	0	0	10,5	0	0	0	0	0
2.1	ww	Camelina sativa	u	capsule	0	3	**3**	0	4	**4**	0	0	0	0	0	0	0	0
2.1	ww	Fallopia convolvulus	u	seed/fruit	7	7	**14**	66	305	**371**	5	7,4	21	14	8,6	0	9	1
2.1	ww	Papaver rhoeas	u	seed/fruit	1	0	**1**	71,6	0	**71,6**	0	0	0	0	0	0	71,6	0
2.1	ww	Stachys annua	u	seed/fruit	3	2	**5**	21,2	23,1	**44,3**	0	3,7	14	0	0	0	0	3,5
2.1	ww	Torilis arvensis	u	seed/fruit	3	1	**4**	13,6	17,6	**31,2**	4	0	0	0	8,6	0	1	0
2.1	ww	Valerianella dentata	u	seed/fruit	6	7	**13**	1772	453,3	**2225,3**	1333	7,4	70	14	0	0	71,6	276
2.1	ww	Valerianella cf rimosa	u	seed/fruit fragm	1	0	**1**	4	0	**4**	0	0	0	0	0	0	4	0
summer crop weeds / mostly annual ruderal																		
2.2 / 2.3 / 2.4	sw	Chenopodium album	c	seed/fruit	1	0	**1**	153	0	**153**	0	0	0	0	0	0	0	153
2.2	sw	Portulaca oleracea	c	seed/fruit	1	0	**1**	190	0	**190**	190	0	0	0	0	0	0	0
2.2	sw	Aethusa cynapium	u	seed/fruit	5	6	**11**	40,6	116,1	**156,7**	0	7,4	1	14	17,2	0	1	0
2.2	sw	Anagallis arvensis	u	seed/fruit	3	4	**7**	80	108,2	**188,2**	0	0	10,5	14	0	0	0	55,5
2.2	sw	cf Anagallis arvensis	u	seed/fruit	0	1	**1**	0	90	**90**	0	0	0	0	0	0	0	0
2.2 / 2.3 / 2.4	sw	Chenopodium album	u	seed/fruit	7	13	**20**	12524	3501	**16025,5**	5525	186	546	436	239,6	0	3029,2	2562,5
2.2 / 2.3 / 2.4	sw	Chenopodium cf glaucum	u	seed/fruit	1	0	**1**	380	0	**380**	380	0	0	0	0	0	0	0
2.2	sw	Chenopodium cf polyspermum	u	seed/fruit	1	0	**1**	10,5	0	**10,5**	0	0	10,5	0	0	0	0	0
2.2 / 2.3 / 2.4	sw	Chenopodium sp.	u	seed/fruit	1	0	**1**	10,5	0	**10,5**	0	0	10,5	0	0	0	0	0
2.2	sw	Cirsium arvense	u	seed/fruit	1	0	**1**	3,5	0	**3,5**	0	0	0	0	0	0	0	3,5
2.2	sw	cf Eragrostis minor	u	seed/fruit	1	0	**1**	71,6	0	**71,6**	0	0	0	0	0	0	71,6	0
2.2	sw	Fumaria sp.	u	seed/fruit	1	0	**1**	1	0	**1**	0	0	0	0	1	0	0	0
2.2	sw	Lamium amplexicaule	u	seed/fruit	1	0	**1**	10,5	0	**10,5**	0	0	10,5	0	0	0	0	0
2.2	sw	Picris hieracioides	u	seed/fruit	1	1	**2**	71,6	8,8	**80,4**	0	0	0	0	0	0	71,6	0
2.2	sw	Portulaca oleracea	u	seed/fruit	7	5	**12**	3364	168,7	**3532,9**	1520	11,1	213,5	112	36,4	0	859,2	612
2.2 / 5.1	sw	Solanum nigrum	u	seed/fruit	2	2	**4**	249,2	70	**319,2**	0	0	0	0	0	0	147,2	102
2.2 / 2.3	sw	Stellaria media	u	seed/fruit	1	0	**1**	71,6	0	**71,6**	0	0	0	0	0	0	71,6	0
2.2 / 2.3	sw	Viola arvensis / V. Tricolor	u	seed/fruit	1	0	**1**	7	0	**7**	0	0	0	7	0	0	0	0

Tab. 6.3a - continued

									sample name		LUC c 1	LUC c 34	LUC c 46	LUC c 51	LUC c 58	LUC c 63	LUC c 107	LUC c 113
RUDERAL AND CROP FIELD UBIQUITARY SPECIES																		
2.4	RU	Lapsana communis	c	seed/fruit	1	0	**1**	7	0	**7**	0	0	7	0	0	0	0	0
2.4	RU	Polygonum aviculare	c	seed/fruit	1	0	**1**	1	0	**1**	0	0	0	0	1	0	0	0
2.3	RU	Cuscuta sp.	u	seed/fruit	1	0	**1**	10,5	0	**10,5**	0	0	10,5	0	0	0	0	0
2.3	RU	cf Cuscuta	u	seed/fruit	0	1	**1**	0	8,8	**8,8**	0	0	0	0	0	0	0	0
2.3	RU	Polygonum persicaria	u	seed/fruit	3	0	**3**	812	0	**812**	760	0	0	0	0	0	1	51
2.4	RU	Ajuga reptans	u	seed/fruit	1	0	**1**	2	0	**2**	2	0	0	0	0	0	0	0
2.4 / 6.	RU	Arctium minius / A. lappa	u	seed/fruit	1	0	**1**	1	0	**1**	1	0	0	0	0	0	0	0
2.4	RU	Carex hirta	u	seed/fruit	3	0	**3**	11,5	0	**11,5**	1	0	7	0	0	0	0	3,5
2.4	RU	Carex cf hirta	u	seed/fruit	2	1	**3**	25,1	5,5	**30,6**	0	11,1	0	14	0	0	0	0
2.4	RU	Dipsacus fullonum	u	seed/fruit	0	1	**1**	0	1	**1**	0	0	0	0	0	0	0	0
2.4	RU	Lapsana communis	u	seed/fruit	6	1	**7**	1031	6	**1037**	954	1	10,5	7	0	0	4	54,5
2.4	RU	cf Lapsana communis	u	seed/fruit	0	1	**1**	0	31,2	**31,2**	0	0	0	0	0	0	0	0
2.4	RU	Plantago major	u	seed/fruit	1	0	**1**	71,6	0	**71,6**	0	0	0	0	0	0	71,6	0
2.4	RU	Polygonum aviculare	u	seed/fruit	4	4	**8**	30	48,9	**78,9**	1	0	14	0	0	0	6	9
2.4 / 4.2	RU	Potentilla reptans	u	seed/fruit	6	7	**13**	1885	1011	**2896,5**	382	14,8	185,5	14	0	0	931,8	357
2.4	RU	Ranunculus acris	u	seed/fruit	1	0	**1**	194	0	**194**	194	0	0	0	0	0	0	0
2.4	RU	Ranunculus cf acris	u	seed/fruit	1	0	**1**	8	0	**8**	0	0	0	0	0	0	8	0
2.4	RU	Ranunculus acris / R. bulbosus	u	seed/fruit	1	0	**1**	7	0	**7**	0	0	0	0	0	0	0	7
2.4	RU	Sambucus ebulus	u	seed/fruit	4	3	**7**	207,3	58	**265,3**	190	3,7	0	0	9,6	0	4	0
2.2 / 2.4 / 3.1	RU	Silene alba	u	seed/fruit	1	0	**1**	3,5	0	**3,5**	0	0	0	0	0	0	0	3,5
2.4	RU	Urtica dioica	u	seed/fruit	4	0	**4**	259,4	0	**259,4**	0	3,7	10,5	0	0	0	143,2	102
2.4	RU	Verbena officinalis	u	seed/fruit	4	3	**7**	1784	102	**1886**	1142	7,4	0	0	0	0	430,6	204

Tab. 6.3a - continued

										sample name	LUC c 1	LUC c 34	LUC c 46	LUC c 51	LUC c 58	LUC c 63	LUC c 107	LUC c 113
GRASSLAND: MEADOWS AND PASTURES																		
3.1	MP	Daucus carota	c	seed/fruit	1	2	**3**	7	78,9	**85,9**	0	0	0	7	0	0	0	0
4.3	MP	Bromus cf hordeaceus	c	grain	1	0	**1**	1	0	**1**	0	0	0	0	1	0	0	0
2.1 / 2.2 / 3.1	MP	Ajuga chamaepytis	u	seed/fruit	4	3	**7**	41,6	142	**183,6**	0	0	0	21	9,6	0	4	7
3.1	MP	Arenaria serpyllifolia	u	seed/fruit	5	4	**9**	2561	135,4	**2696,3**	1711	11,1	63	0	0	0	214,8	561
3.1	MP	Centaurea sp.	u	calix	0	1	**1**	0	1	**1**	0	0	0	0	0	0	0	0
3.1	MP	Daucus carota	u	seed/fruit	6	6	**12**	664,4	427,9	**1092,3**	382	3,7	73,5	57	1	0	147,2	0
3.1	MP	Nepeta cataria	u	seed/fruit	2	0	**2**	73,6	0	**73,6**	1	0	0	0	0	0	72,6	0
3.1	MP	cf Nepeta cataria	u	seed/fruit	0	1	**1**	0	90	**90**	0	0	0	0	0	0	0	0
3.1	MP	cf Pastinaca sativa	u	seed/fruit	1	0	**1**	1	0	**1**	1	0	0	0	0	0	0	0
3.1	MP	Petrorhagia prolifera	u	seed/fruit	4	2	**6**	466,3	14,8	**481,1**	190	0	10,5	0	0	0	214,8	51
4.1	MP	Ajuga genevensis	u	seed/fruit	1	1	**2**	3,7	8,8	**12,5**	0	3,7	0	0	0	0	0	0
4.1	MP	Carex caryophyllea	u	seed/fruit	0	1	**1**	0	90	**90**	0	0	0	0	0	0	0	0
4.1	MP	Dianthus cf deltoides	u	seed/fruit	1	0	**1**	71,6	0	**71,6**	0	0	0	0	0	0	71,6	0
4.1	MP	Potentilla rupestris	u	seed/fruit	0	1	**1**	0	24,6	**24,6**	0	0	0	0	0	0	0	0
4.1	MP	Sanguisorba minor	u	seed/fruit	1	0	**1**	3,5	0	**3,5**	0	0	0	0	0	0	0	3,5
4.1	MP	Silene vulgaris	u	seed/fruit	1	0	**1**	1	0	**1**	0	0	0	0	0	0	1	0
4.1	MP	Stachys recta	u	seed/fruit	1	0	**1**	14	0	**14**	0	0	0	14	0	0	0	0
4.1	MP	Teucrium chamaedrys	u	seed/fruit	3	3	**6**	217,5	56,6	**274,1**	190	0	0	0	0	0	16	11,5
4.3	MP	Calamintha cf nepeta	u	seed/fruit	1	0	**1**	51	0	**51**	0	0	0	0	0	0	0	51
4.3	MP	Calamintha nepeta / C. sylvatica	u	seed/fruit	0	1	**1**	0	1	**1**	0	0	0	0	0	0	0	0
4.3	MP	Cerastium holosteoides / C. fontanum	u	seed/fruit	1	0	**1**	570	0	**570**	570	0	0	0	0	0	0	0
4.1 / 4.3	MP	Dianthus seguieri	u	seed/fruit	0	1	**1**	0	1	**1**	0	0	0	0	0	0	0	0
4.3	MP	Knautia cf arvensis	u	seed/fruit	0	1	**1**	0	36	**36**	0	0	0	0	0	0	0	0
4.3	MP	Knautia sp.	u	seed/fruit	0	3	**3**	0	44	**44**	0	0	0	0	0	0	0	0
4.3	MP	Leucanthemum vulgare	u	seed/fruit	1	0	**1**	10,5	0	**10,5**	0	0	10,5	0	0	0	0	0
2.4 / 4.3	MP	Prunella vulgaris	u	seed/fruit	1	2	**3**	71,6	52,4	**124**	0	0	0	0	0	0	71,6	0
4.3	MP	Rumex acetosella	u	seed/fruit	1	0	**1**	3	0	**3**	0	0	0	0	0	0	3	0
3.1 / 4.3	MP	Trifolium sp.	u	petal fragm	0	1	**1**	0	19,2	**19,2**	0	0	0	0	0	0	0	0

Tab. 6.3a - continued

											LUC c 1	LUC c 34	LUC c 46	LUC c 51	LUC c 58	LUC c 63	LUC c 107	LUC c 113
				sample name														
WOODLAND, WOOD EDGES, CLEARINGS																		
5.1	F	Agrimonia eupatoria	c	seed/fruit	1	0	**1**	7	0	**7**	0	0	7	0	0	0	0	0
5.1	F	Cornus mas	c	stone	1	2	**3**	5	9,8	**14,8**	0	0	0	0	5	0	0	0
5.1	F	Cornus sanguinea	c	stone	1	0	**1**	2	0	**2**	0	0	0	0	2	0	0	0
5.1	F	Corylus avellana	c	seed/fruit fragm.	1	1	**2**	1	1	**2**	0	0	1	0	0	0	0	0
5.1	F	Origanum vulgare	c	seed/fruit	0	1	**1**	0	1	**1**	0	0	0	0	0	0	0	0
6.4 / 5.1	F	Physalis alkekengi	c	seed/fruit	2	0	**2**	193	0	**193**	190	0	0	0	3	0	0	0
5.1	F	Quercus sp.	c	pericarp fragm.> 5mm	3	0	**3**	40	0	**40**	0	0	1	0	27	12	0	0
5.1	F	Quercus sp.	c	acorn base	4	2	**6**	297	23	**320**	0	0	12	0	180	45	60	0
5.1	F	Quercus sp.	c	acorn	3	0	**3**	440	0	**440**	0	0	3	0	180	257	0	0
5.1	F	Quercus sp.	c	cupule	1	0	**1**	1	0	**1**	0	0	0	0	1	0	0	0
5.1	F	Rubus gr fruticosus	c	seed/fruit	2	1	**3**	197	3	**200**	190	0	0	7	0	0	0	0
5.1	F	Staphylea pinnata	c	seed/fruit	0	1	**1**	0	1	**1**	0	0	0	0	0	0	0	0
5.1	F	Vitis vinifera sub. sylvestris	c	seed	0	1	**1**	0	1	**1**	0	0	0	0	0	0	0	0
5.1	F	Agrimonia eupatoria	u	seed/fruit	4	6	**10**	15,5	85	**100,5**	8	0	0	1	0	0	3	3,5
5.1	F	Alnus sp.	u	cone axis	1	0	**1**	1	0	**1**	1	0	0	0	0	0	0	0
5.1	F	Alnus sp.	u	scale	1	0	**1**	1	0	**1**	1	0	0	0	0	0	0	0
5.1	F	Carex elongata	u	seed/fruit	0	1	**1**	0	6	**6**	0	0	0	0	0	0	0	0
5.1	F	Carex cf sylvatica	u	seed/fruit	0	1	**1**	0	16,5	**16,5**	0	0	0	0	0	0	0	0
5.1	F	Carpinus betulus	u	seed/fruit fragm	2	1	**3**	5,5	1	**6,5**	2	0	0	0	0	0	0	3,5
5.1	F	Clinopodium vulgare	u	seed/fruit	1	1	**2**	51	43,6	**94,6**	0	0	0	0	0	0	0	51
5.1	F	cf Clinopodium vulgare	u	seed/fruit	1	0	**1**	3,7	0	**3,7**	0	3,7	0	0	0	0	0	0
5.1	F	Cornus mas	u	stone	5	10	**15**	174	1161	**1335**	0	2	1	6	0	0	25	140
5.1	F	Cornus sanguinea	u	stone	3	2	**5**	5	6	**11**	1	0	0	1	0	0	3	0
5.1	F	Corylus avellana	u	seed/fruit	8	10	**18**	249,2	186,6	**435,8**	196	5,7	16	2	1	1	15	12,5
5.1	F	Crataegus monogyna	u	stone	1	0	**1**	1	0	**1**	1	0	0	0	0	0	0	0
5.1	F	Fagus sylvatica	u	seed/fruit fragm	3	3	**6**	54,5	64,4	**118,9**	1	0	0	0	0	0	4	49,5
5.1	F	Ficus carica	u	seed/fruit	6	7	**13**	9933	2331	**12263,8**	1341	114,3	35	50	0	0	222,2	8170
5.1	F	Fragaria vesca	u	seed/fruit	7	8	**15**	20016	3828	**23843,6**	6473	7,4	269,5	28	60,2	0	4679	8499
5.1	F	Frangula alnus	u	seed/fruit	1	0	**1**	1	0	**1**	1	0	0	0	0	0	0	0
5.1	F	Hypericum perforatum	u	seed/fruit	2	4	**6**	388,4	134,9	**523,3**	0	0	0	0	0	0	286,4	102
5.1	F	Maloideae pericarp	u	=1	0	1	**1**	0	8	**8**	0	0	0	0	0	0	0	0
5.1	F	Maloideae pericarp	u	<1/4	3	7	**10**	2093	1162	**3255,6**	977	0	0	0	0	0	221,2	895
5.1	F	Maloideae pericarp	u	1/2	1	1	**2**	21	14	**35**	0	0	0	0	0	0	0	21
5.1	F	Malus / Pyrus	u	seed/fruit	2	4	**6**	208,5	52,8	**261,3**	0	1	0	0	0	0	0	207,5
5.1	F	Malus sp.	u	seed/fruit	1	1	**2**	4	1	**5**	0	0	0	0	0	0	4	0
5.1	F	Malus sylvestris	u	seed/fruit	2	0	**2**	2	0	**2**	1	0	0	0	0	0	0	1
5.1	F	Origanum vulgare	u	seed/fruit	1	2	**3**	72,6	226,8	**299,4**	0	0	0	0	0	0	72,6	0
5.1 / 6.4	F	Physalis alkekengi	u	seed/fruit	8	13	**21**	2434	860,7	**3294,4**	1345	71,3	179,5	78	167,2	3	202,2	387,5
5.1	F	Prunus spinosa	u	stone	2	2	**4**	4	5	**9**	0	0	0	0	0	0	2	2
5.1	F	Prunus cf avium	u	stone	1	0	**1**	1	0	**1**	1	0	0	0	0	0	0	0
5.1	F	Prunus cf mahaleb	u	stone	2	2	**4**	3	2	**5**	0	0	0	0	0	0	1	2
5.1	F	Prunus sp.	u	stone	4	3	**7**	9,5	12,2	**21,7**	0	0	0	1	0	1	4	3,5
5.1	F	Pteridium sp.	u	leaf fragm	0	2	**2**	0	22,8	**22,8**	0	0	0	0	0	0	0	0
5.1	F	Pyrus pyraster	u	seed/fruit	2	5	**7**	279,5	114,6	**394,1**	4	0	0	0	0	0	0	275,5
5.1	F	Pyrus sp.	u	seed/fruit	1	2	**3**	22	12	**34**	0	0	0	0	0	0	22	0
5.1	F	Pyrus sp.	u	stalk fragm	1	6	**7**	49	39,5	**88,5**	0	0	0	0	0	0	0	49

Tab. 6.3a - continued

											LUC	LUC	LUC	LUC	LUC	LUC	LUC	LUC
								sample name			c 1	c 34	c 46	c 51	c 58	c 63	c 107	c 113
5.1	F	Pyrus sp.	u	calyx tube remnant	6	7	**13**	35	137	**172**	2	1	7	4	1	0	20	0
5.1	F	Pyrus sp.	u	pericarp	0	1	**1**	0	2	**2**	0	0	0	0	0	0	0	0
5.1	F	Pyrus sp.	u	stones	4	8	**12**	42309	2848	**45157,1**	16720	0	21	0	0	0	8018	17550
5.1	F	Quercus sp.	u	pericarp fragm.> 5mm	4	9	**13**	868	478,7	**1346,7**	199	0	8	0	0	0	454	207
5.1	F	Quercus sp.	u	acorn base	5	10	**15**	185,5	323,7	**509,2**	29	0	1	42	0	0	28	85,5
5.1	F	Quercus sp.	u	cupule	2	7	**9**	2	9	**11**	0	0	0	0	0	0	1	1
5.1	F	Rosa cf agrestis	u	seed/fruit	0	1	**1**	0	2	**2**	0	0	0	0	0	0	0	0
5.1	F	Rosa sp.	u	seed/fruit	3	4	**7**	15,5	33,3	**48,8**	3	0	0	0	0	0	9	3,5
5.1	F	Rosa / Rubus	u	prickles	0	2	**2**	0	44,2	**44,2**	0	0	0	0	0	0	0	0
5.1	F	Rubus gr fruticosus	u	seed/fruit	8	14	**22**	6712	38761	**45472,9**	1599	663,6	293,5	931	469,2	2	777,8	1976
5.1	F	Rubus ideaus	u	seed/fruit	1	0	**1**	4	0	**4**	0	0	0	0	0	0	4	0
5.1	F	Rubus cf ideaus	u	seed/fruit	0	1	**1**	0	24	**24**	0	0	0	0	0	0	0	0
5.1	F	Rubus sp.	u	seed/fruit	4	1	**5**	134,1	281,6	**415,7**	0	0	10,5	0	0	1	71,6	51
5.1	F	Sambucus nigra	u	seed/fruit	3	3	**6**	17	56,7	**73,7**	3	0	7	7	0	0	0	0
5.1	F	Silene dioica	u	seed/fruit	0	1	**1**	0	8,8	**8,8**	0	0	0	0	0	0	0	0
5.1	F	Stellaria cf alsine	u	seed/fruit	1	0	**1**	51	0	**51**	0	0	0	0	0	0	0	51
5.1	F	Torilis japonica	u	seed/fruit	1	1	**2**	2	1	**3**	2	0	0	0	0	0	0	0
5.1	F	Viola riviniana / V. reichenbachiana	u	seed/fruit	1	0	**1**	1	0	**1**	1	0	0	0	0	0	0	0
5.1	F	Vitis vinifera sub. sylvestris	u	seed	6	10	**16**	118,4	449	**567,4**	10	24,4	7	1	0	0	26	50
5.1	F	Vitis sp.	u	tendril fragm	0	3	**3**	0	2	**2**	0	0	0	0	0	0	0	0

Tab. 6.3a - continued

										sample name	LUC c 1	LUC c 34	LUC c 46	LUC c 51	LUC c 58	LUC c 63	LUC c 107	LUC c 113
LAKE SHORE VEGETATION																		
6.1	LS	Carex gr muricata	u	seed/fruit	0	1	**1**	0	24,6	**24,6**	0	0	0	0	0	0	0	0
6.1	LS	Cladium mariscus	u	seed/fruit	0	1	**1**	0	8,8	**8,8**	0	0	0	0	0	0	0	0
6.1	LS	Epilobium hirsutum / E. parviflorum	u	seed/fruit	1	0	**1**	51	0	**51**	0	0	0	0	0	0	0	51
6.1	LS	Eupatorium cannabinum	u	seed/fruit	1	0	**1**	10,5	0	**10,5**	0	0	10,5	0	0	0	0	0
6.1	LS	Lycopus europaeus	u	seed/fruit	3	2	**5**	312,6	41,7	**354,3**	190	0	0	0	0	0	71,6	51
6.1	LS	Mentha aquatica / M. arvensis	u	seed/fruit	2	0	**2**	297,2	0	**297,2**	0	0	0	0	0	0	144,2	153
6.1	LS	Mentha cf longifolia	u	seed/fruit	0	1	**1**	0	17,6	**17,6**	0	0	0	0	0	0	0	0
6.1	LS	Mentha spicata / M. suaveolens	u	seed/fruit	2	2	**4**	224,6	58	**282,6**	0	0	0	0	0	0	71,6	153
6.1	LS	Ranunculus sardous	u	seed/fruit	2	3	**5**	11	295,6	**306,6**	0	0	0	7	0	0	4	0
6.2	LS	Cyperus flavescens	u	seed/fruit	1	0	**1**	143,2	0	**143,2**	0	0	0	0	0	0	143,2	0
6.2	LS	Polygonum hydropiper	u	seed/fruit	1	1	**2**	190	24,6	**214,6**	190	0	0	0	0	0	0	0
2.2 / 2.3 / 6.2	LS	Polygonum lapathifolium	u	seed/fruit	5	5	**10**	551,6	244,6	**796,2**	381	0	14	14	0	0	76,6	66
6.2	LS	Polygonum minus	u	seed/fruit	0	1	**1**	0	6	**6**	0	0	0	0	0	0	0	0
6.1 / 6.2	LS	Ranunculus sceleratus	u	seed/fruit	4	3	**7**	551,7	111,4	**663,1**	381	0	10,5	14	0	0	146,2	0
6.2	LS	Scirpus radicans	u	seed/fruit	1	0	**1**	190	0	**190**	190	0	0	0	0	0	0	0
6.3	LS	Alisma plantago-aquatica	u	seed/fruit	2	0	**2**	261,6	0	**261,6**	190	0	0	0	0	0	71,6	0
6.3	LS	cf Poa palustris	u	seed/fruit	0	1	**1**	0	43,6	**43,6**	0	0	0	0	0	0	0	0
6.3	LS	Typha latifolia / T. angustifolia	u	seed/fruit	1	3	**4**	10,5	219,1	**229,6**	0	0	10,5	0	0	0	0	0
AQUATICS																		
7.1	A	Ceratophyllum demersum	u	seed/fruit	0	1	**1**	0	1	**1**	0	0	0	0	0	0	0	0
7.1	A	Characeae	u	seed/fruit	6	4	**10**	7287	161,2	**7448**	1521	7,4	84	28	0	0	2076,4	3570
7.1	A	Najas flexilis	u	seed/fruit	2	0	**2**	224,6	0	**224,6**	0	0	0	0	0	0	71,6	153
7.1	A	cf Najas flexilis	u	seed/fruit	1	0	**1**	3,5	0	**3,5**	0	0	0	0	0	0	0	3,5
7.1	A	Najas minor	u	seed/fruit	0	2	**2**	0	147,2	**147,2**	0	0	0	0	0	0	0	0
7.1	A	cf Najas	u	seed/fruit fragm	1	0	**1**	190	0	**190**	190	0	0	0	0	0	0	0
7.1	A	Nymphaea alba	u	seed/fruit	1	0	**1**	1	0	**1**	1	0	0	0	0	0	0	0
7.1	A	Potamogeton natans	u	seed/fruit	2	0	**2**	4,5	0	**4,5**	0	0	0	0	0	0	0	4,5
7.1	A	Potamogeton sp.	u	seed/fruit	1	2	**3**	71,6	6,7	**78,3**	0	0	0	0	0	0	71,6	0

Tab. 6.3a - continued

											LUC c 1	LUC c 34	LUC c 46	LUC c 51	LUC c 58	LUC c 63	LUC c 107	LUC c 113
VARIA									sample name									
0.	VA	Bromus sp.	c	seed/fruit	1	0	**1**	14	0	**14**	0	0	14	0	0	0	0	0
0.	VA	Fabaceae	c	seme 1/2	0	1	**1**	0	5	**5**	0	0	0	0	0	0	0	0
0.	VA	Fabaceae	c	seme	1	1	**2**	1	1	**2**	1	0	0	0	0	0	0	0
0.	VA	Poaceae	c	seed/fruit	4	0	**4**	52	0	**52**	7	0	35	0	5	0	5	0
0.	VA	Rumex sp.	c	seed/fruit	1	0	**1**	7	0	**7**	0	0	7	0	0	0	0	0
0.	VA	Solanum sp.	c	seed/fruit	1	0	**1**	7	0	**7**	0	0	7	0	0	0	0	0
0.	VA	Ajuga reptans / A. genevensis	u	seed/ruit	1	0	**1**	7	0	**7**	0	0	7	0	0	0	0	0
0.	VA	Ajuga sp.	u	seed/fruit	1	1	**2**	71,6	24,6	**96,2**	0	0	0	0	0	0	71,6	0
0.	VA	Asteraceae	u	bract	1	1	**2**	1	1	**2**	1	0	0	0	0	0	0	0
0.	VA	Asteraceae	u	receptacle	0	2	**2**	0	0	**0**	0	0	0	0	0	0	0	0
0.	VA	Asteraceae	u	calyx	0	1	**1**	0	1	**1**	0	0	0	0	0	0	0	0
0.	VA	Asteraceae	u	seed/fruit	0	2	**2**	0	26,6	**26,6**	0	0	0	0	0	0	0	0
0.	VA	Atriplex sp.	u	seed/fruit	1	0	**1**	3,7	0	**3,7**	0	3,7	0	0	0	0	0	0
0.	VA	Brassicaceae	u	seed/fruit	2	3	**5**	112,5	48,2	**160,7**	0	0	10,5	0	0	0	0	102
0.	VA	Bromus sp.	u	seed/fruit	0	1	**1**	0	12,8	**12,8**	0	0	0	0	0	0	0	0
0.	VA	Bromus sp.	u	testa	0	1	**1**	0	0	**0**	0	0	0	0	0	0	0	0
0.	VA	Carex bicarpellate	u	seed/fruit	2	1	**3**	55	24,6	**79,6**	0	0	0	0	0	0	4	51
0.	VA	Carex sp.	u	utriculus	1	0	**1**	1	0	**1**	1	0	0	0	0	0	0	0
0.	VA	Carex tricarpellate	u	seed/fruit	5	0	**5**	26	0	**26**	0	1	14	0	1	0	3	7
0.	VA	Caryophyllaceae	u	seed/fruit	1	0	**1**	51	0	**51**	0	0	0	0	0	0	0	51
0.	VA	Cerastium sp.	u	seed/fruit	0	1	**1**	0	43,6	**43,6**	0	0	0	0	0	0	0	0
0.	VA	Cyperaceae	u	seed/fruit	0	1	**1**	0	26,4	**26,4**	0	0	0	0	0	0	0	0
0.	VA	Fabaceae	u	pod fragm	3	3	**6**	4	90,2	**94,2**	2	0	0	0	0	0	1	1
0.	VA	Hieracium sp.	u	seed/fruit	0	2	**2**	0	14,8	**14,8**	0	0	0	0	0	0	0	0
0.	VA	Hypericum sp.	u	seed/fruit	1	0	**1**	10,5	0	**10,5**	0	0	10,5	0	0	0	0	0
0.	VA	Lamiaceae	u	seed/fruit	2	0	**2**	242	0	**242**	191	0	0	0	0	0	0	51
0.	VA	Linum sp.	u	capsule fragm.	0	2	**2**	0	50,1	**50,1**	0	0	0	0	0	0	0	0
0.	VA	Poa sp.	u	seed/fruit	1	0	**1**	10,5	0	**10,5**	0	0	10,5	0	0	0	0	0
0.	VA	Poaceae	u	seed/fruit	2	3	**5**	1049	149,6	**1199**	763	0	0	0	0	0	286,4	0
0.	VA	Polygonum sp.	u	seed/fruit	2	3	**5**	61,5	77,2	**138,7**	0	0	10,5	0	0	0	0	51
0.	VA	Potentilla sp.	u	seed/fruit	1	0	**1**	14	0	**14**	0	0	0	14	0	0	0	0
0.	VA	Ranunculus sp.	u	seed/fruit	3	3	**6**	16	20,9	**36,9**	0	0	14	0	0	0	1	1
0.	VA	Sambucus sp.	u	seed/fruit	4	2	**6**	280,7	14,5	**295,2**	190	0	10,5	0	8,6	0	71,6	0
0.	VA	Satureya sp.	u	seed/fruit	0	1	**1**	0	8,8	**8,8**	0	0	0	0	0	0	0	0
0.	VA	Scabiosa sp.	u	seed/fruit	0	1	**1**	0	43,6	**43,6**	0	0	0	0	0	0	0	0
0.	VA	Setaria sp.	u	seed/fruit	2	0	**2**	53	0	**53**	0	0	0	0	2	0	0	51
0.	VA	Silene sp.	u	seed/fruit	1	1	**2**	51	5	**56**	0	0	0	0	0	0	0	51
0.	VA	Solanum sp.	u	seed/fruit	1	0	**1**	24,5	0	**24,5**	0	0	24,5	0	0	0	0	0
0.	VA	Stachys sp.	u	seed/fruit	1	0	**1**	10,5	0	**10,5**	0	0	10,5	0	0	0	0	0
0.	VA	Stellaria sp.	u	seed/fruit	1	1	**2**	190	6,4	**196,4**	190	0	0	0	0	0	0	0
0.	VA	Torilis arvensis / T. japonica	u	seed/fruit	1	1	**2**	71,6	24,6	**96,2**	0	0	0	0	0	0	71,6	0
0.	VA	Verbascum sp.	u	seed/fruit	1	0	**1**	7	0	**7**	0	0	7	0	0	0	0	0
0.	VA	Viola sp.	u	seed/fruit	1	0	**1**	3,7	0	**3,7**	0	3,7	0	0	0	0	0	0
0.	VA	undet.	c	seed/fruit	3	2	**5**	1523	46,2	**1569,2**	1520	0	0	0	3	0	0	0
0.	VA	undet.	u	seed/fruit	5	8	**13**	2849	770,8	**3619,4**	2285	0	0	14	38,4	0	504,2	7
0.	VA	undet.	u	vegetative part	2	2	**4**	33,8	11,4	**45,2**	15	18,8	0	0	0	0	0	0

Tab. 6.3b – Semiquantitative analysis (rapid screening) of the second settlement phase samples from the Lucone D site (all 13 samples, also including the 8 shown on Tab. 6.3a).

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	LUC c 1		LUC c 28		LUC c 33		LUC c 34			LUC c 34b		LUC c 35		LUC c 39	LUC c 46			LUC c 51			LUC c 58		LUC C 63			LUC c 107		LUC c 113		
		sample vol (litres)							9,00	7,00	5,00	5,00	8,00	7,00	1,00	2,00		4,00	7,00	4,00	6,50	4,00	5,00	7,00		4,00	3,50		5,00	7,00	1,50	1,00		7,00	7,00	4,00		
		fraction vol (ml)							1200	1900	700	420	1000	700	450	200	370	1000	500	1600	600	800	1550	1400	1050	300	170	700	2300	1300	900	20	40	1450	800	800	700	1530
		subsample vol (ml)							--	430	--	200	--	200	--	--	100	--	--	--	200	--	--	200	100	--	--	100	--	--	--	--	--	--	200	--	200	100
									2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm
FIELDS																																					
cultivated plants																																					
1.	C	Triticum monococcum	c	spikelet fork	13	14	27	71,05	3	2		2		2		1	1	1	2		2	1		2			2	3		3		1			2		2	
1.	C	Triticum monococcum	c	glume base	3	5	8	21,05	1	2															2	3						2									
1.	C	Triticum monococcum	c	spikelet fork with grain	1	0	1	2,63																	1														
1.	C	Triticum monococcum	c	grains	5	4	9	23,68	3			1									1					1	2	1	3								
1.	C	Triticum dicoccum	c	spikelet fork	13	20	33	86,84	4	3	2	4	2	4	2	3	3	2	4	1	3	2		2		2	4	3	1	3		1	2		4		3	
1.	C	Triticum dicoccum	c	glume base	10	13	23	60,53	3	3				3		2	3		3		2					1	2	4		2			2		2		2	1
1.	C	Triticum dicoccum	c	grains	10	19	29	76,32	4			2		2		2					2	2		1			2		2	3						2			
1.	C	Triticum dicoccum	c	ear uppermost part	0	1	1	2,63																														
1.	C	Triticum nn (new glume wheat)	c	spikelet fork with grain	1	0	1	2,63															3	2														
1.	C	Triticum nn (new glume wheat)	c	spikelet fork	13	21	34	89,47	4	2		4	3	4	1	3	3	1	4		3	1	2	4			4	4	1	4			2		3		3	
1.	C	Triticum nn (new glume wheat)	c	glume base	11	16	27	71,05	3	2		2	2	2			2		2		2		1	3	3		1	3					1		2		2	2
1.	C	Triticum nn (new glume wheat)	c	grain	7	4	11	28,95	4			1		1							2		3	4					2	3						1			
1.	C	Triticum cf nn (cf new glume wheat)	c	spikelet fork	0	1	1	2,63																														
1.	C	Triticum durum / T. turgidum	c	rachis	0	2	2	5,26																														
1.	C	Triticum aestivum / T. durum / T. turgidum	c	grain	4	9	13	34,21						2					1								2								2			
1.	C	Triticum aestivum / T. durum / T. turgidum	c	rachis frg	1	4	5	13,16																				2										
1.	C	cf Triticum aestivum / T. durum / T. turgidum	c	grain	0	1	1	2,63																														
1.	C	cf Triticum aestivum / T. durum / T. turgidum	c	rachis fragments	0	1	1	2,63																														
1.	C	Triticum aestivum	c	rachis	2	1	3	7,89	2				1																									
1.	C	Triticum cf aestivum	c	rachis	3	2	5	13,16													2							2		2									
1.	C	Triticum spelta	c	spikelet fork	1	1	2	5,26	2																													
1.	C	Triticum spelta	c	glume base	3	5	8	21,05				2					2										1	2										
1.	C	Triticum spelta	c	grain	3	6	9	23,68	3			2		2																							
1.	C	Triticum cf spelta	c	glume base	1	2	3	7,89																						1									
1.	C	Triticum cf spelta	c	grain	1	2	3	7,89																						2									
1.	C	cf Triticum spelta	c	glume base	1	0	1	2,63						2																								
1.	C	Triticum monococcum / Triticum nn	c	spikelet fork	6	7	13	34,21	2							2								2						2						2		2	
1.	C	Triticum monococcum / Triticum nn	c	glume base	1	1	2	5,26																						2									
1.	C	Triticum monococcum / T. dicoccum	c	spikelet fork	3	6	9	23,68	3	2		1						1																			
1.	C	Triticum monococcum / T. dicoccum	c	glume base	1	1	2	5,26																						3									
1.	C	Triticum dicoccum / Triticum nn	c	spikelet fork	9	17	26	68,42	4					2		1			3		2		2	2			2			3							1	
1.	C	Triticum dicoccum / Triticum nn	c	spikelet fork with grain	1	0	1	2,63															2																
1.	C	Triticum dicoccum / Triticum nn	c	glume base	2	2	4	10,53	2																					2									
1.	C	Triticum dicoccum / Triticum nn	c	grain	0	1	1	2,63																														
1.	C	Triticum sp.	c	spikelet fork	11	13	24	63,16	4	2		3	1	3					1		2			2	2	1		2		2			1	3	2	2	2	
1.	C	Triticum sp.	c	glume base	11	7	18	47,37	2	2				1			2	1			2			1	3			2		2			1		1	1		
1.	C	Triticum sp.	c	glume fragm	1	1	2	5,26																						1									
1.	C	Triticum sp.	c	grain	4	9	13	34,21		2													2	2												2		1	
1.	C	Triticum sp.	c	grain fragm	0	2	2	5,26																														
1.	C	Triticum sp.	c	ear uppermost part	8	5	13	34,21	2								1		2	2		2			1				2		2			1					
1.	C	Triticum sp.	c	rachis fragm.	5	9	14	36,84	2								2	1							2					2									
1.	C	Hordeum vulgare	c	spikelet fork	11	17	28	73,68	3	2		2	1	2		2	2		3		3	1	1	2	1		2	2								3		2	1
1.	C	Hordeum vulgare	c	grains	11	20	31	81,58	4			1	1	2		2				2	2	2	3	2			2		2	3						1		2	
1.	C	Hordeum vulgare	c	rachis fragm.	3	4	7	18,42	2																					3						2			
1.	C	cf Hordeum	c	grain fragm	0	1	1	2,63																														
1.	C	Cerealia	c	1st rachis segm. fragm.	1	0	1	2,63													1																		
1.	C	Cerealia	c	embryo	2	0	2	5,26		2																		1										
1.	C	Cerealia	c	stem	1	1	2	5,26	2	1																													
1.	C	Cerealia	c	glume frag	3	4	7	18,42	1	2											1																	3
1.	C	Cerealia	c	rachis	5	2	7	18,42	2	2		1		1												2			1										
1.	C	Cerealia	c	grain fragm	7	7	14	36,84				2	1	3								3							1		3						2		1	
1.	C	Cerealia	c	grain	8	16	24	63,16						2		2		1				2	2	3			2	2	1	3				2				
1.	C	Linum usitatissimum	c	capsule fragm.	1	1	2	5,26	3	2																												
1.	C	Linum usitatissimum	c	seed/fruit	7	1	8	21,05	4	4											2	1	2	4	2			1		3				1	1			
1.	C	Triticum dicoccum	u	spikelet fork	2	3	5	13,16																				1							1			

Tab. 6.3b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

									c 1		c 28		c 33		c 34			c 34b		c 35		c 39	c 46			c 51			c 58		C 63			c 107		c 113		
								sample vol (litres)	9,00	7,00	5,00	5,00	8,00	7,00	1,00	2,00		4,00	7,00	4,00	6,50	4,00	5,00	7,00		4,00	3,50		5,00	7,00	1,50	1,00		7,00	7,00	4,00		
								fraction vol (ml)	1200	1900	700	420	1000	700	450	200	370	1000	500	1600	600	800	1550	1400	1050	300	170	700	2300	1300	900	20	40	1450	800	800	700	1530
								subsample vol (ml)	--	430	--	200	--	200	--	--	100	--	--	--	200	--	--	200	100	--	--	100	--	--	--	--	--	--	200	--	200	100
ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm
1.	C	Triticum durum / T. turgidum	u	spikelet fork	1	0	1	2,63																													1	
1.	C	Triticum nn (new glume wheat)	u	spikelet fork	0	1	1	2,63																														
1.	C	Triticum sp.	u	ear fragm	0	1	1	2,63																														
1.	C	Triticum sp.	u	grain	1	0	1	2,63	1																													
1.	C	Triticum sp.	u	rachis fragm.	1	1	2	5,26	1																													
1.	C	Triticum sp.	u	glume base	2	2	4	10,53	2	2																												1
1.	C	Triticum sp.	u	spikelet fork	3	2	5	13,16	2	3															1													1
1.	C	Triticum sp.	u	testa	2	5	7	18,42	1	2																												3
1.	C	Triticum spelta	u	glume base	0	1	1	2,63																														
1.	C	Cerealia	u	culm fragm.	1	0	1	2,63																	1													
1.	C	Cerealia	u	rachis fragm.	1	0	1	2,63																	1													
1.	C	Cerealia	u	glume base	1	2	3	7,89																										2	1			
1.	C	Cerealia	u	spikelet fork	2	2	4	10,53																										2	2	2		
1.	C	Linum usitatissimum	u	seed/fruit fragm	1	2	3	7,89		2																												
1.	C	Linum usitatissimum	u	fibres	2	4	6	15,79	3	4																											2	1
1.	C	Linum usitatissimum	u	seed/fruit	4	5	9	23,68	3	2							2																	2	2	2	2	1
1.	C	Linum usitatissimum	u	capsule fragm.	4	6	10	26,32	4	4														2	3									1	2		3	3
1.	C	Carthamus tinctorius	u	seed/fruit	3	3	6	15,79													1			1											1			
1.	C	Carthamus cf tinctorius	u	seed/fruit fragm	2	3	5	13,16	2					1																								
1.	C	Triticum dicoccum	u/c	spikelet fork	1	2	3	7,89																													2	
1.	C	Triticum nn (new glume wheat)	u/c	spikelet fork	1	1	2	5,26						1																								
1.	C	Triticum sp.	u/c	grain	0	1	1	2,63																														
1.	C	Cerealia	u/c	grain fragm	0	1	1	2,63																														
1.	C	cf Linum usitatissimum	u/c	seed/fruit	1	0	1	2,63	2																													

Tab. 6.3b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	c 1		c 28		c 33		c 34			c 34b		c 35		c 39	c 46			c 51			c 58		C 63			c 107		c 113		
								sample vol (litres)	9,00	7,00	5,00	5,00	8,00	7,00	1,00	2,00		4,00	7,00	4,00	6,50	4,00	5,00	7,00		4,00	3,50		5,00	7,00	1,50	1,00		7,00	7,00	4,00		
								fraction vol (ml)	1200	1900	700	420	1000	700	450	200	370	1000	500	1600	600	800	1550	1400	1050	300	170	700	2300	1300	900	20	40	1450	800	800	700	1530
								subsample vol (ml)	--	430	--	200	--	200	--	--	100	--	--	--	200	--	--	200	100	--	--	100	--	--	--	--	--	--	200	--	200	100
									2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm
winter crop weeds																																						
2.1	WW	Avena sp.	c	grain	1	3	4	10,53																											1			
2.1	WW	Fallopia convolvulus	c	seed/fruit	1	1	2	5,26									1																					
2.1	WW	Valerianella dentata	c	seed/fruit	1	0	1	2,63																	1													
2.1	WW	Camelina sativa	u	capsule fragm.	0	2	2	5,26																														
2.1	WW	Fallopia convolvulus	u	seed/fruit	6	7	13	34,21	2				1	2			2											2						1	2	1		
2.1	WW	Papaver argemone	u	seed/fruit	1	0	1	2,63																														1
2.1	WW	Stachys annua	u	seed/fruit	4	3	7	18,42						1			1							1													1	
2.1	WW	Torilis arvensis	u	seed/fruit	2	1	3	7,89	2																									1				
2.1	WW	Valerianella cf rimosa	u	seed/fruit	1	0	1	2,63																											1			
2.1	WW	Valerianella dentata	u	seed/fruit	5	6	11	28,95	2	2							2								2			2									2	2
2.1	WW	Valerianella dentata	u	seed/fruit fragm	0	1	1	2,63																														
summer crop weeds / mostly annual ruderal																																						
2.2	SW	Portulaca oleracea	c	seed/fruit	1	0	1	2,63		1																												
2.2	SW	Aethusa cynapium	u	seed/fruit	7	4	11	28,95						2			2	1	2		1		1	2				2						1				
2.2	SW	Anagallis arvensis	u	seed/fruit	3	1	4	10,53																	1			2								1	1	2
2.2 / 2.3 / 2.4	SW	Chenopodium album	u	seed/fruit	12	12	24	63,16	3	3		1		2	1		3	2	2		2	1		2	3	2	1	4		2				2	2	2	2	4
2.2 / 2.3 / 2.4	SW	Chenopodium album	u	seed/fruit fragm	2	3	5	13,16																	2			2										
2.2 / 2.3 / 2.4	SW	Chenopodium album	u	seed/fruit 1/2	5	2	7	18,42									2	1							2			3		2								
2.2 / 2.3 / 2.4	SW	Chenopodium cf glaucum	u	seed/fruit	1	0	1	2,63		2																												
2.2 / 2.3 / 2.4	SW	Chenopodium sp.	u	seed/fruit	1	0	1	2,63																	1													
2.2	SW	Chenopodium cf polyspermum	u	seed/fruit	1	0	1	2,63																	1													
2.2	SW	Cirsium arvense	u	seed/fruit	1	0	1	2,63																													1	
2.2	SW	Fumaria officinalis	u	seed/fruit	1	0	1	2,63						1																								
2.2	SW	Fumaria sp	u	seed/fruit	1	0	1	2,63																						1								
2.2	SW	Lamium amplexicaule	u	seed/fruit	1	0	1	2,63																	1													
2.2	SW	Picris hieracioides	u	seed/fruit	1	1	2	5,26																														1
2.2	SW	Portulaca oleracea	u	seed/fruit	5	2	7	18,42		2							2							2	3			3		2								
2.2	SW	Portulaca oleracea	u	seed/fruit half	2	0	2	5,26																				1										2
2.2 / 2.3	SW	Viola arvensis / V. Tricolor	u	seed/fruit	1	0	1	2,63																				1										
2.2 / 5.1	SW	Solanum nigrum	u	seed/fruit	2	1	3	7,89																											1			1

Tab. 6.3b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

									c 1		c 28		c 33		c 34			c 34b		c 35		c 39	c 46			c 51			c 58		C 63			c 107		c 113		
								sample vol (litres)	9,00	7,00	5,00	5,00	8,00	7,00	1,00	2,00		4,00	7,00	4,00	6,50	4,00	5,00	7,00		4,00	3,50		5,00	7,00	1,50	1,00		7,00	7,00	4,00		
								fraction vol (ml)	1200	1900	700	420	1000	700	450	200	370	1000	500	1600	600	800	1550	1400	1050	300	170	700	2300	1300	900	20	40	1450	800	800	700	1530
								subsample vol (ml)	--	430	--	200	--	200	--	--	100	--	--	--	200	--	--	200	100	--	--	100	--	--	--	--	--	--	200	--	200	100
ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm
RUDERAL AND CROP FIELD UBIQUITARY SPECIES																																						
2.4	RU	Carex hirta	c	seed/fruit	2	0	2	5,26																1													1	
2.3	RU	Cuscuta sp.	u	seed/fruit	2	0	2	5,26																	1													1
2.3	RU	cf Cuscuta	u	seed/fruit	0	1	1	2,63																														
2.3	RU	cf Polycnemum	u	seed/fruit	1	0	1	2,63																														1
2.3	RU	Polygonum persicaria	u	seed/fruit	3	0	3	7,89		2																								1				1
2.4	RU	Ajuga reptans	u	seed/fruit	1	0	1	2,63	2																													
2.4	RU	Carex hirta	u	seed/fruit	2	0	2	5,26	1															1														
2.4	RU	Carex cf hirta	u	seed/fruit	2	1	3	7,89									2											2										
2.4	RU	Dipsacus fullonum	u	seed/fruit	0	1	1	2,63																														
2.4	RU	Lapsana communis	u	seed/fruit	6	0	6	15,79	2	2					1										1			1							1		1	
2.4	RU	Polygonum aviculare	u	seed/fruit	5	2	7	18,42	1												1									1				2	1	2	2	2
2.4	RU	Ranunculus acris	u	seed/fruit	1	0	1	2,63	2	1																												
2.4	RU	Ranunculus cf acris	u	seed/fruit	1	0	1	2,63																											2			
2.4	RU	Ranunculus acris / R. bulbosus	u	seed/fruit	1	0	1	2,63																													2	
2.4	RU	Sambucus ebulus	u	seed/fruit	6	2	8	21,05		1		2		1			1													1					1			
2.2 / 2.4 / 3.1	RU	Silene alba	u	seed/fruit	1	0	1	2,63																													1	1
2.4	RU	Urtica dioica	u	seed/fruit	2	0	2	5,26									1								1													
2.4	RU	Verbena officinalis	u	seed/fruit	4	1	5	13,16	2	2							2																	1				2
2.4	RU	Verbena officinalis	u	seed/fruit fragm	0	1	1	2,63																														
2.4 / 6.	RU	Arctium minus	u	seed/fruit	0	1	1	2,63																														
2.4 / 6.	RU	Arctium minius / A. lappa	u	seed/fruit	1	0	1	2,63	1																													
2.4 / 6.	RU	Arctium minus / A. tomentosum	u	seed/fruit	1	0	1	2,63																1														
2.4 / 4.2	RU	Potentilla reptans	u	seed/fruit	6	2	8	21,05	2	2							2								3			2						1				2
GRASSLAND: MEADOWS AND PASTURES																																						
3.1	MP	Daucus carota	c	seed/fruit	1	1	2	5,26																				1										
4.3	MP	Bromus cf hordeaceus	c	grain	1	0	1	2,63																						1								
2.1 / 2.2 / 3.1	MP	Ajuga chamaepytis	u	seed/fruit frg	1	0	1	2,63																						2								
2.1 / 2.2 / 3.1	MP	Ajuga chamaepytis	u	seed/fruit	5	2	7	18,42										1	1									2		1					1		2	
3.1	MP	Arenaria serpyllifolia	u	seed/fruit	4	1	5	13,16	1	2							2								2													3
3.1	MP	Centaurea sp.	u	calix	0	1	1	2,63																														
3.1	MP	Cerastium arvense	u	seed/fruit	1	0	1	2,63																														2
3.1	MP	Daucus carota	u	seed/fruit	6	3	9	23,68	2	2							1								2	1		2		1					1			
3.1	MP	Nepeta cataria	u	seed/fruit	2	0	2	5,26	1																									1				
3.1	MP	cf Pastinaca sativa	u	seed/fruit	1	0	1	2,63	1																													
3.1	MP	Petrorhagia prolifera	u	seed/fruit	3	1	4	10,53		1															1													2
4.1	MP	Ajuga genevensis	u	seed/fruit	1	1	2	5,26									1																					
4.1	MP	Sanguisorba minor	u	seed/fruit	1	0	1	2,63																													1	
4.1	MP	Silene vulgaris	u	seed/fruit	1	0	1	2,63																										1				
4.1	MP	Stachys recta	u	seed/fruit	1	0	1	2,63																				2										
4.1	MP	Teucrium chamaedrys	u	seed/fruit fragm	0	1	1	2,63																														
4.1	MP	Teucrium chamaedrys	u	seed/fruit	3	2	5	13,16		1																									2	1	2	
4.3	MP	Calamintha nepeta / C. sylvatica	u	seed/fruit	0	1	1	2,63																														
4.3	MP	Cerastium holosteoides / C. fontanum	u	seed/fruit	1	0	1	2,63		2																												
4.1 / 4.3	MP	Dianthus seguieri	u	seed/fruit	0	1	1	2,63																														
4.3	MP	Knautia arvensis	u	seed/fruit	0	1	1	2,63																														
4.3	MP	Knautia sp.	u	seed/fruit fragm	0	2	2	5,26																														
4.3	MP	Leucanthemum vulgare	u	seed/fruit	1	0	1	2,63																	1													
2.4 / 4.3	MP	Prunella vulgaris	u	seed/fruit	0	1	1	2,63																														
4.3	MP	Rumex acetosella	u	seed/fruit	1	0	1	2,63																										2				

Tab. 6.3b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	c 1		c 28		c 33		c 34			c 34b		c 35		c 39	c 46			c 51			c 58		C 63			c 107		c 113		
								sample vol (litres)	9,00	7,00	5,00	5,00	8,00	7,00	1,00	2,00		4,00	7,00	4,00	6,50	4,00	5,00	7,00		4,00	3,50		5,00	7,00	1,50	1,00		7,00	7,00	4,00		
								fraction vol (ml)	1200	1900	700	420	1000	700	450	200	370	1000	500	1600	600	800	1550	1400	1050	300	170	700	2300	1300	900	20	40	1450	800	800	700	1530
								subsample vol (ml)	--	430	--	200	--	200	--	--	100	--	--	--	200	--	--	200	100	--	--	100	--	--	--	--	--	--	200	--	200	100
									2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm
WOODLAND, WOOD EDGES, CLEARINGS																																						
5.1	F	Agrimonia eupatoria	c	seed/fruit	0	1	1	2,63																														
5.1	F	Cornus mas	c	stone fragm.	1	0	1	2,63																					1	1								
5.1	F	Cornus mas	c	stone	2	1	3	7,89			1																		2									
5.1	F	Cornus sanguinea	c	stone	1	0	1	2,63																					2									
5.1	F	Corylus avellana	c	seed/fruit fragm.	1	1	2	5,26															1	1														
5.1 / 6.4	F	Physalis alkekengi	c	seed/fruit	3	1	4	10,53		1											2									2								
5.1	F	Quercus sp.	c	acorn	2	0	2	5,26																					3		3							
5.1	F	Quercus sp.	c	cupule	1	1	2	5,26																					1									
5.1	F	Quercus sp.	c	seed/fruit fragm	3	0	3	7,89					1																5	3	4							
5.1	F	Quercus sp.	c	seed/fruit 1/2	5	0	5	13,16										2				2	2						4		4							
5.1	F	Quercus sp.	c	seed/fruit base	4	4	8	21,05											1				2	1					4	4	3	3						
5.1	F	Quercus sp.	c	pericarp fragm.> 5mm	6	3	9	23,68			1									1		2	2						4	3	4	4	3					
5.1	F	Rubus fruticosus	c	seed/fruit	2	1	3	7,89		1																		1										
5.1	F	Staphylea pinnata	c	seed/fruit	0	1	1	2,63																														
5.1	F	Vitis vinifera sub. sylvestris	c	seed	0	2	2	5,26																														
5.1	F	Agrimonia eupatoria	u	seed/fruit fragm	1	6	7	18,42	2																													
5.1	F	Agrimonia eupatoria	u	seed/fruit	5	4	9	23,68	2												1						1							2			1	
5.1	F	Alnus sp.	u	cone axis	1	0	1	2,63	1																													
5.1	F	Alnus sp.	u	scale	1	0	1	2,63	1																													
5.1	F	Carex cf sylvatica	u	seed/fruit	0	1	1	2,63																														
5.1	F	Carpinus betulus	u	seed/fruit fragm	2	2	4	10,53	2																												1	
5.1	F	cf Clinopodium vulgare	u	seed/fruit	1	0	1	2,63									1																					
5.1	F	Cornus mas	u	stone fragm.	7	7	14	36,84					2	3	2	2	1	3	2	2	2					2	2								1		2	
5.1	F	Cornus mas	u	stone	9	14	23	60,53					2	1	2			1		2	2	1	1			2	1							3		4		
5.1	F	Cornus sanguinea	u	stone	4	2	6	15,79	2					2												1								2				
5.1	F	Corylus avellana	u	seed/fruit fragm.	11	15	26	68,42	4	1			3	3	2	2	1	2	3	3	3		3	2		3	3			2	2			3	2	3	2	
5.1	F	Crataegus monogyna	u	stone	1	0	1	2,63	1																													
5.1	F	Fagus sylvatica	u	seed/fruit fragm	5	5	10	26,32	2		1			1																					2	3	4	
5.1	F	Ficus carica	u	seed/fruit fragm.	1	2	3	7,89																	3													
5.1	F	Ficus carica	u	seed/fruit	7	4	11	28,95	3	2					2	2	3	2						3	2		1	2						3	3	4	4	4
5.1	F	Fragaria vesca	u	seed/fruit	6	4	10	26,32	3	3							2								3			2						3	2	3	2	4
5.1	F	Frangula alnus	u	seed/fruit	1	0	1	2,63	1																													
5.1	F	Hypericum perforatum	u	seed/fruit	1	2	3	7,89																														2
5.1	F	Maloideae pericarp	u	1/2	1	2	3	7,89																													2	
5.1	F	Maloideae pericarp	u	<1/4	4	7	11	28,95	3	2											1													2	3	3	4	3
5.1	F	Malus / Pyrus	u	seed/fruit fragm	2	5	7	18,42								1																					4	2
5.1	F	Malus sp.	u	seed/fruit fragm.	2	1	3	7,89											1																2			
5.1	F	Malus sylvestris	u	seed/fruit	2	0	2	5,26	1																											1		
5.1	F	Origanum vulgare	u	seed/fruit	2	2	4	10,53																										1				1
5.1 / 6.4	F	Physalis alkekengi	u	seed/fruit fragm	3	0	3	7,89	1	2															2			2										
5.1 / 6.4	F	Physalis alkekengi	u	seed/fruit	11	11	22	57,89	3	2				1		1	3	2	2		2		1	3	2		1	3		3			2	2	3	3	4	2
5.1	F	Prunus cf avium	u	stone	1	0	1	2,63	1																													
5.1	F	Prunus cf mahaleb	u	stone	2	2	4	10,53																										1		2		
5.1	F	Prunus sp.	u	seed/fruit fragm.	6	5	11	28,95											1		2						2				1				2		1	
5.1	F	Prunus spinosa	u	stone	2	2	4	10,53																										2		2		
5.1	F	Pteridium sp.	u	leaf fragm	0	2	2	5,26																														
5.1	F	Pyrus / Malus	u	seed/fruit	0	1	1	2,63																														
5.1	F	Pyrus / Malus	u	seed/fruit fragm	0	1	1	2,63																														
5.1	F	Pyrus pyraster	u	seed/fruit	1	0	1	2,63																												3	4	
5.1	F	Pyrus pyraster	u	seed/fruit	1	5	6	15,79	2																													
5.1	F	Pyrus sp.	u	seed/fruit	1	0	1	2,63																										2	2			
5.1	F	Pyrus sp.	u	pericarp	0	1	1	2,63																														
5.1	F	Pyrus sp.	u	seed/fruit fragm	2	2	4	10,53																											2		3	
5.1	F	Pyrus sp.	u	stalk fragm	1	6	7	18,42																													3	
5.1	F	Pyrus sp.	u	stones	5	10	15	39,47		4											2				2									3	3	3	5	5
5.1	F	Pyrus sp.	u	calyx tube remnant	9	9	18	47,37	2					2	1				2	2	3				1		2			1					2			
5.1	F	Quercus sp.	u	aborted acorn	1	0	1	2,63													1																	
5.1	F	Quercus sp.	u	cupule fragm	2	7	9	23,68																										2		2		
5.1	F	Quercus sp.	u	pericrp fragm.> 5mm	5	11	16	42,11	4	3			1										1											4	5	4	5	4

Tab. 6.3b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	c 1		c 28		c 33		c 34			c 34b		c 35		c 39	c 46			c 51			c 58		C 63			c 107		c 113		
				sample vol (litres)					9,00	7,00	5,00	5,00	8,00	7,00	1,00	2,00		4,00	7,00	4,00	6,50	4,00	5,00	7,00		4,00	3,50		5,00	7,00	1,50	1,00		7,00	7,00	4,00		
				fraction vol (ml)					1200	1900	700	420	1000	700	450	200	370	1000	500	1600	600	800	1550	1400	1050	300	170	700	2300	1300	900	20	40	1450	800	800	700	1530
				subsample vol (ml)					--	430	--	200	--	200	--	--	100	--	--	--	200	--	--	200	100	--	--	100	--	--	--	--	--	--	200	--	200	100
									2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm
5.1	F	Quercus sp.	u	seed/fruit base	7	15	22	57,89	3				2	1				2	2	2	3		1	1		2	3	1							3			
5.1	F	Rosa / Rubus	u	prckles	0	2	2	5,26																														
5.1	F	Rosa cf agrestis	u	seed/fruit	0	1	1	2,63																														
5.1	F	Rosa cf canina	u	seed/fruit	1	0	1	2,63						2																								
5.1	F	Rosa cf canina	u	seed/fruit fragm	1	0	1	2,63						1																								
5.1	F	Rosa sp.	u	seed/fruit	3	4	7	18,42	2																									1	2		1	
5.1	F	Rubus cf caesius	u	seed/fruit	1	0	1	2,63													1																	
5.1	F	Rubus cf idaeus	u	seed/fruit	1	0	1	2,63																														1
5.1	F	Rubus fruticosus	u	seed/fruit fragm	10	11	21	55,26	3	3				1	2	2	3	1	2	1		2			4			3		2			2					
5.1	F	Rubus fruticosus	u	seed/fruit	12	20	32	84,21	4	3	2	4	3	4	3	4	4	3	4	1	4	3	2	4	1	2	3	4		4				3	4	4	5	3
5.1	F	Rubus idaeus	u	seed/fruit	1	1	2	5,26																											1			
5.1	F	Rubus sp.	u	seed/fruit fragm.	2	0	2	5,26																	1								1					
5.1	F	Sambucus nigra	u	seed/fruit	5	2	7	18,42	2									1	2		2			2				1										
5.1	F	Silene dioica	u	seed/fruit	0	1	1	2,63																														
5.1	F	Torilis japonica	u	seed/fruit	1	1	2	5,26	1																													
5.1	F	Viola riviniana / V. reichenbachiana	u	seed/fruit	1	0	1	2,63	1																													
5.1	F	Vitis sp.	u	tendril frg	0	3	3	7,89																														
5.1	F	Vitis vinifera sub. sylvestris	u	seed fragm	6	10	16	42,11						2		3	2		2					1			2	2							2			
5.1	F	Vitis vinifera sub. sylvestris	u	seed	6	15	21	55,26	2					2	2	3			1															2	2	2	3	

Tab. 6.3b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

									c 1		c 28		c 33		c 34			c 34b		c 35		c 39	c 46			c 51			c 58		C 63			c 107		c 113		
								sample vol (litres)	9,00	7,00	5,00	5,00	8,00	7,00	1,00	2,00		4,00	7,00	4,00	6,50	4,00	5,00	7,00		4,00	3,50		5,00	7,00	1,50	1,00		7,00	7,00	4,00		
								fraction vol (ml)	1200	1900	700	420	1000	700	450	200	370	1000	500	1600	600	800	1550	1400	1050	300	170	700	2300	1300	900	20	40	1450	800	800	700	1530
								subsample vol (ml)	--	430	--	200	--	200	--	--	100	--	--	--	200	--	--	200	100	--	--	100	--	--	--	--	--	--	200	--	200	100
ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm
LAKE SHORE VEGETATION																																						
6.2	LS	Polygonum minus	c	seed/fruit	1	0	1	2,63																														1
6.1	LS	Carex pseudocyperus	u	seed/fruit	1	0	1	2,63																														1
6.1	LS	Claudium mariscus	u	seed/fruit	0	1	1	2,63																														
6.1	LS	Eupathorium cannabinum	u	seed/fruit	1	0	1	2,63																	1													
6.1	LS	Lycopus europaeus	u	seed/fruit	1	3	4	10,53		1																												
6.1	LS	Mentha aquatica / M. arvensis	u	seed/fruit	2	0	2	5,26																										1				1
6.1	LS	Mentha cf longifolia	u	seed/fruit	0	1	1	2,63																														
6.1	LS	Mentha spicata / suaveolens	u	seed/fruit	0	1	1	2,63																														
6.1	LS	Ranunculus sardous	u	seed/fruit	2	1	3	7,89																				1							1			
6.2	LS	Polygonum hydropiper	u	seed/fruit	1	0	1	2,63		1																												
2.2 / 2.3 / 6.2	LS	Polygonum lapathifolium	u	seed/fruit 1/2	0	1	1	2,63																														
2.2 / 2.3 / 6.2	LS	Polygonum lapathifolium	u	seed/fruit fragm	0	1	1	2,63																														
2.2 / 2.3 / 6.2	LS	Polygonum lapathifolium	u	seed/fruit	4	2	6	15,79	1	2																		2						1	1	1	3	1
6.1 / 6.2	LS	Ranunculus sceleratus	u	seed/fruit	4	0	4	10,53	1	2															1			2						2				
6.2	LS	Scirpus radicans	u	seed/fruit	1	0	1	2,63		1																												
6.3	LS	Alisma plantago-aquatica	u	seed/fruit	2	0	2	5,26		1																												1
6.3	LS	Phalaris arundinacea	u	seed/fruit	1	0	1	2,63																														1
6.3	LS	Typha latifolia / angustifolia	u	seed/fruit	1	2	3	7,89																	1													
AQUATICS								0,00																														
7.1	A	Ceratophyllum demersum	u	seed/fruit	0	2	2	5,26																														
7.1	A	Ceratophyllum sp.	u	seed/fruit	1	0	1	2,63													1																	
7.1	A	Characeae	u	seed/fruit	5	1	6	15,79	1	2							2								2			2										4
7.1	A	Najas flexilis	u	seed/fruit	1	0	1	2,63																														2
7.1	A	cf Najas flexilis	u	seed/fruit	1	0	1	2,63																													1	
7.1	A	cf Najas	u	seed/fruit fragm	1	0	1	2,63		1																												
7.1	A	Nymphaea alba	u	seed/fruit	1	0	1	2,63	1																													
7.1	A	Potamogeton natans	u	seed/fruit	1	0	1	2,63																												1	1	
7.1	A	Potamogeton sp.	u	seed/fruit	0	2	2	5,26																														
VARIA																																						
0.	VA	Fabaceae	c	seed 1/2	0	1	1	2,63																														
0.	VA	Fabaceae	c	seed	1	2	3	7,89	1																													
0.	VA	Poaceae	c	seed/fruit	2	0	2	5,26	2																					2								
0.	VA	Solanum sp.	c	seed/fruit	1	0	1	2,63																1	1													
0.	VA	undet.	c	seed/fruit	2	1	3	7,89		2																			2									
0.	VA	Asteraceae	u	bract	0	1	1	2,63																														
0.	VA	Asteraceae	u	calyx	0	1	1	2,63																														
0.	VA	Asteraceae	u	receptacle	0	2	2	5,26																														
0.	VA	Asteraceae	u	seed/fruit	0	2	2	5,26																														
0.	VA	Atriplex sp.	u	seed/fruit	1	0	1	2,63									1																					
0.	VA	Brassicaceae	u	seed/fruit	2	1	3	7,89																	1													1
0.	VA	Carex bicarpellate	u	seed/fruit	1	1	2	5,26																											1			
0.	VA	Carex tricarpellate	u	seed/fruit	4	0	4	10,53							1															1				2			2	
0.	VA	Carex sp.	u	utriculus	2	0	2	5,26	1									1																				
0.	VA	Cyperaceae	u	seed/fruit	0	1	1	2,63																														
0.	VA	Fabaceae	u	pod fragm	3	3	6	15,79	2	1																								2	2	1	2	
0.	VA	Hieracium sp.	u	seed/fruit	0	1	1	2,63																														
0.	VA	Hypericum sp.	u	seed/fruit	1	0	1	2,63																	1													
0.	VA	Lamiaceae	u	seed/fruit	1	0	1	2,63	1	1																												
0.	VA	Linum sp.	u	capsule fragm.	0	2	2	5,26																														
0.	VA	Poaceae	u	seed/fruit	3	2	5	13,16	2	2															1									1	1			
0.	VA	Polygonum sp.	u	seed/fruit	1	1	2	5,26																	1													
0.	VA	Potentilla sp.	u	seed/fruit	1	0	1	2,63																				2										
0.	VA	Ranunculus sp.	u	seed/fruit	2	3	5	13,16																										1		1		
0.	VA	Sambucus sp.	u	seed/fruit fragm	2	2	4	10,53		1															1													
0.	VA	Satureya sp.	u	seed/fruit	0	1	1	2,63																														
0.	VA	Setaria sp.	u	seed/frut	1	0	1	2,63																						2								
0.	VA	Silene sp.	u	seed/fruit	0	1	1	2,63																														
0.	VA	Stachys sp.	u	seed/fruit	1	0	1	2,63																	1													
0.	VA	Stellaria sp.	u	seed/fruit	1	1	2	5,26		1																												
0.	VA	Viola sp.	u	seed/fruit	1	0	1	2,63									1																					
0.	VA	undet.	u	vegetative part	2	2	4	10,53	3						2		2																					
0.	VA	undet.	u	seed/fruit	8	7	15	39,47	2					2	2						1				3			2		2				2			2	

Tab. 6.3b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	c 1		c 28		c 33		c 34			c 34b		c 35		c 39	c 46			c 51			c 58		C 63			c 107		c 113		
		sample vol (litres)							9,00	7,00	5,00	5,00	8,00	7,00	1,00	2,00		4,00	7,00	4,00	6,50	4,00	5,00	7,00		4,00	3,50		5,00	7,00	1,50	1,00		7,00	7,00	4,00		
		fraction vol (ml)							1200	1900	700	420	1000	700	450	200	370	1000	500	1600	600	800	1550	1400	1050	300	170	700	2300	1300	900	20	40	1450	800	800	700	1530
		subsample vol (ml)							--	430	--	200	--	200	--	--	100	--	--	--	200	--	--	200	100	--	--	100	--	--	--	--	--	--	200	--	200	100
									2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm
other finds																																						
		stalk base	u																																			
		Pteridophyta leaf fragments	u																																			
		insect remains							2	2															2					2				1				3
		fly puparia							3	3											1			2	2									1	2			2
		bone fragments									5%		5%																					2	1	2	2	5%
		bones small animals									2	1	1																1							2		
		fish bones								2										1																		
		fish vertebrae																																				
		fish scale											1																					1				
		fish teeth																																				
		molluscs																					1	2	2													
		charcoal	c								85%	80%	50%	30%	30%	30%	30%	90%	60%	20%	30%	85%	40%	35%		60%	60%	50%						30%	25%	30%	20%	30%
		wood unc.	u										10%	30%	15%	20%	20%		5%	45%	20%	5%	5%	10%		20%	10%	30%						30%	20%	20%	20%	5%
		twigs with bark unc.	u																	5%	5%		5%	5%				5%						5%	10%	20%	10%	
		twigs unc.	u										5%	5%						10%	5%		10%	5%				5%						5%	20%	10%	20%	
		bark	u								10%	10%	20%	30%					5%	10%	10%	5%		5%		15%	10%	5%						30%	20%	20%	20%	5%
		thorns	u						1	2					15%	15%	15%																					
		thorns	c							1																												
		leaf fragments	u						3	2																								2	2	2		
		leaf fragments	c																																			2
		epidermis fragm.	u																																			
		bud	u						3	2				1		2			1		1		1											1	2		2	
		bud	c																											1								
		bud scale	u						2	3					1										2			1						1		1		2
		moss	u																															2				2
		rhizome	u																																			15%
		root unc.	u																																			
		Amphibian/reptile vertebra																																				
		goat/sheep coprolite	u						3	1																									1		1	
		herbaceous stem	u												5%	5%	5%																					40%
		dung fragments	u						4																										2		1	
		aggregates										10%	10%	5%	35%	30%	30%	10%	20%	10%	30%	5%	40%	40%		5%	20%	5%							5%		10%	
		stones																																				
		stalk	u																																			2
		endocarp undet. (?)	u																																			
		mammal tooth																																				
		mammal emimandible																																				
		mammal vertebra																																				
		carnivore tooth (corona)																																				
		carbonized dung	c																																			
		mouse escrements	u						2																					1								
		cfr insect remains																																				
		catkin																																				
		fragmented charred cereals	c																																			
		undeterminable remains																																				

Tab. 6.4a – Results (n. of remains) of the full analysis of the second settlement phase samples from the Lucone D site (14 samples). Also ubiquity values are shown.

total volume 50,5 litres
total remains (extrapolated) = 146981
total remains (identified) = 14143
total remains identified for statistic analysis = 17175
mean concentration (n. remains / litre) = 2853,20

ecol grp	large ecol grp	taxon	pres.	remain type	ubiq n.smpl 1st ph	ubiq n.smpl 2nd ph	ubiq tot	n. remain 1st ph	n remain 2nd ph	n. remain tot	LUC c207	LUC c 220	LUC c 226	LUC c 237	LUC c 242	LUC NN1	LUC c 305	LUC c 310	LUC c 325	LUC c 343	LUC c 367	LUC c 372	LUC c 394	LUC c 397
		volume saturated in water (l)									4,00	2,50	4,00	4,00	3,00	5,00	4,00	3,00	3,50	3,50	4,00	3,50	3,50	3,00
		concentration (n. remains / l)									**995,5**	**1756**	**1449,25**	**1651,75**	**1845,8333**	**1835,24**	**11168,225**	**2720,6667**	**4224,2286**	**740,85714**	**3176,5**	**5435,1429**	**1425,2571**	**1520,3333**
		n. remains									3982	4390	5797	6607	5537,5	9176,2	44672,9	8162	14784,8	2593	12706	19023	4988,4	4561
FIELDS																								
cultivated plants																								
1.	c	Triticum monococcum	c	spikelet fork	8	13	**21**	2416	3509	**5924,8**	50	2	116	294	145	299,6	360	540	563,6	162	700,8	269,6	0	6
1.	c	Triticum monococcum	c	glume base	4	9	**13**	2247	1507	**3754,1**	15	0	0	22	22	35,2	360	252	249,6	0	246	305,2	0	0
1.	c	Triticum monococcum	c	grain	4	2	**6**	71	26,6	**97,6**	0	0	0	0	0	0	0	0	2	0	24,6	0	0	0
1.	c	Triticum dicoccum	c	spikelet fork	8	13	**21**	8301	10995	**19295,3**	1638	1724	1402	2375	367	726,8	62,7	714	664	478	282	523,2	0	38
1.	c	Triticum dicoccum	c	glume base	8	13	**21**	4902	5059	**9960,6**	300	880	631	553	204,5	285,8	1001,4	145	436,8	108	206,8	305,2	0	1
1.	c	Triticum dicoccum	c	ear uppermost part	0	1	**1**	0	2	**2**	0	0	2	0	0	0	0	0	0	0	0	0	0	0
1.	c	Triticum dicoccum	c	grain	7	11	**18**	392,5	61,4	**453,9**	7	6	8	3	0	0	12,4	3	4	6	3	8	0	1
1.	c	Triticum nn (new glume wheat)	c	spikelet fork	8	14	**22**	8100	19757	**27857,2**	826	776	1410	1583	803	1203,2	4552,8	1588	4037,6	770	1314	850,8	12,8	30
1.	c	Triticum cf nn (cf new glume wheat)	c	spikelet fork	0	1	**1**	0	45,6	**45,6**	0	0	0	0	0	0	45,6	0	0	0	0	0	0	0
1.	c	Triticum nn (new glume wheat)	c	spikelet fork with grains	1	1	**2**	86	24	**110**	0	0	0	0	0	0	0	0	0	0	0	0	0	24
1.	c	Triticum nn (new glume wheat)	c	glume base	8	13	**21**	2202	5039	**7240,6**	65	60	45	89	214,5	336,4	2205,6	631	1	9	718,4	657	0	7
1.	c	Triticum nn (new glume wheat)	c	grain	4	3	**7**	926	41	**967**	0	0	0	0	0	0	11,4	0	0	5	24,6	0	0	0
1.	c	Triticum durum / T. turgidum	c	rachis	1	4	**5**	35	112,7	**147,7**	0	0	0	5,5	0	0	0	36	0	0	27,6	43,6	0	0
1.	c	cf Triticum durum / T. turgidum	c	rachis	0	1	**1**	0	130,8	**130,8**	0	0	0	0	0	0	0	0	0	0	0	130,8	0	0
1.	c	Triticum aestivum / T. durum / T. turgidum	c	rachis	0	3	**3**	0	9	**9**	1	1	7	0	0	0	0	0	0	0	0	0	0	0
1.	c	cf Triticum aestivum / T. durum / T. turgidum	c	rachis	0	1	**1**	0	3	**3**	0	0	0	0	0	0	0	0	0	0	3	0	0	0
1.	c	Triticum aestivum / T. durum / T turgidum	c	grain	3	5	**8**	19	8	**27**	2	0	0	1	0	0	0	1	0	0	3	1	0	0
1.	c	cf Triticum aestivum / T durum / T. turgidum	c	grain	0	1	**1**	0	3	**3**	0	0	0	0	0	0	0	0	0	0	3	0	0	0
1.	c	Triticum spelta	c	spikelet fork	0	1	**1**	0	1	**1**	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.	c	Triticum spelta	c	glume base	3	7	**10**	43,4	472,4	**515,8**	1	0	39	0	5,5	3	287,1	0	124,8	0	0	0	0	12
1.	c	Triticum cf spelta	c	glume base	1	1	**2**	1	1	**2**	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1.	c	Triticum spelta	c	grain	1	2	**3**	41	5	**46**	0	0	0	2	0	0	0	0	0	0	0	3	0	0
1.	c	Triticum cf spelta	c	grain	1	1	**2**	5	2	**7**	0	0	0	0	0	0	0	0	0	0	0	2	0	0
1.	c	Triticum aestivum	c	rachis	1	1	**2**	8	18	**26**	0	0	0	0	0	0	0	18	0	0	0	0	0	0
1.	c	Triticum cf aestivum	c	rachis	2	1	**3**	100	44,5	**144,5**	0	0	0	44,5	0	0	0	0	0	0	0	0	0	0
1.	c	Triticum monococcum / T. nn	c	spikelet fork	6	6	**12**	238,6	425,8	**664,4**	0	0	0	66	77	62,8	180	38	0	0	0	2	0	0
1.	c	Triticum monococcum / T. nn	c	glume base	2	4	**6**	38,6	562,6	**601,2**	0	0	0	0	0	0	360	54	0	0	147,6	1	0	0
1.	c	Triticum monococcum / T. dicoccum	c	spikelet fork	1	6	**7**	786	141	**927**	20	40	0	33	22	8	0	0	0	18	0	0	0	0
1.	c	Triticum monococcum / T. dicoccum	c	glume base	1	1	**2**	33	5	**38**	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.	c	Triticum dicoccum / T. nn (new glume wheat)	c	spikelet fork	6	13	**19**	427	2839	**3265,8**	40	10	12	33	16	74	1339,8	2	706,4	0	312	281,6	6	6
1.	c	Triticum dicoccum / T. nn (new glume wheat)	c	spikelet fork with grains	1	0	**1**	4	0	**4**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.	c	Triticum dicoccum / T. nn (new glume wheat)	c	glume base	3	6	**9**	108	572,4	**680,4**	5	0	0	0	0	0	180	0	187,2	0	147,6	46,6	0	6
1.	c	Triticum dicoccum / T. nn (new glume wheat)	c	grain	0	1	**1**	0	4	**4**	0	0	0	0	0	0	0	0	4	0	0	0	0	0
1.	c	Triticum sp.	c	spikelet fork	7	14	**21**	2320	7157	**9477,4**	240	20	540	308	1052	1132,8	665,4	720	1060,8	6	1192,8	182,4	12,8	24
1.	c	Triticum sp.	c	glume base	8	11	**19**	3358	3871	**7228,7**	0	20	3	44	469,5	316,8	720	252	1123,2	0	861	43,6	0	18
1.	c	Triticum sp.	c	glume	1	1	**2**	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.	c	Triticum sp.	c	rachis	5	9	**14**	520,5	1002	**1522,5**	5	5	24	0	0	49	292,8	0	156	0	369	89,2	0	12
1.	c	Triticum sp.	c	ear uppermost part	6	7	**13**	216	612,4	**828,4**	0	70	0	44	0	0	22,8	74	126,8	0	98,4	176,4	0	0
1.	c	Triticum sp.	c	grain	4	8	**12**	397,5	16	**413,5**	0	0	0	0	6	0	0	0	0	3	5	0	1	1
1.	c	Hordeum vulgare	c	spikelet fork	7	13	**20**	3261	4755	**8016,6**	80	46	892	212	145	302,4	1508,4	400	319	92	393,6	350,8	0	14
1.	c	Hordeum vulgare	c	spikelet fork with grains	1	0	**1**	2	0	**2**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.	c	Hordeum vulgare	c	rachis	4	3	**7**	112,4	78,2	**190,6**	0	0	10	0	0	0	0	0	0	0	60,2	0	8	0
1.	c	Hordeum vulgare	c	grain	7	12	**19**	760	269,1	**1029,1**	8	2	5	3	1	1	208,5	1	4	3	31,6	0	0	1
1.	c	cf Hordeum	c	grain	0	1	**1**	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.	c	Cerealia	c	glume	1	4	**5**	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.	c	Cerealia	c	grain	6	12	**18**	364,5	68,9	**433,4**	8	1	1	14	14,5	1	11,4	1	1	0	9	6	0	1
1.	c	Cerealia	c	embryo	2	0	**2**	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.	c	Cerealia	c	rachis	3	2	**5**	1787	74	**1861**	0	0	0	0	2	0	0	72	0	0	0	0	0	0
1.	c	Cerealia	c	culm	2	1	**3**	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.	c	Linum usitatissimum	c	seed/fruit	5	1	**6**	21081	9	**21090**	0	0	0	0	0	0	0	0	0	9	0	0	0	0
1.	c	Linum usitatissimum	c	capsule	2	0	**2**	33	0	**33**	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Tab. 6.4a - continued

										sample name	LUC c207	LUC c 220	LUC c 226	LUC c 237	LUC c 242	LUC NN1	LUC c 305	LUC c 310	LUC c 325	LUC c 343	LUC c 367	LUC c 372	LUC c 394	LUC c 397
1.	c	Triticum dicoccum	u	spikelet fork	2	3	**5**	22	57,2	**79,2**	0	0	0	0	0	0	0	0	0	0	2	4	51,2	0
1.	c	Triticum nn (new glume wheat)	u	spikelet fork	0	4	**4**	0	165,6	**165,6**	0	0	0	0	0	0	0	0	62,4	0	4	87,2	0	12
1.	c	Triticum nn (new glume wheat)	u	glume base	1	1	**2**	7	1810	**1816,6**	0	0	0	0	0	0	0	0	1809,6	0	0	0	0	0
1.	c	Triticum durum / T. turgidum	u	spikeletfork	1	0	**1**	7	0	**7**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.	c	Triticum aestivum	u	rachis	0	2	**2**	0	6,4	**6,4**	0	0	0	0	0	0	0	0	0	0	0	0	6,4	0
1.	c	Triticum spelta	u	glume base	0	1	**1**	0	7,4	**7,4**	0	0	0	0	0	0	0	0	0	0	0	0	6,4	1
1.	c	Triticum dicoccum / T. spelta	u	glume base	0	1	**1**	0	31,2	**31,2**	0	0	0	0	0	0	0	0	31,2	0	0	0	0	0
1.	c	Triticum sp.	u	ear frg	0	1	**1**	0	1	**1**	0	0	0	0	0	1	0	0	0	0	0	0	0	0
1.	c	Triticum sp.	u	spikelet fork	3	3	**6**	7163	5021	**12184,2**	0	0	0	0	0	0	0	0	0	0	0	4895,2	29,6	96
1.	c	Triticum sp.	u	glume base	3	4	**7**	3273	2497	**5770**	0	0	0	0	0	0	0	0	0	0	1	2398	13,8	84
1.	c	Triticum sp.	u	rachis	1	1	**2**	1	1	**2**	0	0	0	1	0	0	0	0	0	0	0	0	0	0
1.	c	Triticum sp.	u	testa	3	5	**8**	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.	c	Hordeum vulgare	u	spikelet	0	1	**1**	0	87,2	**87,2**	0	0	0	0	0	0	0	0	0	0	0	87,2	0	0
1.	c	Cerealia	u	glume base	1	3	**4**	7	455,6	**462,6**	0	0	0	0	0	158,4	0	0	0	0	295,2	0	0	2
1.	c	Cerealia	u	spikelet fork	2	3	**5**	26	1843	**1869,2**	0	0	0	0	0	756,8	0	0	0	0	1082,4	0	0	4
1.	c	Cerealia	u	rachis	1	0	**1**	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.	c	Carthamus tinctorius	u	seed/fruit	1	3	**4**	4	3	**7**	0	0	0	0	0	1	0	0	0	0	0	1	0	1
1.	c	Carthamus cf tinctorius	u	seed/fruit	1	4	**5**	1	59,1	**60,1**	0	0	0	0	0	8,8	5,7	0	0	0	1	43,6	0	0
1.	c	Linum usitatissimum	u	seed/fruit	4	5	**9**	490	692	**1182**	0	0	0	0	0	10,8	0	0	0	0	24,6	437	124,6	95
1.	c	Linum usitatissimum	u	capsule	4	5	**9**	3009	669	**3677,9**	0	0	0	0	0	96,8	0	0	0	0	148,6	396,4	20,2	7
1.	c	Linum usitatissimum	u	fibres	2	5	**7**	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.	c	Triticum dicoccum	u/c	spikelet fork	1	2	**3**	21	4	**25**	0	0	0	0	0	0	0	0	0	0	0	2	2	0
1.	c	Triticum sp.	u/c	grain	0	1	**1**	0	1	**1**	0	0	0	0	0	0	0	0	0	0	0	0	1	0
1.	c	Cerealia	u/c	grain	0	1	**1**	0	1	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1.	c	cf Linum usitatissimum	u/c	seed/fruit	1	0	**1**	2	0	**2**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
winter crop weeds																								
2.1	ww	Avena sp.	c	grain	1	2	**3**	4	6	**10**	5	1	0	0	0	0	0	0	0	0	0	0	0	0
2.1	ww	Fallopia convolvulus	c	seed/fruit	1	1	**2**	3,7	1	**4,7**	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2.1	ww	Valerianella dentata	c	seed/fruit	1	0	**1**	10,5	0	**10,5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.1	ww	Camelina sativa	u	capsule	0	3	**3**	0	4	**4**	0	0	0	0	0	1	0	0	0	0	0	2	1	0
2.1	ww	Fallopia convolvulus	u	seed/fruit	7	7	**14**	66	305	**371**	0	10	0	0	0	31,4	90	0	0	0	125	46,6	1	1
2.1	ww	Papaver rhoeas	u	seed/fruit	1	0	**1**	71,6	0	**71,6**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.1	ww	Stachys annua	u	seed/fruit	3	2	**5**	21,2	23,1	**44,3**	0	0	0	0	5,5	17,6	0	0	0	0	0	0	0	0
2.1	ww	Torilis arvensis	u	seed/fruit	3	1	**4**	13,6	17,6	**31,2**	0	0	0	0	0	17,6	0	0	0	0	0	0	0	0
2.1	ww	Valerianella dentata	u	seed/fruit	6	7	**13**	1772	453,3	**2225,3**	0	0	0	0	5,5	17,6	180	0	31,2	18	25,6	175,4	0	0
2.1	ww	Valerianella cf rimosa	u	seed/fruit fragm	1	0	**1**	4	0	**4**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
summer crop weeds / mostly annual ruderal																								
2.2 / 2.3 / 2.4	sw	Chenopodium album	c	seed/fruit	1	0	**1**	153	0	**153**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	sw	Portulaca oleracea	c	seed/fruit	1	0	**1**	190	0	**190**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	sw	Aethusa cynapium	u	seed/fruit	5	6	**11**	40,6	116,1	**156,7**	0	0	0	0	0	0	5,7	1	31,2	9	24,6	44,6	0	0
2.2	sw	Anagallis arvensis	u	seed/fruit	3	4	**7**	80	108,2	**188,2**	0	0	0	0	0	8,8	0	0	31,2	0	24,6	43,6	0	0
2.2	sw	cf Anagallis arvensis	u	seed/fruit	0	1	**1**	0	90	**90**	0	0	0	0	0	0	90	0	0	0	0	0	0	0
2.2 / 2.3 / 2.4	sw	Chenopodium album	u	seed/fruit	7	13	**20**	12524	3501	**16025,5**	10	5	0	6,5	215,5	36,2	1901,4	72	436,8	144	225,4	436	6,4	6
2.2 / 2.3 / 2.4	sw	Chenopodium cf glaucum	u	seed/fruit	1	0	**1**	380	0	**380**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	sw	Chenopodium cf polyspermum	u	seed/fruit	1	0	**1**	10,5	0	**10,5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2 / 2.3 / 2.4	sw	Chenopodium sp.	u	seed/fruit	1	0	**1**	10,5	0	**10,5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	sw	Cirsium arvense	u	seed/fruit	1	0	**1**	3,5	0	**3,5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	sw	cf Eragrostis minor	u	seed/fruit	1	0	**1**	71,6	0	**71,6**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	sw	Fumaria sp.	u	seed/fruit	1	0	**1**	1	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	sw	Lamium amplexicaule	u	seed/fruit	1	0	**1**	10,5	0	**10,5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	sw	Picris hieracioides	u	seed/fruit	1	1	**2**	71,6	8,8	**80,4**	0	0	0	0	0	8,8	0	0	0	0	0	0	0	0
2.2	sw	Portulaca oleracea	u	seed/fruit	7	5	**12**	3364	168,7	**3532,9**	0	0	0	0	5,5	0	0	18	62,4	9	73,8	0	0	0
2.2 / 5.1	sw	Solanum nigrum	u	seed/fruit	2	2	**4**	249,2	70	**319,2**	0	0	0	0	0	26,4	0	0	0	0	0	43,6	0	0
2.2 / 2.3	sw	Stellaria media	u	seed/fruit	1	0	**1**	71,6	0	**71,6**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2 / 2.3	sw	Viola arvensis / V. Tricolor	u	seed/fruit	1	0	**1**	7	0	**7**	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Tab. 6.4a - continued

								sample name			LUC c207	LUC c 220	LUC c 226	LUC c 237	LUC c 242	LUC NN1	LUC c 305	LUC c 310	LUC c 325	LUC c 343	LUC c 367	LUC c 372	LUC c 394	LUC c 397
RUDERAL AND CROP FIELD UBIQUITARY SPECIES																								
2.4	RU	Lapsana communis	c	seed/fruit	1	0	**1**	7	0	**7**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.4	RU	Polygonum aviculare	c	seed/fruit	1	0	**1**	1	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.3	RU	Cuscuta sp.	u	seed/fruit	1	0	**1**	10,5	0	**10,5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.3	RU	cf Cuscuta	u	seed/fruit	0	1	**1**	0	8,8	**8,8**	0	0	0	0	0	8,8	0	0	0	0	0	0	0	0
2.3	RU	Polygonum persicaria	u	seed/fruit	3	0	**3**	812	0	**812**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.4	RU	Ajuga reptans	u	seed/fruit	1	0	**1**	2	0	**2**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.4 / 6.	RU	Arctium minius / A. lappa	u	seed/fruit	1	0	**1**	1	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.4	RU	Carex hirta	u	seed/fruit	3	0	**3**	11,5	0	**11,5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.4	RU	Carex cf hirta	u	seed/fruit	2	1	**3**	25,1	5,5	**30,6**	0	0	0	5,5	0	0	0	0	0	0	0	0	0	0
2.4	RU	Dipsacus fullonum	u	seed/fruit	0	1	**1**	0	1	**1**	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2.4	RU	Lapsana communis	u	seed/fruit	6	1	**7**	1031	6	**1037**	0	0	0	0	0	0	0	0	0	0	0	0	0	6
2.4	RU	cf Lapsana communis	u	seed/fruit	0	1	**1**	0	31,2	**31,2**	0	0	0	0	0	0	0	0	31,2	0	0	0	0	0
2.4	RU	Plantago major	u	seed/fruit	1	0	**1**	71,6	0	**71,6**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.4	RU	Polygonum aviculare	u	seed/fruit	4	4	**8**	30	48,9	**78,9**	0	0	0	0	5,5	0	0	0	0	0	24,6	0	12,8	6
2.4 / 4.2	RU	Potentilla reptans	u	seed/fruit	6	7	**13**	1885	1011	**2896,5**	0	0	0	0	11	0	450	0	156	9	73,8	305,2	6,4	0
2.4	RU	Ranunculus acris	u	seed/fruit	1	0	**1**	194	0	**194**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.4	RU	Ranunculus cf acris	u	seed/fruit	1	0	**1**	8	0	**8**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.4	RU	Ranunculus acris / R. bulbosus	u	seed/fruit	1	0	**1**	7	0	**7**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.4	RU	Sambucus ebulus	u	seed/fruit	4	3	**7**	207,3	58	**265,3**	5	35	0	0	0	0	0	18	0	0	0	0	0	0
2.2 / 2.4 / 3.1	RU	Silene alba	u	seed/fruit	1	0	**1**	3,5	0	**3,5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.4	RU	Urtica dioica	u	seed/fruit	4	0	**4**	259,4	0	**259,4**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.4	RU	Verbena officinalis	u	seed/fruit	4	3	**7**	1784	102	**1886**	0	0	0	0	0	8,8	0	0	0	0	0	87,2	0	6
GRASSLAND: MEADOWS AND PASTURES																								
3.1	MP	Daucus carota	c	seed/fruit	1	2	**3**	7	78,9	**85,9**	0	0	0	16,5	0	0	0	0	62,4	0	0	0	0	0
4.3	MP	Bromus cf hordeaceus	c	grain	1	0	**1**	1	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.1 / 2.2 / 3.1	MP	Ajuga chamaepytis	u	seed/fruit	4	3	**7**	41,6	142	**183,6**	0	0	0	0	5,5	0	5,7	0	0	0	0	130,8	0	0
3.1	MP	Arenaria serpyllifolia	u	seed/fruit	5	4	**9**	2561	135,4	**2696,3**	0	0	0	0	0	17,6	0	0	0	0	24,6	87,2	0	6
3.1	MP	Centaurea sp.	u	calix	0	1	**1**	0	1	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	1
3.1	MP	Daucus carota	u	seed/fruit	6	6	**12**	664,4	427,9	**1092,3**	0	0	0	0	27,5	35,2	270	0	0	27	24,6	43,6	0	0
3.1	MP	Nepeta cataria	u	seed/fruit	2	0	**2**	73,6	0	**73,6**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.1	MP	cf Nepeta cataria	u	seed/fruit	0	1	**1**	0	90	**90**	0	0	0	0	0	0	90	0	0	0	0	0	0	0
3.1	MP	cf Pastinaca sativa	u	seed/fruit	1	0	**1**	1	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.1	MP	Petrorhagia prolifera	u	seed/fruit	4	2	**6**	466,3	14,8	**481,1**	0	0	0	0	0	8,8	0	0	0	0	0	0	0	6
4.1	MP	Ajuga genevensis	u	seed/fruit	1	1	**2**	3,7	8,8	**12,5**	0	0	0	0	0	8,8	0	0	0	0	0	0	0	0
4.1	MP	Carex caryophyllea	u	seed/fruit	0	1	**1**	0	90	**90**	0	0	0	0	0	0	90	0	0	0	0	0	0	0
4.1	MP	Dianthus cf deltoides	u	seed/fruit	1	0	**1**	71,6	0	**71,6**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.1	MP	Potentilla rupestris	u	seed/fruit	0	1	**1**	0	24,6	**24,6**	0	0	0	0	0	0	0	0	0	0	24,6	0	0	0
4.1	MP	Sanguisorba minor	u	seed/fruit	1	0	**1**	3,5	0	**3,5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.1	MP	Silene vulgaris	u	seed/fruit	1	0	**1**	1	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.1	MP	Stachys recta	u	seed/fruit	1	0	**1**	14	0	**14**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.1	MP	Teucrium chamaedrys	u	seed/fruit	3	3	**6**	217,5	56,6	**274,1**	0	0	0	0	11	2	0	0	0	0	0	43,6	0	0
4.3	MP	Calamintha cf nepeta	u	seed/fruit	1	0	**1**	51	0	**51**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.3	MP	Calamintha nepeta / C. sylvatica	u	seed/fruit	0	1	**1**	0	1	**1**	0	0	0	0	0	1	0	0	0	0	0	0	0	0
4.3	MP	Cerastium holosteoides / C. fontanum	u	seed/fruit	1	0	**1**	570	0	**570**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.1 / 4.3	MP	Dianthus seguieri	u	seed/fruit	0	1	**1**	0	1	**1**	0	0	0	0	0	1	0	0	0	0	0	0	0	0
4.3	MP	Knautia cf arvensis	u	seed/fruit	0	1	**1**	0	36	**36**	0	0	0	0	0	0	0	0	0	36	0	0	0	0
4.3	MP	Knautia sp.	u	seed/fruit	0	3	**3**	0	44	**44**	0	0	0	0	0	8,8	0	0	31,2	0	0	0	0	4
4.3	MP	Leucanthemum vulgare	u	seed/fruit	1	0	**1**	10,5	0	**10,5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.4 / 4.3	MP	Prunella vulgaris	u	seed/fruit	1	2	**3**	71,6	52,4	**124**	0	0	0	0	0	8,8	0	0	0	0	0	43,6	0	0
4.3	MP	Rumex acetosella	u	seed/fruit	1	0	**1**	3	0	**3**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.1 / 4.3	MP	Trifolium sp.	u	petal fragm	0	1	**1**	0	19,2	**19,2**	0	0	0	0	0	0	0	0	0	0	0	0	19,2	0

Tab. 6.4a - continued

				sample name							LUC c207	LUC c 220	LUC c 226	LUC c 237	LUC c 242	LUC NN1	LUC c 305	LUC c 310	LUC c 325	LUC c 343	LUC c 367	LUC c 372	LUC c 394	LUC c 397
WOODLAND, WOOD EDGES, CLEARINGS																								
5.1	F	Agrimonia eupatoria	c	seed/fruit	1	0	**1**	7	0	**7**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.1	F	Cornus mas	c	stone	1	2	**3**	5	9,8	**14,8**	0	0	0	0	0	8,8	0	0	0	0	0	0	1	0
5.1	F	Cornus sanguinea	c	stone	1	0	**1**	2	0	**2**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.1	F	Corylus avellana	c	seed/fruit fragm.	1	1	**2**	1	1	**2**	0	1	0	0	0	0	0	0	0	0	0	0	0	0
5.1	F	Origanum vulgare	c	seed/fruit	0	1	**1**	0	1	**1**	0	0	0	0	0	0	0	0	0	0	1	0	0	0
6.4 / 5.1	F	Physalis alkekengi	c	seed/fruit	2	0	**2**	193	0	**193**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.1	F	Quercus sp.	c	pericarp fragm.> 5mm	3	0	**3**	40	0	**40**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.1	F	Quercus sp.	c	acorn base	4	2	**6**	297	23	**320**	0	0	0	0	0	1	0	0	0	0	0	22	0	0
5.1	F	Quercus sp.	c	acorn	3	0	**3**	440	0	**440**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.1	F	Quercus sp.	c	cupule	1	0	**1**	1	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.1	F	Rubus gr fruticosus	c	seed/fruit	2	1	**3**	197	3	**200**	0	0	3	0	0	0	0	0	0	0	0	0	0	0
5.1	F	Staphylea pinnata	c	seed/fruit	0	1	**1**	0	1	**1**	0	0	0	0	0	0	0	0	1	0	0	0	0	0
5.1	F	Vitis vinifera sub. sylvestris	c	seed	0	1	**1**	0	1	**1**	0	0	0	0	0	0	0	1	0	0	0	0	0	0
5.1	F	Agrimonia eupatoria	u	seed/fruit	4	6	**10**	15,5	85	**100,5**	0	0	0	0	0	52	0	0	0	2	8	21	1	1
5.1	F	Alnus sp.	u	cone axis	1	0	**1**	1	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.1	F	Alnus sp.	u	scale	1	0	**1**	1	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.1	F	Carex elongata	u	seed/fruit	0	1	**1**	0	6	**6**	0	0	0	0	0	0	0	0	0	0	0	0	0	6
5.1	F	Carex cf sylvatica	u	seed/fruit	0	1	**1**	0	16,5	**16,5**	0	0	0	0	16,5	0	0	0	0	0	0	0	0	0
5.1	F	Carpinus betulus	u	seed/fruit fragm	2	1	**3**	5,5	1	**6,5**	0	0	0	0	0	0	0	0	0	0	0	1	0	0
5.1	F	Clinopodium vulgare	u	seed/fruit	1	1	**2**	51	43,6	**94,6**	0	0	0	0	0	0	0	0	0	0	0	43,6	0	0
5.1	F	cf Clinopodium vulgare	u	seed/fruit	1	0	**1**	3,7	0	**3,7**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.1	F	Cornus mas	u	stone	5	10	**15**	174	1161	**1335**	0	0	0	1	8	70	30	0	5	2	2	3	603	437
5.1	F	Cornus sanguinea	u	stone	3	2	**5**	5	6	**11**	0	0	0	0	1	5	0	0	0	0	0	0	0	0
5.1	F	Corylus avellana	u	seed/fruit	8	10	**18**	249,2	186,6	**435,8**	0	0	0	1	71,5	33,8	7,7	0	1	1	32,6	5	15	18
5.1	F	Crataegus monogyna	u	stone	1	0	**1**	1	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.1	F	Fagus sylvatica	u	seed/fruit fragm	3	3	**6**	54,5	64,4	**118,9**	0	0	0	0	1	11,8	0	0	0	0	0	51,6	0	0
5.1	F	Ficus carica	u	seed/fruit	6	7	**13**	9933	2331	**12263,8**	0	0	0	0	16,5	44	1271,4	0	93,6	72	221,4	612,4	0	0
5.1	F	Fragaria vesca	u	seed/fruit	7	8	**15**	20016	3828	**23843,6**	0	0	0	0	27,5	26,4	1080	0	93,6	27	1033,2	1527	12,8	0
5.1	F	Frangula alnus	u	seed/fruit	1	0	**1**	1	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.1	F	Hypericum perforatum	u	seed/fruit	2	4	**6**	388,4	134,9	**523,3**	0	0	0	0	5,5	17,6	0	0	0	0	24,6	87,2	0	0
5.1	F	Maloideae pericarp	u	=1	0	1	**1**	0	8	**8**	0	0	0	0	0	0	0	0	0	0	0	0	8	0
5.1	F	Maloideae pericarp	u	<1/4	3	7	**10**	2093	1162	**3255,6**	0	0	0	0	59	450,2	0	0	0	1	147,6	227	144,6	133
5.1	F	Maloideae pericarp	u	1/2	1	1	**2**	21	14	**35**	0	0	0	0	0	0	0	0	0	0	0	0	0	14
5.1	F	Malus / Pyrus	u	seed/fruit	2	4	**6**	208,5	52,8	**261,3**	0	0	0	0	0	8,8	0	0	0	0	0	3	27	14
5.1	F	Malus sp.	u	seed/fruit	1	1	**2**	4	1	**5**	0	0	0	0	0	1	0	0	0	0	0	0	0	0
5.1	F	Malus sylvestris	u	seed/fruit	2	0	**2**	2	0	**2**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.1	F	Origanum vulgare	u	seed/fruit	1	2	**3**	72,6	226,8	**299,4**	0	0	0	0	0	8,8	0	0	0	0	0	218	0	0
5.1 / 6.4	F	Physalis alkekengi	u	seed/fruit	8	13	**21**	2434	860,7	**3294,4**	5	30	12	26	0	8,8	185,7	37	157	45	24,6	87,2	70,4	172
5.1	F	Prunus spinosa	u	stone	2	2	**4**	4	5	**9**	0	0	0	0	4	1	0	0	0	0	0	0	0	0
5.1	F	Prunus cf avium	u	stone	1	0	**1**	1	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.1	F	Prunus cf mahaleb	u	stone	2	2	**4**	3	2	**5**	0	0	0	0	0	0	0	0	0	0	0	0	1	1
5.1	F	Prunus sp.	u	stone	4	3	**7**	9,5	12,2	**21,7**	0	0	0	0	5,5	0	5,7	0	0	0	0	1	0	0
5.1	F	Pteridium sp.	u	leaf fragm	0	2	**2**	0	22,8	**22,8**	0	0	0	0	0	0	0	0	0	0	0	0	19,8	3
5.1	F	Pyrus pyraster	u	seed/fruit	2	5	**7**	279,5	114,6	**394,1**	0	0	0	0	0	2	0	0	0	0	1	46,6	31	34
5.1	F	Pyrus sp.	u	seed/fruit	1	2	**3**	22	12	**34**	0	0	0	0	11	0	0	0	0	0	0	1	0	0
5.1	F	Pyrus sp.	u	stalk fragm	1	6	**7**	49	39,5	**88,5**	0	0	0	1	2	0	28,5	0	0	2	0	0	1	5
5.1	F	Pyrus sp.	u	calyx tube remnant	6	7	**13**	35	137	**172**	0	0	0	0	22	77	1	0	0	0	8	12	7	10
5.1	F	Pyrus sp.	u	pericarp	0	1	**1**	0	2	**2**	0	0	0	0	0	2	0	0	0	0	0	0	0	0
5.1	F	Pyrus sp.	u	stones	4	8	**12**	42309	2848	**45157,1**	0	0	0	0	506	643,2	275,7	0	0	19	617	312,2	161	314
5.1	F	Quercus sp.	u	pericarp fragm.> 5mm	4	9	**13**	868	478,7	**1346,7**	0	0	0	0	7,5	61,4	90	0	2	9	31,6	236,2	19	22
5.1	F	Quercus sp.	u	acorn base	5	10	**15**	185,5	323,7	**509,2**	0	0	0	6,5	15	88,8	130,4	0	1	13	50	10	3	6
5.1	F	Quercus sp.	u	cupule	2	7	**9**	2	9	**11**	0	0	0	0	1	1	2	0	1	0	2	1	0	1
5.1	F	Rosa cf agrestis	u	seed/fruit	0	1	**1**	0	2	**2**	0	0	0	0	0	2	0	0	0	0	0	0	0	0
5.1	F	Rosa sp.	u	seed/fruit	3	4	**7**	15,5	33,3	**48,8**	0	0	0	0	1	0	5,7	0	0	0	25,6	1	0	0
5.1	F	Rosa / Rubus	u	prickles	0	2	**2**	0	44,2	**44,2**	0	0	0	0	0	35,2	0	0	0	9	0	0	0	0
5.1	F	Rubus gr fruticosus	u	seed/fruit	8	14	**22**	6712	38761	**45472,9**	600	639	635	796,5	837,5	1091,6	23093	2471	1468,4	419	571,8	596,8	3059,2	2482
5.1	F	Rubus ideaus	u	seed/fruit	1	0	**1**	4	0	**4**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.1	F	Rubus cf ideaus	u	seed/fruit	0	1	**1**	0	24	**24**	0	0	0	0	0	0	0	0	0	0	0	0	0	24
5.1	F	Rubus sp.	u	seed/fruit	4	1	**5**	134,1	281,6	**415,7**	0	0	0	0	0	0	0	0	0	0	0	0	281,6	0
5.1	F	Sambucus nigra	u	seed/fruit	3	3	**6**	17	56,7	**73,7**	20	0	0	5,5	0	0	0	0	31,2	0	0	0	0	0
5.1	F	Silene dioica	u	seed/fruit	0	1	**1**	0	8,8	**8,8**	0	0	0	0	0	8,8	0	0	0	0	0	0	0	0
5.1	F	Stellaria cf alsine	u	seed/fruit	1	0	**1**	51	0	**51**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.1	F	Torilis japonica	u	seed/fruit	1	1	**2**	2	1	**3**	0	0	0	0	0	0	0	0	0	0	1	0	0	0
5.1	F	Viola riviniana / V. reichenbachiana	u	seed/fruit	1	0	**1**	1	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.1	F	Vitis vinifera sub. sylvestris	u	seed	6	10	**16**	118,4	449	**567,4**	0	1	0	0	8	33	151	0	6	6	19	24	139	62
5.1	F	Vitis sp.	u	tendril fragm	0	3	**3**	0	2	**2**	0	0	0	0	1	1	0	0	0	0	0	0	0	0

Tab. 6.4a - continued

								sample name			LUC c207	LUC c 220	LUC c 226	LUC c 237	LUC c 242	LUC NN1	LUC c 305	LUC c 310	LUC c 325	LUC c 343	LUC c 367	LUC c 372	LUC c 394	LUC c 397
LAKE SHORE VEGETATION																								
6.1	LS	Carex gr muricata	u	seed/fruit	0	1	**1**	0	24,6	**24,6**	0	0	0	0	0	0	0	0	0	0	24,6	0	0	0
6.1	LS	Cladium mariscus	u	seed/fruit	0	1	**1**	0	8,8	**8,8**	0	0	0	0	0	8,8	0	0	0	0	0	0	0	0
6.1	LS	Epilobium hirsutum / E. parviflorum	u	seed/fruit	1	0	**1**	51	0	**51**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.1	LS	Eupatorium cannabinum	u	seed/fruit	1	0	**1**	10,5	0	**10,5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.1	LS	Lycopus europaeus	u	seed/fruit	3	2	**5**	312,6	41,7	**354,3**	0	0	0	0	5,5	36,2	0	0	0	0	0	0	0	0
6.1	LS	Mentha aquatica / M. arvensis	u	seed/fruit	2	0	**2**	297,2	0	**297,2**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.1	LS	Mentha cf longifolia	u	seed/fruit	0	1	**1**	0	17,6	**17,6**	0	0	0	0	0	17,6	0	0	0	0	0	0	0	0
6.1	LS	Mentha spicata / M. suaveolens	u	seed/fruit	2	2	**4**	224,6	58	**282,6**	0	0	0	0	0	8,8	0	0	0	0	49,2	0	0	0
6.1	LS	Ranunculus sardous	u	seed/fruit	2	3	**5**	11	295,6	**306,6**	0	0	0	0	0	1	270	0	0	0	24,6	0	0	0
6.2	LS	Cyperus flavescens	u	seed/fruit	1	0	**1**	143,2	0	**143,2**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.2	LS	Polygonum hydropiper	u	seed/fruit	1	1	**2**	190	24,6	**214,6**	0	0	0	0	0	0	0	0	0	0	24,6	0	0	0
2.2 / 2.3 / 6.2	LS	Polygonum lapathifolium	u	seed/fruit	5	5	**10**	551,6	244,6	**796,2**	0	0	0	0	0	52,8	90	0	0	9	49,2	43,6	0	0
6.2	LS	Polygonum minus	u	seed/fruit	0	1	**1**	0	6	**6**	0	0	0	0	0	0	0	0	0	0	0	0	0	6
6.1 / 6.2	LS	Ranunculus sceleratus	u	seed/fruit	4	3	**7**	551,7	111,4	**663,1**	0	0	0	0	0	0	0	0	31,2	0	73,8	0	6,4	0
6.2	LS	Scirpus radicans	u	seed/fruit	1	0	**1**	190	0	**190**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.3	LS	Alisma plantago-aquatica	u	seed/fruit	2	0	**2**	261,6	0	**261,6**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.3	LS	cf Poa palustris	u	seed/fruit	0	1	**1**	0	43,6	**43,6**	0	0	0	0	0	0	0	0	0	0	0	43,6	0	0
6.3	LS	Typha latifolia / T. angustifolia	u	seed/fruit	1	3	**4**	10,5	219,1	**229,6**	0	0	0	0	5,5	0	0	0	0	0	0	43,6	0	170
AQUATICS																								
7.1	A	Ceratophyllum demersum	u	seed/fruit	0	1	**1**	0	1	**1**	0	0	0	0	0	1	0	0	0	0	0	0	0	0
7.1	A	Characeae	u	seed/fruit	6	4	**10**	7287	161,2	**7448**	0	0	0	0	0	0	0	0	62,4	0	49,2	43,6	0	6
7.1	A	Najas flexilis	u	seed/fruit	2	0	**2**	224,6	0	**224,6**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.1	A	cf Najas flexilis	u	seed/fruit	1	0	**1**	3,5	0	**3,5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.1	A	Najas minor	u	seed/fruit	0	2	**2**	0	147,2	**147,2**	0	0	0	0	0	0	0	0	0	0	0	87,2	0	60
7.1	A	cf Najas	u	seed/fruit fragm	1	0	**1**	190	0	**190**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.1	A	Nymphaea alba	u	seed/fruit	1	0	**1**	1	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.1	A	Potamogeton natans	u	seed/fruit	2	0	**2**	4,5	0	**4,5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.1	A	Potamogeton sp.	u	seed/fruit	1	2	**3**	71,6	6,7	**78,3**	0	0	0	0	0	0	5,7	0	0	0	1	0	0	0

Tab. 6.4a - continued

								sample name			LUC c207	LUC c 220	LUC c 226	LUC c 237	LUC c 242	LUC NN1	LUC c 305	LUC c 310	LUC c 325	LUC c 343	LUC c 367	LUC c 372	LUC c 394	LUC c 397
VARIA																								
0.	VA	Bromus sp.	c	seed/fruit	1	0	**1**	14	0	**14**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Fabaceae	c	seme 1/2	0	1	**1**	0	5	**5**	0	5	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Fabaceae	c	seme	1	1	**2**	1	1	**2**	0	0	0	0	0	0	0	1	0	0	0	0	0	0
0.	VA	Poaceae	c	seed/fruit	4	0	**4**	52	0	**52**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Rumex sp.	c	seed/fruit	1	0	**1**	7	0	**7**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Solanum sp.	c	seed/fruit	1	0	**1**	7	0	**7**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Ajuga reptans / A. genevensis	u	seed/ruit	1	0	**1**	7	0	**7**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Ajuga sp.	u	seed/fruit	1	1	**2**	71,6	24,6	**96,2**	0	0	0	0	0	0	0	0	0	0	24,6	0	0	0
0.	VA	Asteraceae	u	bract	1	1	**2**	1	1	**2**	0	0	0	0	0	0	0	0	0	0	0	1	0	0
0.	VA	Asteraceae	u	receptacle	0	2	**2**	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Asteraceae	u	calyx	0	1	**1**	0	1	**1**	0	0	0	0	0	0	0	0	0	0	0	0	1	0
0.	VA	Asteraceae	u	seed/fruit	0	2	**2**	0	26,6	**26,6**	0	0	0	0	0	17,6	0	0	0	9	0	0	0	0
0.	VA	Atriplex sp.	u	seed/fruit	1	0	**1**	3,7	0	**3,7**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Brassicaceae	u	seed/fruit	2	3	**5**	112,5	48,2	**160,7**	0	0	0	0	0	17,6	0	0	0	0	24,6	0	0	6
0.	VA	Bromus sp.	u	seed/fruit	0	1	**1**	0	12,8	**12,8**	0	0	0	0	0	0	0	0	0	0	0	0	12,8	0
0.	VA	Bromus sp.	u	testa	0	1	**1**	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Carex bicarpellate	u	seed/fruit	2	1	**3**	55	24,6	**79,6**	0	0	0	0	0	0	0	0	0	0	24,6	0	0	0
0.	VA	Carex sp.	u	utriculus	1	0	**1**	1	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Carex tricarpellate	u	seed/fruit	5	0	**5**	26	0	**26**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Caryophyllaceae	u	seed/fruit	1	0	**1**	51	0	**51**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Cerastium sp.	u	seed/fruit	0	1	**1**	0	43,6	**43,6**	0	0	0	0	0	0	0	0	0	0	0	43,6	0	0
0.	VA	Cyperaceae	u	seed/fruit	0	1	**1**	0	26,4	**26,4**	0	0	0	0	0	26,4	0	0	0	0	0	0	0	0
0.	VA	Fabaceae	u	pod fragm	3	3	**6**	4	90,2	**94,2**	0	0	0	0	1	0	0	0	0	0	0	88,2	1	0
0.	VA	Hieracium sp.	u	seed/fruit	0	2	**2**	0	14,8	**14,8**	0	0	0	0	0	8,8	0	0	0	0	0	0	0	6
0.	VA	Hypericum sp.	u	seed/fruit	1	0	**1**	10,5	0	**10,5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Lamiaceae	u	seed/fruit	2	0	**2**	242	0	**242**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Linum sp.	u	capsule fragm.	0	2	**2**	0	50,1	**50,1**	0	0	0	0	5,5	0	0	0	0	0	0	44,6	0	0
0.	VA	Poa sp.	u	seed/fruit	1	0	**1**	10,5	0	**10,5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Poaceae	u	seed/fruit	2	3	**5**	1049	149,6	**1199**	0	0	0	0	0	9,8	0	0	0	9	0	130,8	0	0
0.	VA	Polygonum sp.	u	seed/fruit	2	3	**5**	61,5	77,2	**138,7**	0	0	0	0	0	0	0	0	0	9	24,6	43,6	0	0
0.	VA	Potentilla sp.	u	seed/fruit	1	0	**1**	14	0	**14**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Ranunculus sp.	u	seed/fruit	3	3	**6**	16	20,9	**36,9**	0	0	0	0	0	8,8	5,7	0	0	0	0	0	6,4	0
0.	VA	Sambucus sp.	u	seed/fruit	4	2	**6**	280,7	14,5	**295,2**	0	0	0	5,5	0	0	0	0	0	9	0	0	0	0
0.	VA	Satureya sp.	u	seed/fruit	0	1	**1**	0	8,8	**8,8**	0	0	0	0	0	8,8	0	0	0	0	0	0	0	0
0.	VA	Scabiosa sp.	u	seed/fruit	0	1	**1**	0	43,6	**43,6**	0	0	0	0	0	0	0	0	0	0	0	43,6	0	0
0.	VA	Setaria sp.	u	seed/fruit	2	0	**2**	53	0	**53**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Silene sp.	u	seed/fruit	1	1	**2**	51	5	**56**	5	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Solanum sp.	u	seed/fruit	1	0	**1**	24,5	0	**24,5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Stachys sp.	u	seed/fruit	1	0	**1**	10,5	0	**10,5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Stellaria sp.	u	seed/fruit	1	1	**2**	190	6,4	**196,4**	0	0	0	0	0	0	0	0	0	0	0	0	6,4	0
0.	VA	Torilis arvensis / T. japonica	u	seed/fruit	1	1	**2**	71,6	24,6	**96,2**	0	0	0	0	0	0	0	0	0	0	24,6	0	0	0
0.	VA	Verbascum sp.	u	seed/fruit	1	0	**1**	7	0	**7**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	Viola sp.	u	seed/fruit	1	0	**1**	3,7	0	**3,7**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.	VA	undet.	c	seed/fruit	3	2	**5**	1523	46,2	**1569,2**	15	0	0	0	0	0	0	0	31,2	0	0	0	0	0
0.	VA	undet.	u	seed/fruit	5	8	**13**	2849	770,8	**3619,4**	0	0	0	5,5	33	8,8	365,7	0	249,6	0	50,2	51,6	6,4	0
0.	VA	undet.	u	vegetative part	2	2	**4**	33,8	11,4	**45,2**	0	0	0	0	0	0	11,4	0	0	0	0	0	0	0

Tab. 6.4b – Semiquantitative analysis (rapid screening) of the second settlement phase samples from the Lucone D site (all 25 samples, also including the 14 shown on Tab. 6.4a).

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	LUC c 207			LUC c 220			LUC c 226			LUC c 237			LUC c 238		LUC c 242			LUC c NN1		LUC c 299		LUC c 300		LUC c 301		LUC c 302		LUC c 304	LUC c 305	
		sample vol (litres)							4,50	4,00		4,00	2,50		4,50	4,00		5,00	4,00		4,00	4,00	4,00	3,00		5,00	5,00	3,00	2,00	4,00	4,00	3,80	3,70	4,50	4,00	3,00	5,50	4,00
		fraction vol (ml)							200	100	500	200	110	500	100	50	300	200	120	550	300	310	220	160	550	2200	880	100	120	260	180	200	120	60	100	360	1340	1140
		subsample vol (ml)							--	--	100	--	--	100	--	--	100	--	--	100	--	200	--	--	100	--	100	--	--	--	--	--	--	--	--	--	--	200
									4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	4 mm	2 mm
FIELDS																																						
cultivated plants																																						
1.	C	Triticum monococcum	c	spikelet fork	13	14	27	71,05			2		1			2	3		2	3		3		1	3	2	3											
1.	C	Triticum monococcum	c	glume base	3	5	8	21,05			2									2		2			2		2											
1.	C	Triticum monococcum	c	spikelet fork with grain	1	0	1	2,63																														
1.	C	Triticum monococcum	c	grains	5	4	9	23,68																					2						1			
1.	C	Triticum dicoccum	c	spikelet fork	13	20	33	86,84	2	4	4	2	4	4		4	4	1	4	4		4		3	3	4	3		3		3		2		2			3
1.	C	Triticum dicoccum	c	glume base	10	13	23	60,53			4			4		1	4		2	4		2		1	3	3	3		1									2
1.	C	Triticum dicoccum	c	grains	10	19	29	76,32	2	2			2			2	1		2			2							2		2	1	2		2		1	2
1.	C	Triticum dicoccum	c	ear uppermost part	0	1	1	2,63								1																						
1.	C	Triticum nn (new glume wheat)	c	spikelet fork with grain	1	0	1	2,63																														
1.	C	Triticum nn (new glume wheat)	c	spikelet fork	13	21	34	89,47		3	4		3	4		4	4		4	4	1	4		3	4	4	4		3		3		2		2			4
1.	C	Triticum nn (new glume wheat)	c	glume base	11	16	27	71,05			2			3			3		1	3		2			3	2	3											2
1.	C	Triticum nn (new glume wheat)	c	grain	7	4	11	28,95																														2
1.	C	Triticum cf nn (cf new glume wheat)	c	spikelet fork	0	1	1	2,63																														2
1.	C	Triticum durum / T. turgidum	c	rachis	0	2	2	5,26												1																		
1.	C	Triticum aestivum / T. durum / T. turgidum	c	grain	4	9	13	34,21		2									1												1				2			
1.	C	Triticum aestivum / T. durum / T. turgidum	c	rachis frg	1	4	5	13,16		1			1			1	2																					
1.	C	cf Triticum aestivum / T. durum / T. turgidum	c	grain	0	1	1	2,63																														
1.	C	cf Triticum aestivum / T. durum / T. turgidum	c	rachis fragments	0	1	1	2,63																														
1.	C	Triticum aestivum	c	rachis	2	1	3	7,89														1																
1.	C	Triticum cf aestivum	c	rachis	3	2	5	13,16											1	2		2																
1.	C	Triticum spelta	c	spikelet fork	1	1	2	5,26		1																												
1.	C	Triticum spelta	c	glume base	3	5	8	21,05		1						2	3								1	2												2
1.	C	Triticum spelta	c	grain	3	6	9	23,68											2			2											2		1			
1.	C	Triticum cf spelta	c	glume base	1	2	3	7,89																														
1.	C	Triticum cf spelta	c	grain	1	2	3	7,89																						1	2							
1.	C	cf Triticum spelta	c	glume base	1	0	1	2,63																														
1.	C	Triticum monococcum / Triticum nn	c	spikelet fork	6	7	13	34,21												2					2	2	2		1									
1.	C	Triticum monococcum / Triticum nn	c	glume base	1	1	2	5,26																														
1.	C	Triticum monococcum / T. dicoccum	c	spikelet fork	3	6	9	23,68			2			2						2					2	2												
1.	C	Triticum monococcum / T. dicoccum	c	glume base	1	1	2	5,26			1																											
1.	C	Triticum dicoccum / Triticum nn	c	spikelet fork	9	17	26	68,42			2			1			2			2		2		2		3			3		2				1			2
1.	C	Triticum dicoccum / Triticum nn	c	spikelet fork with grain	1	0	1	2,63																														
1.	C	Triticum dicoccum / Triticum nn	c	glume base	2	2	4	10,53			1																											
1.	C	Triticum dicoccum / Triticum nn	c	grain	0	1	1	2,63																														
1.	C	Triticum sp.	c	spikelet fork	11	13	24	63,16			3			2			4		3	3		3		2	4	3	4				1				1			3
1.	C	Triticum sp.	c	glume base	11	7	18	47,37						2			1			2		2		2	4		3											
1.	C	Triticum sp.	c	glume fragm	1	1	2	5,26																														
1.	C	Triticum sp.	c	grain	4	9	13	34,21																2							2							
1.	C	Triticum sp.	c	grain fragm	0	2	2	5,26			2															3												
1.	C	Triticum sp.	c	ear uppermost part	8	5	13	34,21						2						2																		2
1.	C	Triticum sp.	c	rachis fragm.	5	9	14	36,84			1			1			2									2	2											2
1.	C	Hordeum vulgare	c	spikelet fork	11	17	28	73,68			2		2	2		3	4		2	3		2		1	3	3	3	2					2					2
1.	C	Hordeum vulgare	c	grains	11	20	31	81,58		2	1		2			2	1		2			2		1		1		2					2		2			2
1.	C	Hordeum vulgare	c	rachis fragm.	3	4	7	18,42								1	2																					
1.	C	cf Hordeum	c	grain fragm	0	1	1	2,63																		2												
1.	C	Cerealia	c	1st rachis segm. fragm.	1	0	1	2,63																														
1.	C	Cerealia	c	embryo	2	0	2	5,26																														
1.	C	Cerealia	c	stem	1	1	2	5,26																														
1.	C	Cerealia	c	glume frag	3	4	7	18,42					1				5									1												
1.	C	Cerealia	c	rachis	5	2	7	18,42														2		2														
1.	C	Cerealia	c	grain fragm	7	7	14	36,84																		3	2											2
1.	C	Cerealia	c	grain	8	16	24	63,16		2			1			1			3		1	3		2	1			3			1		2		2			2
1.	C	Linum usitatissimum	c	capsule fragm.	1	1	2	5,26																														
1.	C	Linum usitatissimum	c	seed/fruit	7	1	8	21,05																														
1.	C	Triticum dicoccum	u	spikelet fork	2	3	5	13,16																														

Tab. 6.4b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	c 207			c 220			c 226			c 237			c 238		c 242			c NN1		c 299		c 300		c 301		c 302		c 304	c 305	
sample vol (litres)									4,50	4,00		4,00	2,50		4,50	4,00		5,00	4,00		4,00	4,00	4,00	3,00		5,00	5,00	3,00	2,00	4,00	4,00	3,80	3,70	4,50	4,00	3,00	5,50	4,00
fraction vol (ml)									200	100	500	200	110	500	100	50	300	200	120	550	300	310	220	160	550	2200	880	100	120	260	180	200	120	60	100	360	1340	1140
subsample vol (ml)									--	--	100	--	--	100	--	--	100	--	--	100	--	200	--	--	100	--	100	--	--	--	--	--	--	--	--	--	--	200
									4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	4 mm	2 mm
1.	C	Triticum durum / T. turgidum	u	spikelet fork	1	0	1	2,63																														
1.	C	Triticum nn (new glume wheat)	u	spikelet fork	0	1	1	2,63																														
1.	C	Triticum sp.	u	ear fragm	0	1	1	2,63																		1												
1.	C	Triticum sp.	u	grain	1	0	1	2,63																														
1.	C	Triticum sp.	u	rachis fragm.	1	1	2	5,26											1																			
1.	C	Triticum sp.	u	glume base	2	2	4	10,53																														
1.	C	Triticum sp.	u	spikelet fork	3	2	5	13,16																														
1.	C	Triticum sp.	u	testa	2	5	7	18,42																			2											
1.	C	Triticum spelta	u	glume base	0	1	1	2,63																														
1.	C	Cerealia	u	culm fragm.	1	0	1	2,63																														
1.	C	Cerealia	u	rachis fragm.	1	0	1	2,63																														
1.	C	Cerealia	u	glume base	1	2	3	7,89																			3											
1.	C	Cerealia	u	spikelet fork	2	2	4	10,53																			3											
1.	C	Linum usitatissimum	u	seed/fruit fragm	1	2	3	7,89																			2											
1.	C	Linum usitatissimum	u	fibres	2	4	6	15,79																			3											
1.	C	Linum usitatissimum	u	seed/fruit	4	5	9	23,68																		2	1									1		
1.	C	Linum usitatissimum	u	capsule fragm.	4	6	10	26,32																		2	3									2		
1.	C	Carthamus tinctorius	u	seed/fruit	3	3	6	15,79																		1												
1.	C	Carthamus cf tinctorius	u	seed/fruit fragm	2	3	5	13,16																			1											1
1.	C	Triticum dicoccum	u/c	spikelet fork	1	2	3	7,89																														
1.	C	Triticum nn (new glume wheat)	u/c	spikelet fork	1	1	2	5,26																														
1.	C	Triticum sp.	u/c	grain	0	1	1	2,63																														
1.	C	Cerealia	u/c	grain fragm	0	1	1	2,63																														
1.	C	cf Linum usitatissimum	u/c	seed/fruit	1	0	1	2,63																														

Tab. 6.4b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	LUC c 307		LUC c 310		LUC c 311		LUC c 313	LUC c 320		LUC c 325		LUC c 333		LUC c 343			LUC c 367		LUC c 372		LUC c 394			LUC c397	
								sample vol (litres)	5,00	4,00	4,00	3,00	3,00	3,00	3,00	3,50	3,00	4,20	3,50	4,00	3,50	3,50	3,50		4,00	4,00	4,00	3,50	3,00	2,50		3,50	3,00
								fraction vol (ml)	260	400	150	250	150	150	240	400	400	260	380	420	440	300	300	900	240	200	440	400	340	100	640	280	160
								subsample vol (ml)	--	--								--	--	--	--	--	--	100	--	--	--	--	--	--	100	--	--
									4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm
FIELDS																																	
cultivated plants																																	
1.	C	Triticum monococcum	c	spikelet fork	13	14	27	71,05		2				2					1					2		2		2					2
1.	C	Triticum monococcum	c	glume base	3	5	8	21,05																									
1.	C	Triticum monococcum	c	spikelet fork with grain	1	0	1	2,63																									
1.	C	Triticum monococcum	c	grains	5	4	9	23,68		1									2														
1.	C	Triticum dicoccum	c	spikelet fork	13	20	33	86,84		2		3		3	4				3				3	3		3							2
1.	C	Triticum dicoccum	c	glume base	10	13	23	60,53				1												3		2							1
1.	C	Triticum dicoccum	c	grains	10	19	29	76,32		2		2		2	2				2				2			2		2					1
1.	C	Triticum dicoccum	c	ear uppermost part	0	1	1	2,63																									
1.	C	Triticum nn (new glume wheat)	c	spikelet fork with grain	1	0	1	2,63																									
1.	C	Triticum nn (new glume wheat)	c	spikelet fork	13	21	34	89,47		4	2	3				1	3		3		2		3	3		3		3					2
1.	C	Triticum nn (new glume wheat)	c	glume base	11	16	27	71,05		1		1		1					1					1		2		2					2
1.	C	Triticum nn (new glume wheat)	c	grain	7	4	11	28,95									2				1		2										
1.	C	Triticum cf nn (cf new glume wheat)	c	spikelet fork	0	1	1	2,63																									
1.	C	Triticum durum / T. turgidum	c	rachis	0	2	2	5,26																		2							
1.	C	Triticum aestivum / T. durum / T. turgidum	c	grain	4	9	13	34,21		1		1		1												2		1					
1.	C	Triticum aestivum / T. durum / T. turgidum	c	rachis frg	1	4	5	13,16		1																							
1.	C	cf Triticum aestivum / T. durum / T. turgidum	c	grain	0	1	1	2,63																		2							
1.	C	cf Triticum aestivum / T. durum / T. turgidum	c	rachis fragments	0	1	1	2,63																		2							
1.	C	Triticum aestivum	c	rachis	2	1	3	7,89																									
1.	C	Triticum cf aestivum	c	rachis	3	2	5	13,16																									
1.	C	Triticum spelta	c	spikelet fork	1	1	2	5,26																									
1.	C	Triticum spelta	c	glume base	3	5	8	21,05																									
1.	C	Triticum spelta	c	grain	3	6	9	23,68						1														2					
1.	C	Triticum cf spelta	c	glume base	1	2	3	7,89							1																		1
1.	C	Triticum cf spelta	c	grain	1	2	3	7,89																				1					
1.	C	cf Triticum spelta	c	glume base	1	0	1	2,63																									
1.	C	Triticum monococcum / Triticum nn	c	spikelet fork	6	7	13	34,21				1			4													1					
1.	C	Triticum monococcum / Triticum nn	c	glume base	1	1	2	5,26																				1					
1.	C	Triticum monococcum / T. dicoccum	c	spikelet fork	3	6	9	23,68																1									
1.	C	Triticum monococcum / T. dicoccum	c	glume base	1	1	2	5,26																									
1.	C	Triticum dicoccum / Triticum nn	c	spikelet fork	9	17	26	68,42				1			3				2							3		2		2			
1.	C	Triticum dicoccum / Triticum nn	c	spikelet fork with grain	1	0	1	2,63																									
1.	C	Triticum dicoccum / Triticum nn	c	glume base	2	2	4	10,53																				2					
1.	C	Triticum dicoccum / Triticum nn	c	grain	0	1	1	2,63											2														
1.	C	Triticum sp.	c	spikelet fork	11	13	24	63,16															2			2		2					
1.	C	Triticum sp.	c	glume base	11	7	18	47,37													1												
1.	C	Triticum sp.	c	glume fragm	1	1	2	5,26																		2							
1.	C	Triticum sp.	c	grain	4	9	13	34,21	1	2					3		1						2			2				1			1
1.	C	Triticum sp.	c	grain fragm	0	2	2	5,26																									
1.	C	Triticum sp.	c	ear uppermost part	8	5	13	34,21				1																1					
1.	C	Triticum sp.	c	rachis fragm.	5	9	14	36,84									2		1		1							2					
1.	C	Hordeum vulgare	c	spikelet fork	11	17	28	73,68				2		2			3		2				1	2				1					1
1.	C	Hordeum vulgare	c	grains	11	20	31	81,58		2		1			3		2		2		1		2		1	2							1
1.	C	Hordeum vulgare	c	rachis fragm.	3	4	7	18,42							2											2				1			
1.	C	cf Hordeum	c	grain fragm	0	1	1	2,63																									
1.	C	Cerealia	c	1st rachis segm. fragm.	1	0	1	2,63																									
1.	C	Cerealia	c	embryo	2	0	2	5,26																									
1.	C	Cerealia	c	stem	1	1	2	5,26				1																					
1.	C	Cerealia	c	glume frag	3	4	7	18,42																									2
1.	C	Cerealia	c	rachis	5	2	7	18,42																									
1.	C	Cerealia	c	grain fragm	7	7	14	36,84						2	3				2							1							2
1.	C	Cerealia	c	grain	8	16	24	63,16		2		2									2					2		2					
1.	C	Linum usitatissimum	c	capsule fragm.	1	1	2	5,26									1																
1.	C	Linum usitatissimum	c	seed/fruit	7	1	8	21,05																1									
1.	C	Triticum dicoccum	u	spikelet fork	2	3	5	13,16																		2		2			3		

Tab. 6.4b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

									c 307		c 310		c 311		c 313	c 320		c 325		c 333		c 343			c 367		c 372		c 394			c397	
								sample vol (litres)	5,00	4,00	4,00	3,00	3,00	3,00	3,00	3,50	3,00	4,20	3,50	4,00	3,50	3,50	3,50		4,00	4,00	4,00	3,50	3,00	2,50		3,50	3,00
								fraction vol (ml)	260	400	150	250	150	150	240	400	400	260	380	420	440	300	300	900	240	200	440	400	340	100	640	280	160
								subsample vol (ml)	--	--								--	--	--	--	--	--	100	--	--	--	--	--	--	100	--	--
ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm
1.	C	Triticum durum / T. turgidum	u	spikelet fork	1	0	1	2,63																									
1.	C	Triticum nn (new glume wheat)	u	spikelet fork	0	1	1	2,63																		2							
1.	C	Triticum sp.	u	ear fragm	0	1	1	2,63																									
1.	C	Triticum sp.	u	grain	1	0	1	2,63																									
1.	C	Triticum sp.	u	rachis fragm.	1	1	2	5,26																									
1.	C	Triticum sp.	u	glume base	2	2	4	10,53																		1				1			
1.	C	Triticum sp.	u	spikelet fork	3	2	5	13,16																				2		2			
1.	C	Triticum sp.	u	testa	2	5	7	18,42																		1	1			2			2
1.	C	Triticum spelta	u	glume base	0	1	1	2,63																									1
1.	C	Cerealia	u	culm fragm.	1	0	1	2,63																									
1.	C	Cerealia	u	rachis fragm.	1	0	1	2,63																									
1.	C	Cerealia	u	glume base	1	2	3	7,89																									2
1.	C	Cerealia	u	spikelet fork	2	2	4	10,53																									2
1.	C	Linum usitatissimum	u	seed/fruit fragm	1	2	3	7,89																							3		
1.	C	Linum usitatissimum	u	fibres	2	4	6	15,79																				2		4	5		3
1.	C	Linum usitatissimum	u	seed/fruit	4	5	9	23,68																				1	1	2	4		2
1.	C	Linum usitatissimum	u	capsule fragm.	4	6	10	26,32																		1		2		1	4		1
1.	C	Carthamus tinctorius	u	seed/fruit	3	3	6	15,79																				2					1
1.	C	Carthamus cf tinctorius	u	seed/fruit fragm	2	3	5	13,16																		1							
1.	C	Triticum dicoccum	u/c	spikelet fork	1	2	3	7,89																				1		1			
1.	C	Triticum nn (new glume wheat)	u/c	spikelet fork	1	1	2	5,26						3																			
1.	C	Triticum sp.	u/c	grain	0	1	1	2,63																						1			
1.	C	Cerealia	u/c	grain fragm	0	1	1	2,63																									1
1.	C	cf Linum usitatissimum	u/c	seed/fruit	1	0	1	2,63																									

Tab. 6.4b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	c 207 4 mm	c 207 2 mm	c 207 0,35 mm	c 220 4 mm	c 220 2 mm	c 220 0,35 mm	c 226 4 mm	c 226 2 mm	c 226 0,35 mm	c 237 4 mm	c 237 2 mm	c 237 0,35 mm	c 238 4 mm	c 238 2 mm	c 242 4 mm	c 242 2 mm	c 242 0,35 mm	c NN1 2 mm	c NN1 0,35 mm	c 299 4 mm	c 299 2 mm	c 300 4 mm	c 300 2 mm	c 301 4 mm	c 301 2 mm	c 302 4 mm	c 302 2 mm	c 304 4 mm	c 305 4 mm	c 305 2 mm
		sample vol (litres)							4,50	4,00		4,00	2,50		4,50	4,00		5,00	4,00		4,00	4,00	4,00	3,00		5,00	5,00	3,00	2,00	4,00	4,00	3,80	3,70	4,50	4,00	3,00	5,50	4,00
		fraction vol (ml)							200	100	500	200	110	500	100	50	300	200	120	550	300	310	220	160	550	2200	880	100	120	260	180	200	120	60	100	360	1340	1140
		subsample vol (ml)							--	--	100	--	--	100	--	--	100	--	--	100	--	200	--	--	100	--	100	--	--	--	--	--	--	--	--	--	--	200
winter crop weeds																																						
2.1	ww	Avena sp.	c	grain	1	3	4	10,53			1		1																									
2.1	ww	Fallopia convolvulus	c	seed/fruit	1	1	2	5,26																														
2.1	ww	Valerianella dentata	c	seed/fruit	1	0	1	2,63																														
2.1	ww	Camelina sativa	u	capsule fragm.	0	2	2	5,26																		1												
2.1	ww	Fallopia convolvulus	u	seed/fruit	6	7	13	34,21						2												2	2											
2.1	ww	Papaver argemone	u	seed/fruit	1	0	1	2,63																														
2.1	ww	Stachys annua	u	seed/fruit	4	3	7	18,42																	1		2											
2.1	ww	Torilis arvensis	u	seed/fruit	2	1	3	7,89																			2											
2.1	ww	Valerianella cf rimosa	u	seed/fruit	1	0	1	2,63																														
2.1	ww	Valerianella dentata	u	seed/fruit	5	6	11	28,95																	2		2									1		
2.1	ww	Valerianella dentata	u	seed/fruit fragm	0	1	1	2,63																			1											
summer crop weeds / mostly annual ruderal																																						
2.2	sw	Portulaca oleracea	c	seed/fruit	1	0	1	2,63																														
2.2	sw	Aethusa cynapium	u	seed/fruit	7	4	11	28,95																														1
2.2	sw	Anagallis arvensis	u	seed/fruit	3	1	4	10,53																			1											
2.2 / 2.3 / 2.4	sw	Chenopodium album	u	seed/fruit	12	12	24	63,16			2			1					1	1		1		1	3	1	2											1
2.2 / 2.3 / 2.4	sw	Chenopodium album	u	seed/fruit fragm	2	3	5	13,16											1	2							1											
2.2 / 2.3 / 2.4	sw	Chenopodium album	u	seed/fruit 1/2	5	2	7	18,42																														1
2.2 / 2.3 / 2.4	sw	Chenopodium cf glaucum	u	seed/fruit	1	0	1	2,63																														
2.2 / 2.3 / 2.4	sw	Chenopodium sp.	u	seed/fruit	1	0	1	2,63																														
2.2	sw	Chenopodium cf polyspermum	u	seed/fruit	1	0	1	2,63																														
2.2	sw	Cirsium arvense	u	seed/fruit	1	0	1	2,63																														
2.2	sw	Fumaria officinalis	u	seed/fruit	1	0	1	2,63																														
2.2	sw	Fumaria sp	u	seed/fruit	1	0	1	2,63																														
2.2	sw	Lamium amplexicaule	u	seed/fruit	1	0	1	2,63																														
2.2	sw	Picris hieracioides	u	seed/fruit	1	1	2	5,26																			1											
2.2	sw	Portulaca oleracea	u	seed/fruit	5	2	7	18,42																	1													
2.2	sw	Portulaca oleracea	u	seed/fruit half	2	0	2	5,26																														
2.2 / 2.3	sw	Viola arvensis / V. Tricolor	u	seed/fruit	1	0	1	2,63																														
2.2 / 5.1	sw	Solanum nigrum	u	seed/fruit	2	1	3	7,89																			2											

Tab. 6.4b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	c 307		c 310		c 311		c 313	c 320		c 325		c 333		c 343			c 367		c 372		c 394			c397	
								sample vol (litres)	5,00	4,00	4,00	3,00	3,00	3,00	3,00	3,50	3,00	4,20	3,50	4,00	3,50	3,50	3,50		4,00	4,00	4,00	3,50	3,00	2,50		3,50	3,00
								fraction vol (ml)	260	400	150	250	150	150	240	400	400	260	380	420	440	300	300	900	240	200	440	400	340	100	640	280	160
								subsample vol (ml)	--	--								--	--	--	--	--	--	100	--	--	--	--	--	--	100	--	--
									4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm
winter crop weeds																																	
2.1	WW	Avena sp.	c	grain	1	3	4	10,53						1																			
2.1	WW	Fallopia convolvulus	c	seed/fruit	1	1	2	5,26				1																					
2.1	WW	Valerianella dentata	c	seed/fruit	1	0	1	2,63																									
2.1	WW	Camelina sativa	u	capsule fragm.	0	2	2	5,26																				2					
2.1	WW	Fallopia convolvulus	u	seed/fruit	6	7	13	34,21													1					2		2		1			1
2.1	WW	Papaver argemone	u	seed/fruit	1	0	1	2,63																									
2.1	WW	Stachys annua	u	seed/fruit	4	3	7	18,42																							2		
2.1	WW	Torilis arvensis	u	seed/fruit	2	1	3	7,89																									
2.1	WW	Valerianella cf rimosa	u	seed/fruit	1	0	1	2,63																									
2.1	WW	Valerianella dentata	u	seed/fruit	5	6	11	28,95																2		1		1					
2.1	WW	Valerianella dentata	u	seed/fruit fragm	0	1	1	2,63																									
summer crop weeds / mostly annual ruderal																																	
2.2	SW	Portulaca oleracea	c	seed/fruit	1	0	1	2,63																									
2.2	SW	Aethusa cynapium	u	seed/fruit	7	4	11	28,95				1												1				1					
2.2	SW	Anagallis arvensis	u	seed/fruit	3	1	4	10,53																									
2.2 / 2.3 / 2.4	SW	Chenopodium album	u	seed/fruit	12	12	24	63,16				1					1							3		2					2		
2.2 / 2.3 / 2.4	SW	Chenopodium album	u	seed/fruit fragm	2	3	5	13,16				2																					
2.2 / 2.3 / 2.4	SW	Chenopodium album	u	seed/fruit 1/2	5	2	7	18,42				2																					
2.2 / 2.3 / 2.4	SW	Chenopodium cf glaucum	u	seed/fruit	1	0	1	2,63																									
2.2 / 2.3 / 2.4	SW	Chenopodium sp.	u	seed/fruit	1	0	1	2,63																									
2.2	SW	Chenopodium cf polyspermum	u	seed/fruit	1	0	1	2,63																									
2.2	SW	Cirsium arvense	u	seed/fruit	1	0	1	2,63																									
2.2	SW	Fumaria officinalis	u	seed/fruit	1	0	1	2,63																									
2.2	SW	Fumaria sp	u	seed/fruit	1	0	1	2,63																									
2.2	SW	Lamium amplexicaule	u	seed/fruit	1	0	1	2,63																									
2.2	SW	Picris hieracioides	u	seed/fruit	1	1	2	5,26																									
2.2	SW	Portulaca oleracea	u	seed/fruit	5	2	7	18,42																1									
2.2	SW	Portulaca oleracea	u	seed/fruit half	2	0	2	5,26																									
2.2 / 2.3	SW	Viola arvensis / V. Tricolor	u	seed/fruit	1	0	1	2,63																									
2.2 / 5.1	SW	Solanum nigrum	u	seed/fruit	2	1	3	7,89																									

Tab. 6.4b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	c 207			c 220			c 226			c 237			c 238		c 242			c NN1		c 299		c 300		c 301		c 302		c 304	c 305	
		sample vol (litres)							4,50	4,00		4,00	2,50		4,50	4,00		5,00	4,00		4,00	4,00	4,00	3,00		5,00	5,00	3,00	2,00	4,00	4,00	3,80	3,70	4,50	4,00	3,00	5,50	4,00
		fraction vol (ml)							200	100	500	200	110	500	100	50	300	200	120	550	300	310	220	160	550	2200	880	100	120	260	180	200	120	60	100	360	1340	1140
		subsample vol (ml)							--	--	100	--	--	100	--	--	100	--	--	100	--	200	--	--	100	--	100	--	--	--	--	--	--	--	--	--	--	200
									4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	4 mm	2 mm
RUDERAL AND CROP FIELD UBIQUITARY SPECIES																																						
2.4	RU	Carex hirta	c	seed/fruit	2	0	2	5,26																														
2.3	RU	Cuscuta sp.	u	seed/fruit	2	0	2	5,26																														
2.3	RU	cf Cuscuta	u	seed/fruit	0	1	1	2,63																			1											
2.3	RU	cf Polycnemum	u	seed/fruit	1	0	1	2,63																														
2.3	RU	Polygonum persicaria	u	seed/fruit	3	0	3	7,89																														
2.4	RU	Ajuga reptans	u	seed/fruit	1	0	1	2,63																														
2.4	RU	Carex hirta	u	seed/fruit	2	0	2	5,26																														
2.4	RU	Carex cf hirta	u	seed/fruit	2	1	3	7,89												1																		
2.4	RU	Dipsacus fullonum	u	seed/fruit	0	1	1	2,63																		1												
2.4	RU	Lapsana communis	u	seed/fruit	6	0	6	15,79																														
2.4	RU	Polygonum aviculare	u	seed/fruit	5	2	7	18,42																	1													
2.4	RU	Ranunculus acris	u	seed/fruit	1	0	1	2,63																														
2.4	RU	Ranunculus cf acris	u	seed/fruit	1	0	1	2,63																														
2.4	RU	Ranunculus acris / R. bulbosus	u	seed/fruit	1	0	1	2,63																														
2.4	RU	Sambucus ebulus	u	seed/fruit	6	2	8	21,05			1			2																								
2.2 / 2.4 / 3.1	RU	Silene alba	u	seed/fruit	1	0	1	2,63																														
2.4	RU	Urtica dioica	u	seed/fruit	2	0	2	5,26																														
2.4	RU	Verbena officinalis	u	seed/fruit	4	1	5	13,16																			1											
2.4	RU	Verbena officinalis	u	seed/fruit fragm	0	1	1	2,63																			2											
2.4 / 6.	RU	Arctium minus	u	seed/fruit	0	1	1	2,63														1																
2.4 / 6.	RU	Arctium minius / A. lappa	u	seed/fruit	1	0	1	2,63																														
2.4 / 6.	RU	Arctium minus / A. tomentosum	u	seed/fruit	1	0	1	2,63																														
2.4 / 4.2	RU	Potentilla reptans	u	seed/fruit	6	2	8	21,05																	2													
GRASSLAND: MEADOWS AND PASTURES																																						
3.1	MP	Daucus carota	c	seed/fruit	1	1	2	5,26												2																		
4.3	MP	Bromus cf hordeaceus	c	grain	1	0	1	2,63																														
2.1 / 2.2 / 3.1	MP	Ajuga chamaepytis	u	seed/fruit frg	1	0	1	2,63																														
2.1 / 2.2 / 3.1	MP	Ajuga chamaepytis	u	seed/fruit	5	2	7	18,42																	1													1
3.1	MP	Arenaria serpyllifolia	u	seed/fruit	4	1	5	13,16																			2											
3.1	MP	Centaurea sp.	u	calix	0	1	1	2,63																														
3.1	MP	Cerastium arvense	u	seed/fruit	1	0	1	2,63																														
3.1	MP	Daucus carota	u	seed/fruit	6	3	9	23,68																	2		2											
3.1	MP	Nepeta cataria	u	seed/fruit	2	0	2	5,26																														
3.1	MP	cf Pastinaca sativa	u	seed/fruit	1	0	1	2,63																														
3.1	MP	Petrorhagia prolifera	u	seed/fruit	3	1	4	10,53																			1											
4.1	MP	Ajuga genevensis	u	seed/fruit	1	1	2	5,26																			1											
4.1	MP	Sanguisorba minor	u	seed/fruit	1	0	1	2,63																														
4.1	MP	Silene vulgaris	u	seed/fruit	1	0	1	2,63																														
4.1	MP	Stachys recta	u	seed/fruit	1	0	1	2,63																														
4.1	MP	Teucrium chamaedrys	u	seed/fruit fragm	0	1	1	2,63																			1											
4.1	MP	Teucrium chamaedrys	u	seed/fruit	3	2	5	13,16																	2	2												
4.3	MP	Calamintha nepeta / C. sylvatica	u	seed/fruit	0	1	1	2,63																		1												
4.3	MP	Cerastium holosteoides / C. fontanum	u	seed/fruit	1	0	1	2,63																														
4.1 / 4.3	MP	Dianthus seguieri	u	seed/fruit	0	1	1	2,63																		1												
4.3	MP	Knautia arvensis	u	seed/fruit	0	1	1	2,63																														
4.3	MP	Knautia sp.	u	seed/fruit fragm	0	2	2	5,26																			1											
4.3	MP	Leucanthemum vulgare	u	seed/fruit	1	0	1	2,63																														
2.4 / 4.3	MP	Prunella vulgaris	u	seed/fruit	0	1	1	2,63																			1											
4.3	MP	Rumex acetosella	u	seed/fruit	1	0	1	2,63																														

Tab. 6.4b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

									c 307		c 310		c 311		c 313	c 320		c 325		c 333		c 343			c 367		c 372		c 394			c397	
								sample vol (litres)	5,00	4,00	4,00	3,00	3,00	3,00	3,00	3,50	3,00	4,20	3,50	4,00	3,50	3,50	3,50		4,00	4,00	4,00	3,50	3,00	2,50		3,50	3,00
								fraction vol (ml)	260	400	150	250	150	150	240	400	400	260	380	420	440	300	300	900	240	200	440	400	340	100	640	280	160
								subsample vol (ml)	--	--								--	--	--	--	--	--	100	--	--	--	--	--	--	100	--	--
ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm
RUDERAL AND CROP FIELD UBIQUITARY SPECIES																																	
2.4	RU	Carex hirta	c	seed/fruit	2	0	2	5,26																									
2.3	RU	Cuscuta sp.	u	seed/fruit	2	0	2	5,26																									
2.3	RU	cf Cuscuta	u	seed/fruit	0	1	1	2,63																									
2.3	RU	cf Polycnemum	u	seed/fruit	1	0	1	2,63																									
2.3	RU	Polygonum persicaria	u	seed/fruit	3	0	3	7,89																									
2.4	RU	Ajuga reptans	u	seed/fruit	1	0	1	2,63																									
2.4	RU	Carex hirta	u	seed/fruit	2	0	2	5,26																									
2.4	RU	Carex cf hirta	u	seed/fruit	2	1	3	7,89																									
2.4	RU	Dipsacus fullonum	u	seed/fruit	0	1	1	2,63																									
2.4	RU	Lapsana communis	u	seed/fruit	6	0	6	15,79																									
2.4	RU	Polygonum aviculare	u	seed/fruit	5	2	7	18,42																							2		
2.4	RU	Ranunculus acris	u	seed/fruit	1	0	1	2,63																									
2.4	RU	Ranunculus cf acris	u	seed/fruit	1	0	1	2,63																									
2.4	RU	Ranunculus acris / R. bulbosus	u	seed/fruit	1	0	1	2,63																									
2.4	RU	Sambucus ebulus	u	seed/fruit	6	2	8	21,05																									
2.2 / <u>2.4</u> / 3.1	RU	Silene alba	u	seed/fruit	1	0	1	2,63																									
2.4	RU	Urtica dioica	u	seed/fruit	2	0	2	5,26																									
2.4	RU	Verbena officinalis	u	seed/fruit	4	1	5	13,16																									
2.4	RU	Verbena officinalis	u	seed/fruit fragm	0	1	1	2,63																									
<u>2.4</u> / 6.	RU	Arctium minus	u	seed/fruit	0	1	1	2,63																									
<u>2.4</u> / 6.	RU	Arctium minius / A. lappa	u	seed/fruit	1	0	1	2,63																									
<u>2.4</u> / 6.	RU	Arctium minius / A. tomentosum	u	seed/fruit	1	0	1	2,63																									
<u>2.4</u> / 4.2	RU	Potentilla reptans	u	seed/fruit	6	2	8	21,05																1									
GRASSLAND: MEADOWS AND PASTURES																																	
3.1	MP	Daucus carota	c	seed/fruit	1	1	2	5,26																									
4.3	MP	Bromus cf hordeaceus	c	grain	1	0	1	2,63																									
2.1 / 2.2 / <u>3.1</u>	MP	Ajuga chamaepytis	u	seed/fruit frg	1	0	1	2,63																									
2.1 / 2.2 / <u>3.1</u>	MP	Ajuga chamaepytis	u	seed/fruit	5	2	7	18,42																									
3.1	MP	Arenaria serpyllifolia	u	seed/fruit	4	1	5	13,16																									
3.1	MP	Centaurea sp.	u	calix	0	1	1	2,63																									1
3.1	MP	Cerastium arvense	u	seed/fruit	1	0	1	2,63																									
3.1	MP	Daucus carota	u	seed/fruit	6	3	9	23,68																2									
3.1	MP	Nepeta cataria	u	seed/fruit	2	0	2	5,26																									
3.1	MP	cf Pastinaca sativa	u	seed/fruit	1	0	1	2,63																									
3.1	MP	Petrorhagia prolifera	u	seed/fruit	3	1	4	10,53																									
4.1	MP	Ajuga genevensis	u	seed/fruit	1	1	2	5,26																									
4.1	MP	Sanguisorba minor	u	seed/fruit	1	0	1	2,63																									
4.1	MP	Silene vulgaris	u	seed/fruit	1	0	1	2,63																									
4.1	MP	Stachys recta	u	seed/fruit	1	0	1	2,63																									
4.1	MP	Teucrium chamaedrys	u	seed/fruit fragm	0	1	1	2,63																									
4.1	MP	Teucrium chamaedrys	u	seed/fruit	3	2	5	13,16																									
4.3	MP	Calamintha nepeta / C. sylvatica	u	seed/fruit	0	1	1	2,63																									
4.3	MP	Cerastium holosteoides / C. fontanum	u	seed/fruit	1	0	1	2,63																									
4.1 / <u>4.3</u>	MP	Dianthus seguieri	u	seed/fruit	0	1	1	2,63																									
4.3	MP	Knautia arvensis	u	seed/fruit	0	1	1	2,63																2									
4.3	MP	Knautia sp.	u	seed/fruit fragm	0	2	2	5,26																									1
4.3	MP	Leucanthemum vulgare	u	seed/fruit	1	0	1	2,63																									
2.4 / <u>4.3</u>	MP	Prunella vulgaris	u	seed/fruit	0	1	1	2,63																									
4.3	MP	Rumex acetosella	u	seed/fruit	1	0	1	2,63																									

Tab. 6.4b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

									c 207			c 220			c 226			c 237			c 238		c 242			c NN1		c 299		c 300		c 301		c 302		c 304	c 305	
sample vol (litres)									4,50	4,00		4,00	2,50		4,50	4,00		5,00	4,00		4,00	4,00	4,00	3,00		5,00	5,00	3,00	2,00	4,00	4,00	3,80	3,70	4,50	4,00	3,00	5,50	4,00
fraction vol (ml)									200	100	500	200	110	500	100	50	300	200	120	550	300	310	220	160	550	2200	880	100	120	260	180	200	120	60	100	360	1340	1140
subsample vol (ml)									--	--	100	--	--	100	--	--	100	--	--	100	--	200	--	--	100	--	100	--	--	--	--	--	--	--	--	--	--	200
ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	4 mm	2 mm
WOODLAND, WOOD EDGES, CLEARINGS																																						
5.1	F	Agrimonia eupatoria	c	seed/fruit	0	1	1	2,63																														
5.1	F	Cornus mas	c	stone fragm.	1	0	1	2,63																														
5.1	F	Cornus mas	c	stone	2	1	3	7,89																														
5.1	F	Cornus sanguinea	c	stone	1	0	1	2,63																														
5.1	F	Corylus avellana	c	seed/fruit fragm.	1	1	2	5,26					1																									
5.1 / 6.4	F	Physalis alkekengi	c	seed/fruit	3	1	4	10,53																			1											
5.1	F	Quercus sp.	c	acorn	2	0	2	5,26																														
5.1	F	Quercus sp.	c	cupule	1	1	2	5,26																														
5.1	F	Quercus sp.	c	seed/fruit fragm	3	0	3	7,89																														
5.1	F	Quercus sp.	c	seed/fruit 1/2	5	0	5	13,16																														
5.1	F	Quercus sp.	c	seed/fruit base	4	4	8	21,05														1				1												
5.1	F	Quercus sp.	c	pericarp fragm.> 5mm	6	3	9	23,68																										1				
5.1	F	Rubus fruticosus	c	seed/fruit	2	1	3	7,89									1																					
5.1	F	Staphylea pinnata	c	seed/fruit	0	1	1	2,63																														
5.1	F	Vitis vinifera sub. sylvestris	c	seed	0	2	2	5,26																							2							
5.1	F	Agrimonia eupatoria	u	seed/fruit fragm	1	6	7	18,42																			1											
5.1	F	Agrimonia eupatoria	u	seed/fruit	5	4	9	23,68																		3												
5.1	F	Alnus sp.	u	cone axis	1	0	1	2,63																														
5.1	F	Alnus sp.	u	scale	1	0	1	2,63																														
5.1	F	Carex cf sylvatica	u	seed/fruit	0	1	1	2,63																	2													
5.1	F	Carpinus betulus	u	seed/fruit fragm	2	2	4	10,53																														
5.1	F	cf Clinopodium vulgare	u	seed/fruit	1	0	1	2,63																														
5.1	F	Cornus mas	u	stone fragm.	7	7	14	36,84											1					2	1		1											2
5.1	F	Cornus mas	u	stone	9	14	23	60,53													2		2			3										2		3
5.1	F	Cornus sanguinea	u	stone	4	2	6	15,79																1		2												
5.1	F	Corylus avellana	u	seed/fruit fragm.	11	15	26	68,42											2		2	3	4	4	3	5	1						2			2	3	2
5.1	F	Crataegus monogyna	u	stone	1	0	1	2,63																														
5.1	F	Fagus sylvatica	u	seed/fruit fragm	5	5	10	26,32																1		3	2											
5.1	F	Ficus carica	u	seed/fruit fragm.	1	2	3	7,89																														2
5.1	F	Ficus carica	u	seed/fruit	7	4	11	28,95																	2		2											
5.1	F	Fragaria vesca	u	seed/fruit	6	4	10	26,32																	2		2											
5.1	F	Frangula alnus	u	seed/fruit	1	0	1	2,63																														
5.1	F	Hypericum perforatum	u	seed/fruit	1	2	3	7,89																	1		2											
5.1	F	Maloideae pericarp	u	1/2	1	2	3	7,89																														
5.1	F	Maloideae pericarp	u	<1/4	4	7	11	28,95																2	2	4	3											
5.1	F	Malus / Pyrus	u	seed/fruit fragm	2	5	7	18,42																			1											
5.1	F	Malus sp.	u	seed/fruit fragm.	2	1	3	7,89																		2	1											
5.1	F	Malus sylvestris	u	seed/fruit	2	0	2	5,26																														
5.1	F	Origanum vulgare	u	seed/fruit	2	2	4	10,53																			1											
5.1 / 6.4	F	Physalis alkekengi	u	seed/fruit fragm	3	0	3	7,89																														
5.1 / 6.4	F	Physalis alkekengi	u	seed/fruit	11	11	22	57,89			1			2			2		2	2		1																1
5.1	F	Prunus cf avium	u	stone	1	0	1	2,63																														
5.1	F	Prunus cf mahaleb	u	stone	2	2	4	10,53																														
5.1	F	Prunus sp.	u	seed/fruit fragm.	6	5	11	28,95																	1													1
5.1	F	Prunus spinosa	u	stone	2	2	4	10,53															2			1												
5.1	F	Pteridium sp.	u	leaf fragm	0	2	2	5,26																														
5.1	F	Pyrus / Malus	u	seed/fruit	0	1	1	2,63																		2												
5.1	F	Pyrus / Malus	u	seed/fruit fragm	0	1	1	2,63																									1					
5.1	F	Pyrus pyraster	u	seed/fruit	1	0	1	2,63																														
5.1	F	Pyrus pyraster	u	seed/fruit	1	5	6	15,79																		2												
5.1	F	Pyrus sp.	u	seed/fruit	1	0	1	2,63																														
5.1	F	Pyrus sp.	u	pericarp	0	1	1	2,63																		2												
5.1	F	Pyrus sp.	u	seed/fruit fragm	2	2	4	10,53															3															
5.1	F	Pyrus sp.	u	stalk fragm	1	6	7	18,42											1					2														2
5.1	F	Pyrus sp.	u	stones	5	10	15	39,47																3	4	4	4											1
5.1	F	Pyrus sp.	u	calyx tube remnant	9	9	18	47,37																3		4											1	2
5.1	F	Quercus sp.	u	aborted acorn	1	0	1	2,63																														
5.1	F	Quercus sp.	u	cupule fragm	2	7	9	23,68																2		1											2	
5.1	F	Quercus sp.	u	pericrp fragm.> 5mm	5	11	16	42,11														1	2	3	3	5	4									2		

Tab. 6.4b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

									c 207			c 220			c 226			c 237			c 238		c 242			c NN1		c 299		c 300		c 301		c 302		c 304	c 305	
								sample vol (litres)	4,50	4,00		4,00	2,50		4,50	4,00		5,00	4,00		4,00	4,00	4,00	3,00		5,00	5,00	3,00	2,00	4,00	4,00	3,80	3,70	4,50	4,00	3,00	5,50	4,00
								fraction vol (ml)	200	100	500	200	110	500	100	50	300	200	120	550	300	310	220	160	550	2200	880	100	120	260	180	200	120	60	100	360	1340	1140
								subsample vol (ml)	--	--	100	--	--	100	--	--	100	--	--	100	--	200	--	--	100	--	100	--	--	--	--	--	--	--	--	--	--	200
ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	4 mm	2 mm
5.1	F	Quercus sp.	u	seed/fruit base	7	15	22	57,89											1	1	2	2	2	2		4	1									1	2	3
5.1	F	Rosa / Rubus	u	prckles	0	2	2	5,26																			2											
5.1	F	Rosa cf agrestis	u	seed/fruit	0	1	1	2,63																		2												
5.1	F	Rosa cf canina	u	seed/fruit	1	0	1	2,63																														
5.1	F	Rosa cf canina	u	seed/fruit fragm	1	0	1	2,63																														
5.1	F	Rosa sp.	u	seed/fruit	3	4	7	18,42																1														2
5.1	F	Rubus cf caesius	u	seed/fruit	1	0	1	2,63																														
5.1	F	Rubus cf idaeus	u	seed/fruit	1	0	1	2,63																														
5.1	F	Rubus fruticosus	u	seed/fruit fragm	10	11	21	55,26			3			2			3		3	4		2			4		3										2	
5.1	F	Rubus fruticosus	u	seed/fruit	12	20	32	84,21			4		2	4		2	4		4	4	2	4		2	4	4	4				2		1				3	4
5.1	F	Rubus idaeus	u	seed/fruit	1	1	2	5,26														1																
5.1	F	Rubus sp.	u	seed/fruit fragm.	2	0	2	5,26																														
5.1	F	Sambucus nigra	u	seed/fruit	5	2	7	18,42			2									1																		
5.1	F	Silene dioica	u	seed/fruit	0	1	1	2,63																			1											
5.1	F	Torilis japonica	u	seed/fruit	1	1	2	5,26																														
5.1	F	Viola riviniana / V. reichenbachiana	u	seed/fruit	1	0	1	2,63																														
5.1	F	Vitis sp.	u	tendril frg	0	3	3	7,89																1		1												
5.1	F	Vitis vinifera sub. sylvestris	u	seed fragm	6	10	16	42,11														2		2	3		1											2
5.1	F	Vitis vinifera sub. sylvestris	u	seed	6	15	21	55,26					1									2	1	2		4										2	2	2

Tab. 6.4b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	c 307		c 310		c 311		c 313	c 320		c 325		c 333		c 343			c 367		c 372		c 394			c397	
		sample vol (litres)							5,00	4,00	4,00	3,00	3,00	3,00	3,00	3,50	3,00	4,20	3,50	4,00	3,50	3,50	3,50		4,00	4,00	4,00	3,50	3,00	2,50		3,50	3,00
		fraction vol (ml)							260	400	150	250	150	150	240	400	400	260	380	420	440	300	300	900	240	200	440	400	340	100	640	280	160
		subsample vol (ml)							--	--								--	--	--	--	--	--	100	--	--	--	--	--	--	100	--	--
									4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm
WOODLAND, WOOD EDGES, CLEARINGS																																	
5.1	F	Agrimonia eupatoria	c	seed/fruit	0	1	1	2,63						1																			
5.1	F	Cornus mas	c	stone fragm.	1	0	1	2,63																									
5.1	F	Cornus mas	c	stone	2	1	3	7,89																						2			
5.1	F	Cornus sanguinea	c	stone	1	0	1	2,63																									
5.1	F	Corylus avellana	c	seed/fruit fragm.	1	1	2	5,26																									
5.1 / 6.4	F	Physalis alkekengi	c	seed/fruit	3	1	4	10,53																									
5.1	F	Quercus sp.	c	acorn	2	0	2	5,26																									
5.1	F	Quercus sp.	c	cupule	1	1	2	5,26																	2								
5.1	F	Quercus sp.	c	seed/fruit fragm	3	0	3	7,89																									
5.1	F	Quercus sp.	c	seed/fruit 1/2	5	0	5	13,16																									
5.1	F	Quercus sp.	c	seed/fruit base	4	4	8	21,05							1													3					
5.1	F	Quercus sp.	c	pericarp fragm.> 5mm	6	3	9	23,68							2									1									
5.1	F	Rubus fruticosus	c	seed/fruit	2	1	3	7,89																									
5.1	F	Staphylea pinnata	c	seed/fruit	0	1	1	2,63										1															
5.1	F	Vitis vinifera sub. sylvestris	c	seed	0	2	2	5,26				1																					
5.1	F	Agrimonia eupatoria	u	seed/fruit fragm	1	6	7	18,42															2			2		3		1			1
5.1	F	Agrimonia eupatoria	u	seed/fruit	5	4	9	23,68									2			1	3							1					
5.1	F	Alnus sp.	u	cone axis	1	0	1	2,63																									
5.1	F	Alnus sp.	u	scale	1	0	1	2,63																									
5.1	F	Carex cf sylvatica	u	seed/fruit	0	1	1	2,63																									
5.1	F	Carpinus betulus	u	seed/fruit fragm	2	2	4	10,53									1											1					
5.1	F	cf Clinopodium vulgare	u	seed/fruit	1	0	1	2,63																									
5.1	F	Cornus mas	u	stone fragm.	7	7	14	36,84												2	2								3			2	2
5.1	F	Cornus mas	u	stone	9	14	23	60,53					1			2		2		3		2			2		2		5			4	
5.1	F	Cornus sanguinea	u	stone	4	2	6	15,79																									
5.1	F	Corylus avellana	u	seed/fruit fragm.	11	15	26	68,42								2		2		4	4		2		3	3	2	1	3	3		3	2
5.1	F	Crataegus monogyna	u	stone	1	0	1	2,63																									
5.1	F	Fagus sylvatica	u	seed/fruit fragm	5	5	10	26,32								1	2			1	2						2	3					
5.1	F	Ficus carica	u	seed/fruit fragm.	1	2	3	7,89									2																
5.1	F	Ficus carica	u	seed/fruit	7	4	11	28,95																2				2					
5.1	F	Fragaria vesca	u	seed/fruit	6	4	10	26,32																2				1					
5.1	F	Frangula alnus	u	seed/fruit	1	0	1	2,63																									
5.1	F	Hypericum perforatum	u	seed/fruit	1	2	3	7,89																									
5.1	F	Maloideae pericarp	u	1/2	1	2	3	7,89									2																2
5.1	F	Maloideae pericarp	u	<1/4	4	7	11	28,95													2		1					2		4		1	4
5.1	F	Malus / Pyrus	u	seed/fruit fragm	2	5	7	18,42												1	1						2	2	2	3	2		3
5.1	F	Malus sp.	u	seed/fruit fragm.	2	1	3	7,89																									
5.1	F	Malus sylvestris	u	seed/fruit	2	0	2	5,26																									
5.1	F	Origanum vulgare	u	seed/fruit	2	2	4	10,53																		1							
5.1 / 6.4	F	Physalis alkekengi	u	seed/fruit fragm	3	0	3	7,89																									
5.1 / 6.4	F	Physalis alkekengi	u	seed/fruit	11	11	22	57,89				1							1					2							4		2
5.1	F	Prunus cf avium	u	stone	1	0	1	2,63																									
5.1	F	Prunus cf mahaleb	u	stone	2	2	4	10,53																					1	2			1
5.1	F	Prunus sp.	u	seed/fruit fragm.	6	5	11	28,95						1							1							1					
5.1	F	Prunus spinosa	u	stone	2	2	4	10,53																									
5.1	F	Pteridium sp.	u	leaf fragm	0	2	2	5,26																						2			2
5.1	F	Pyrus / Malus	u	seed/fruit	0	1	1	2,63																									
5.1	F	Pyrus / Malus	u	seed/fruit fragm	0	1	1	2,63																									
5.1	F	Pyrus pyraster	u	seed/fruit	1	0	1	2,63																									
5.1	F	Pyrus pyraster	u	seed/fruit	1	5	6	15,79																		1		2	2	3		2	3
5.1	F	Pyrus sp.	u	seed/fruit	1	0	1	2,63																									
5.1	F	Pyrus sp.	u	pericarp	0	1	1	2,63																									
5.1	F	Pyrus sp.	u	seed/fruit fragm	2	2	4	10,53																				2					
5.1	F	Pyrus sp.	u	stalk fragm	1	6	7	18,42															2							1		1	2
5.1	F	Pyrus sp.	u	stones	5	10	15	39,47									2				2		1	2		2		2	2	4	4		4
5.1	F	Pyrus sp.	u	calyx tube remnant	9	9	18	47,37								2	2			3	3					2	2	2	2			2	2
5.1	F	Quercus sp.	u	aborted acorn	1	0	1	2,63																									
5.1	F	Quercus sp.	u	cupule fragm	2	7	9	23,68								3		1										2					2
5.1	F	Quercus sp.	u	pericrp fragm.> 5mm	5	11	16	42,11								3	5	2	1		2				2	4	4	4	2	3		2	4

Tab. 6.4b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

									c 307		c 310		c 311		c 313	c 320		c 325		c 333		c 343			c 367		c 372		c 394			c397	
								sample vol (litres)	5,00	4,00	4,00	3,00	3,00	3,00	3,00	3,50	3,00	4,20	3,50	4,00	3,50	3,50	3,50		4,00	4,00	4,00	3,50	3,00	2,50		3,50	3,00
								fraction vol (ml)	260	400	150	250	150	150	240	400	400	260	380	420	440	300	300	900	240	200	440	400	340	100	640	280	160
								subsample vol (ml)	--	--								--	--	--	--	--	--	100	--	--	--	--	--	--	100	--	--
ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm
5.1	F	Quercus sp.	u	seed/fruit base	7	15	22	57,89						1		2	3	1		3	3		2	1	2	3	2	3	2			2	1
5.1	F	Rosa / Rubus	u	prckles	0	2	2	5,26																1									
5.1	F	Rosa cf agrestis	u	seed/fruit	0	1	1	2,63																									
5.1	F	Rosa cf canina	u	seed/fruit	1	0	1	2,63																									
5.1	F	Rosa cf canina	u	seed/fruit fragm	1	0	1	2,63																									
5.1	F	Rosa sp.	u	seed/fruit	3	4	7	18,42																		1		1					
5.1	F	Rubus cf caesius	u	seed/fruit	1	0	1	2,63																									
5.1	F	Rubus cf idaeus	u	seed/fruit	1	0	1	2,63																									
5.1	F	Rubus fruticosus	u	seed/fruit fragm	10	11	21	55,26									2		2										2	4			
5.1	F	Rubus fruticosus	u	seed/fruit	12	20	32	84,21		3	2	3		2	2						2		3	3		2		3			5		4
5.1	F	Rubus idaeus	u	seed/fruit	1	1	2	5,26																									
5.1	F	Rubus sp.	u	seed/fruit fragm.	2	0	2	5,26																									
5.1	F	Sambucus nigra	u	seed/fruit	5	2	7	18,42																									
5.1	F	Silene dioica	u	seed/fruit	0	1	1	2,63																									
5.1	F	Torilis japonica	u	seed/fruit	1	1	2	5,26																		1							
5.1	F	Viola riviniana / V. reichenbachiana	u	seed/fruit	1	0	1	2,63																									
5.1	F	Vitis sp.	u	tendril frg	0	3	3	7,89																						1			
5.1	F	Vitis vinifera sub. sylvestris	u	seed fragm	6	10	16	42,11						1		2		2			2		2	2		2							
5.1	F	Vitis vinifera sub. sylvestris	u	seed	6	15	21	55,26						1			2	2	2	2	4		2			3	2	3	3	4		2	4

Tab. 6.4b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	c 207			c 220			c 226			c 237			c 238		c 242			c NN1		c 299		c 300		c 301		c 302		c 304	c 305	
								sample vol (litres)	4,50	4,00		4,00	2,50		4,50	4,00		5,00	4,00		4,00	4,00	4,00	3,00		5,00	5,00	3,00	2,00	4,00	4,00	3,80	3,70	4,50	4,00	3,00	5,50	4,00
								fraction vol (ml)	200	100	500	200	110	500	100	50	300	200	120	550	300	310	220	160	550	2200	880	100	120	260	180	200	120	60	100	360	1340	1140
								subsample vol (ml)	--	--	100	--	--	100	--	--	100	--	--	100	--	200	--	--	100	--	100	--	--	--	--	--	--	--	--	--	--	200
									4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	4 mm	2 mm
LAKE SHORE VEGETATION																																						
6.2	LS	Polygonum minus	c	seed/fruit	1	0	1	2,63																														
6.1	LS	Carex pseudocyperus	u	seed/fruit	1	0	1	2,63																														
6.1	LS	Claudium mariscus	u	seed/fruit	0	1	1	2,63																			1											
6.1	LS	Eupathorium cannabinum	u	seed/fruit	1	0	1	2,63																														
6.1	LS	Lycopus europaeus	u	seed/fruit	1	3	4	10,53																	1	1	2											
6.1	LS	Mentha aquatica / M. arvensis	u	seed/fruit	2	0	2	5,26																														
6.1	LS	Mentha cf longifolia	u	seed/fruit	0	1	1	2,63																			2											
6.1	LS	Mentha spicata / suaveolens	u	seed/fruit	0	1	1	2,63																			1											
6.1	LS	Ranunculus sardous	u	seed/fruit	2	1	3	7,89																		1												
6.2	LS	Polygonum hydropiper	u	seed/fruit	1	0	1	2,63																														
2.2 / 2.3 / 6.2	LS	Polygonum lapathifolium	u	seed/fruit 1/2	0	1	1	2,63																			2											
2.2 / 2.3 / 6.2	LS	Polygonum lapathifolium	u	seed/fruit fragm	0	1	1	2,63																			1											
2.2 / 2.3 / 6.2	LS	Polygonum lapathifolium	u	seed/fruit	4	2	6	15,79																			2											
6.1 / 6.2	LS	Ranunculus sceleratus	u	seed/fruit	4	0	4	10,53																														
6.2	LS	Scirpus radicans	u	seed/fruit	1	0	1	2,63																														
6.3	LS	Alisma plantago-aquatica	u	seed/fruit	2	0	2	5,26																														
6.3	LS	Phalaris arundinacea	u	seed/fruit	1	0	1	2,63																														
6.3	LS	Typha latifolia / angustifolia	u	seed/fruit	1	2	3	7,89																	1													
AQUATICS								0,00																														
7.1	A	Ceratophyllum demersum	u	seed/fruit	0	2	2	5,26														2				1												
7.1	A	Ceratophyllum sp.	u	seed/fruit	1	0	1	2,63																														
7.1	A	Characeae	u	seed/fruit	5	1	6	15,79														1																
7.1	A	Najas flexilis	u	seed/fruit	1	0	1	2,63																														
7.1	A	cf Najas flexilis	u	seed/fruit	1	0	1	2,63																														
7.1	A	cf Najas	u	seed/fruit fragm	1	0	1	2,63																														
7.1	A	Nymphaea alba	u	seed/fruit	1	0	1	2,63																														
7.1	A	Potamogeton natans	u	seed/fruit	1	0	1	2,63																														
7.1	A	Potamogeton sp.	u	seed/fruit	0	2	2	5,26																														1
VARIA																																						
0.	VA	Fabaceae	c	seed 1/2	0	1	1	2,63						1																								
0.	VA	Fabaceae	c	seed	1	2	3	7,89																														
0.	VA	Poaceae	c	seed/fruit	2	0	2	5,26																														
0.	VA	Solanum sp.	c	seed/fruit	1	0	1	2,63																														
0.	VA	undet.	c	seed/fruit	2	1	3	7,89			2																											
0.	VA	Asteraceae	u	bract	0	1	1	2,63																														
0.	VA	Asteraceae	u	calyx	0	1	1	2,63																														
0.	VA	Asteraceae	u	receptacle	0	2	2	5,26																														
0.	VA	Asteraceae	u	seed/fruit	0	2	2	5,26																			2											
0.	VA	Atriplex sp.	u	seed/fruit	1	0	1	2,63																														
0.	VA	Brassicaceae	u	seed/fruit	2	1	3	7,89																			2											
0.	VA	Carex bicarpellate	u	seed/fruit	1	1	2	5,26																														
0.	VA	Carex tricarpellate	u	seed/fruit	4	0	4	10,53																														
0.	VA	Carex sp.	u	utriculus	2	0	2	5,26																														
0.	VA	Cyperaceae	u	seed/fruit	0	1	1	2,63																			2											
0.	VA	Fabaceae	u	pod fragm	3	3	6	15,79																1														
0.	VA	Hieracium sp.	u	seed/fruit	0	1	1	2,63																			1											
0.	VA	Hypericum sp.	u	seed/fruit	1	0	1	2,63																														
0.	VA	Lamiaceae	u	seed/fruit	1	0	1	2,63																														
0.	VA	Linum sp.	u	capsule fragm.	0	2	2	5,26																	1													
0.	VA	Poaceae	u	seed/fruit	3	2	5	13,16																		1	1											
0.	VA	Polygonum sp.	u	seed/fruit	1	1	2	5,26																														
0.	VA	Potentilla sp.	u	seed/fruit	1	0	1	2,63																														
0.	VA	Ranunculus sp.	u	seed/fruit	2	3	5	13,16																			1											1
0.	VA	Sambucus sp.	u	seed/fruit fragm	2	2	4	10,53											1																			
0.	VA	Satureya sp.	u	seed/fruit	0	1	1	2,63																			1											
0.	VA	Setaria sp.	u	seed/frut	1	0	1	2,63																														
0.	VA	Silene sp.	u	seed/fruit	0	1	1	2,63			1																											
0.	VA	Stachys sp.	u	seed/fruit	1	0	1	2,63																														
0.	VA	Stellaria sp.	u	seed/fruit	1	1	2	5,26																														
0.	VA	Viola sp.	u	seed/fruit	1	0	1	2,63																														
0.	VA	undet.	u	vegetative part	2	2	4	10,53																														2
0.	VA	undet.	u	seed/fruit	8	7	15	39,47											1						2		1											1

Tab. 6.4b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

									c 307		c 310		c 311		c 313	c 320		c 325		c 333		c 343			c 367		c 372		c 394			c397	
								sample vol (litres)	5,00	4,00	4,00	3,00	3,00	3,00	3,00	3,50	3,00	4,20	3,50	4,00	3,50	3,50	3,50		4,00	4,00	4,00	3,50	3,00	2,50		3,50	3,00
								fraction vol (ml)	260	400	150	250	150	150	240	400	400	260	380	420	440	300	300	900	240	200	440	400	340	100	640	280	160
								subsample vol (ml)	--	--								--	--	--	--	--	--	100	--	--	--	--	--	--	100	--	--
ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm
LAKE SHORE VEGETATION																																	
6.2	LS	Polygonum minus	c	seed/fruit	1	0	1	2,63																									
6.1	LS	Carex pseudocyperus	u	seed/fruit	1	0	1	2,63																									
6.1	LS	Claudium mariscus	u	seed/fruit	0	1	1	2,63																									
6.1	LS	Eupathorium cannabinum	u	seed/fruit	1	0	1	2,63																									
6.1	LS	Lycopus europaeus	u	seed/fruit	1	3	4	10,53																							2		
6.1	LS	Mentha aquatica / M. arvensis	u	seed/fruit	2	0	2	5,26																									
6.1	LS	Mentha cf longifolia	u	seed/fruit	0	1	1	2,63																									
6.1	LS	Mentha spicata / suaveolens	u	seed/fruit	0	1	1	2,63																									
6.1	LS	Ranunculus sardous	u	seed/fruit	2	1	3	7,89																									
6.2	LS	Polygonum hydropiper	u	seed/fruit	1	0	1	2,63																									
2.2 / 2.3 / 6.2	LS	Polygonum lapathifolium	u	seed/fruit 1/2	0	1	1	2,63																									
2.2 / 2.3 / 6.2	LS	Polygonum lapathifolium	u	seed/fruit fragm	0	1	1	2,63																									
2.2 / 2.3 / 6.2	LS	Polygonum lapathifolium	u	seed/fruit	4	2	6	15,79																1									
6.1 / 6.2	LS	Ranunculus sceleratus	u	seed/fruit	4	0	4	10,53																									
6.2	LS	Scirpus radicans	u	seed/fruit	1	0	1	2,63																									
6.3	LS	Alisma plantago-aquatica	u	seed/fruit	2	0	2	5,26																									
6.3	LS	Phalaris arundinacea	u	seed/fruit	1	0	1	2,63																									
6.3	LS	Typha latifolia / angustifolia	u	seed/fruit	1	2	3	7,89																									3
AQUATICS								0,00																									
7.1	A	Ceratophyllum demersum	u	seed/fruit	0	2	2	5,26																									
7.1	A	Ceratophyllum sp.	u	seed/fruit	1	0	1	2,63																									
7.1	A	Characeae	u	seed/fruit	5	1	6	15,79																									
7.1	A	Najas flexilis	u	seed/fruit	1	0	1	2,63																									
7.1	A	cf Najas flexilis	u	seed/fruit	1	0	1	2,63																									
7.1	A	cf Najas	u	seed/fruit fragm	1	0	1	2,63																									
7.1	A	Nymphaea alba	u	seed/fruit	1	0	1	2,63																									
7.1	A	Potamogeton natans	u	seed/fruit	1	0	1	2,63																									
7.1	A	Potamogeton sp.	u	seed/fruit	0	2	2	5,26																		1							
VARIA																																	
0.	VA	Fabaceae	c	seed 1/2	0	1	1	2,63																									
0.	VA	Fabaceae	c	seed	1	2	3	7,89				1			1																		
0.	VA	Poaceae	c	seed/fruit	2	0	2	5,26																									
0.	VA	Solanum sp.	c	seed/fruit	1	0	1	2,63																									
0.	VA	undet.	c	seed/fruit	2	1	3	7,89																									
0.	VA	Asteraceae	u	bract	0	1	1	2,63																				2					
0.	VA	Asteraceae	u	calyx	0	1	1	2,63																						1			
0.	VA	Asteraceae	u	receptacle	0	2	2	5,26																				2			1		
0.	VA	Asteraceae	u	seed/fruit	0	2	2	5,26																1									
0.	VA	Atriplex sp.	u	seed/fruit	1	0	1	2,63																									
0.	VA	Brassicaceae	u	seed/fruit	2	1	3	7,89																									
0.	VA	Carex bicarpellate	u	seed/fruit	1	1	2	5,26																							1		
0.	VA	Carex tricarpellate	u	seed/fruit	4	0	4	10,53																									
0.	VA	Carex sp.	u	utriculus	2	0	2	5,26																									
0.	VA	Cyperaceae	u	seed/fruit	0	1	1	2,63																									
0.	VA	Fabaceae	u	pod fragm	3	3	6	15,79																				1		1			
0.	VA	Hieracium sp.	u	seed/fruit	0	1	1	2,63																									
0.	VA	Hypericum sp.	u	seed/fruit	1	0	1	2,63																									
0.	VA	Lamiaceae	u	seed/fruit	1	0	1	2,63																									
0.	VA	Linum sp.	u	capsule fragm.	0	2	2	5,26																				1					
0.	VA	Poaceae	u	seed/fruit	3	2	5	13,16																1									
0.	VA	Polygonum sp.	u	seed/fruit	1	1	2	5,26																1									
0.	VA	Potentilla sp.	u	seed/fruit	1	0	1	2,63																									
0.	VA	Ranunculus sp.	u	seed/fruit	2	3	5	13,16																							1		
0.	VA	Sambucus sp.	u	seed/fruit fragm	2	2	4	10,53																1									
0.	VA	Satureya sp.	u	seed/fruit	0	1	1	2,63																									
0.	VA	Setaria sp.	u	seed/frut	1	0	1	2,63																									
0.	VA	Silene sp.	u	seed/fruit	0	1	1	2,63																									
0.	VA	Stachys sp.	u	seed/fruit	1	0	1	2,63																									
0.	VA	Stellaria sp.	u	seed/fruit	1	1	2	5,26																							1		
0.	VA	Viola sp.	u	seed/fruit	1	0	1	2,63																									
0.	VA	undet.	u	vegetative part	2	2	4	10,53																		2							
0.	VA	undet.	u	seed/fruit	8	7	15	39,47							1											2		2					

Tab. 6.4b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	c 207			c 220			c 226			c 237			c 238		c 242			c NN1		c 299		c 300		c 301		c 302		c 304	c 305	
		sample vol (litres)							4,50	4,00		4,00	2,50		4,50	4,00		5,00	4,00		4,00	4,00	4,00	3,00		5,00	5,00	3,00	2,00	4,00	4,00	3,80	3,70	4,50	4,00	3,00	5,50	4,00
		fraction vol (ml)							200	100	500	200	110	500	100	50	300	200	120	550	300	310	220	160	550	2200	880	100	120	260	180	200	120	60	100	360	1340	1140
		subsample vol (ml)							--	--	100	--	--	100	--	--	100	--	--	100	--	200	--	--	100	--	100	--	--	--	--	--	--	--	--	--	--	200
									4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	4 mm	2 mm
other finds																																						
		stalk base	u																																			
		Pteridophyta leaf fragments	u																																			
		insect remains																																				
		fly puparia																							2	2	3											
		bone fragments							20%						10%	10%		10%			15%	5%	10%	5%				10%	10%	5%	5%	10%		5%	10%			5%
		bones small animals										20%	19%	5%								1							2									2
		fish bones									3%		1%										5%		5%	1												
		fish vertebrae																				2			5%	1					1				2			
		fish scale																																				
		fish teeth																				2																
		molluscs									2%																		1									
		charcoal	c						75%	85%	85%	80%	80%	80%	90%	90%	45%	90%	80%	80%	55%	20%	60%	45%	30%	9%	20%	90%	90%	95%	90%	90%		90%	80%	10%	70%	30%
		wood unc.	u																	5%	5%	10%		10%	5%	20%	20%									25%	15%	25%
		twigs with bark unc.	u																		5%					20%	10%									10%		
		twigs unc.	u																5%					5%		20%	10%									10%		
		bark	u																			10%	5%	10%	5%	10%	10%									15%	15%	10%
		thorns	u																						1													
		thorns	c																																			
		leaf fragments	u																								2											
		leaf fragments	c																																			
		epidermis fragm.	u																																			
		bud	u																						1	2	1											
		bud	c																																			
		bud scale	u																						1	3	2											
		moss	u																							1												
		rhizome	u														5%								5%													
		root unc.	u																																			
		Amphibian/reptile vertebra																																				
		goat/sheep coprolite	u																					1		10%										2		
		herbaceous stem	u																																			
		dung fragments	u																				20%	25%	5%													
		aggregates							5%		5%			10%							20%	55%			10%	10%	30%				5%				5%	30%		30%
		stones												5%																				5%	5%			
		stalk	u																																			
		endocarp undet. (?)	u																																			
		mammal tooth																																				
		mammal emimandible																																				
		mammal vertebra																																				
		carnivore tooth (corona)																																				
		carbonized dung	c																																			
		mouse escrements	u																																			
		cfr insect remains																																				
		catkin																																				
		fragmented charred cereals	c														50%								30%													
		undeterminable remains																																				

Tab. 6.4b - continued

Scale of abundance: 1=present; 2=2-10 items; 3=11-50 items; 4=51-500 items; 5=>500 items.

ecol grp	large ecol grp	taxon	preservation	remain type	ubiq 1st ph	ubiq 2nd ph	ubiquity	ubiquity %	c 307		c 310		c 311		c 313	c 320		c 325		c 333		c 343			c 367		c 372		c 394			c397	
		sample vol (litres)							5,00	4,00	4,00	3,00	3,00	3,00	3,00	3,50	3,00	4,20	3,50	4,00	3,50	3,50	3,50		4,00	4,00	4,00	3,50	3,00	2,50		3,50	3,00
		fraction vol (ml)							260	400	150	250	150	150	240	400	400	260	380	420	440	300	300	900	240	200	440	400	340	100	640	280	160
		subsample vol (ml)							--	--								--	--	--	--	--	--	100	--	--	--	--	--	--	100	--	--
									4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm	4 mm	2 mm	4 mm	2 mm	0,35 mm	4 mm	2 mm
other finds																																	
		stalk base	u																														
		Pteridophyta leaf fragments	u																														
		insect remains															2																
		fly puparia															2				2		1	2		2		3					
		bone fragments							10%	5%	10%		5%	5%	5%																	10%	
		bones small animals															1	1	1	1								2					
		fish bones															1				1												
		fish vertebrae													1																		
		fish scale																															
		fish teeth																															
		molluscs																					1										
		charcoal	c						85%	90%	80%	80%	95%	85%	80%	20%	20%	80%	80%	30%	10%	60%	20%	20%								20%	
		wood unc.	u													30%	20%	10%	10%	30%	5%	20%	10%									10%	
		twigs with bark unc.	u													10%	10%			10%	5%		10%			2						10%	
		twigs unc.	u													20%	10%			10%	5%		10%									50%	
		bark	u													10%	10%	10%	10%	20%		10%											
		thorns	u																							1							
		thorns	c																														
		leaf fragments	u																									1		2			1
		leaf fragments	c																														
		epidermis fragm.	u																														
		bud	u																					1			1	2		1			2
		bud	c																				1										
		bud scale	u														2							1		2		1		2			2
		moss	u																									2		1			1
		rhizome	u																														
		root unc.	u																														
		Amphibian/reptile vertebra																															
		goat/sheep coprolite	u													3				2	2		2					3					1
		herbaceous stem	u																		5%			20%									
		dung fragments	u														3						10%					1		3		1	2
		aggregates							5%	5%	10%	20%		10%	15%	10%	30%				70%	10%	40%	50%									
		stones																															
		stalk	u																											2			2
		endocarp undet. (?)	u																	2													
		mammal tooth																															
		mammal emimandible																															
		mammal vertebra													2																		
		carnivore tooth (corona)																															
		carbonized dung	c																														
		mouse escrements	u																														
		cfr insect remains																															
		catkin																															
		fragmented charred cereals	c																					10%									
		undeterminable remains																															

Tab. 7.1 – Lavagnone samples sieved for coprolites and number of coprolites found and analysed.

Samples with dung remains
fraction analysed: 4mm and 2 mm

SAMPLES	sample short name	sample volume litres	**goat/sheep coprolites (n.)** complete or almost c.	fragments	**unidentif. dung fragments**	**carbonized dung fragments**	**n of analysed coprolite**
LAV96A US 338d qN4 campione 95	**c95**	1,3	--	--	--	--	
LAV96A US 338c q8-7L	**NN1**	2,8	--	--	--	some	
LAV97A US 338 qN7 RR 114	**rr114**	6,1	2	3	many	1	
LAV97A US 338c qO7 RR 140	**rr140**	9,2	2 + 1 ??	1	1	many	
LAV97A US 338a qO7 campione131	**c131**	4	2	1	some	--	
LAV97A US 338d qO7 campione 147	**c147**	2	--	--	--	--	
LAV97A US 338c qO9 campione 136	**c136**	2,2	--	--	--	1	
LAV97A US 338c qO8 campione 135	**c135**	2	1	--	4	--	
LAV97A US 338 qN5 rr115	**rr115**	2,4	1	2	--	--	
LAV97A US 338c qO6 campione 143	**c143**	1,8	2	--	--	--	
LAV97A US 338c qO7 campione 134	**c134**	2	1	4	--	1	
LAV99A US 338 qI6 campione 169	**c169**	1,8	--	--	--	some	
LAV02A US 338c qOP7 campione 195	**c195bis**	1,24	16 + 1?	23	many	--	5
LAV02A US 338c qOP7 campione 195	**c195**	1	5	--	--	--	5
LAV04A US 338c qP6	**E2**	1,8	12	19	many	1	3
LAV04A B1 02	**B1/02**		3				3
LAV04A B2 04	**B2/04**	0,4	--	--	some	--	
LAV04A B2 03	**B2/03**	0,4	2	--	--	--	2
LAV04A B2 06	**B2/06**	0,6	--	--	some	--	
LAV04A B2 07	**B2/07**	0,44	2	4	some	--	2
LAV04A B2 12	**B2/12**	0,5	6	--	some	--	6
LAV04A B2 18	**B2/18**	0,45	1	--	some	--	1
LAV05A US 338c qP5 campione 258	**c258**	0,8	10	3	--	--	10
LAV96A US 338a qL8-9 c.76	**c76**	1,5	6	3	--	--	1
LAV02A US 338c qO6 campione 197	**c197**	0,95	1	--	--	--	
LAV97A US 338 qO8 c.132	**c132**	2,4	1	--	--	--	1
LAV97A US 338c qO6 campione 133	**c133**	0,6	--	--	--	--	
LAV99A US 338a qP5 campione168	**c168**	1	1	1	--	--	1
LAV04A US 338a qO8	**E1**	1	3	1	--	1	2
LAV96A US 338 q8-7L c.98	**c98**	1	--	--	--	--	
LAV03A US 338 c/d qOP9	**W04**	1,9	4	2	--	--	3
LAV05A US 338d qOP5-6 campione 270	**c270**	0,92	--	7	--	--	
LAV05A US338c qP5	**RP02**	4	8	77	many	--	2
core LAV 37 108-113 cm	**108-113 cm**		1	--	--	--	1
LAV11D US4006 qC3 campione 4075	**c4075**	4,5	1	--	--	--	1
total	**35**		**86**	**151**			**49**

Tab. 7.2 – Results of the Lavagnone coprolites analysis (list of remains and their ubiquity values indicated as % and n. of coprolites in which the remains have been found).

Analysis of goat/sheep coprolites (n = 49)

MACROREMAINS (>0.5 mm)

Trees/Shrubs	**%**	**n. samples**
Rosa/Rubus prickle	32,65	16
cf. *Hedera helix* epidermis	12,24	6
Rubus sp. (fragm fruit)	12,24	6
Quercus sp. epidermis	8,16	4
Rubus cf *fruticosus* (fragm fruit)	6,12	3
Quercus sp. pericarp	4,08	2
Herbs		
Arenaria serpyllifolia	4,08	2
Arenaria serpyllifolia (seed fragment)	4,08	2
Caryophyllaceae fruits/seeds	4,08	2
Polygonum sp. fragment	4,08	2
Verbena officinalis	4,08	2
Campanula cf. *bononiensis*	2,04	1
Cyperaceae fruit	2,04	1
Fragaria vesca	2,04	1
Hypericum sp.	2,04	1
Juncus cf. *compressus*	2,04	1
Juncus sp.	2,04	1
Poa palustris	2,04	1
Potentilla cf. *reptans*	2,04	1
Ranunculus sceleratus	2,04	1
Cultivated plants		
Triticum sp. testa	18,37	9
Ferns/Mosses		
Pteridophyta epidermis	8,16	4
Bryophyta leaf	4,08	2
Bryophyta stem	4,08	2
Pteridophyta sporangium	2,04	1
Unidentified plant fossils		
tissue "thick"	100,00	49
tissue "thin"	65,31	32
leaf fragment	40,82	20
undet. seed/fruit fragm	38,78	19
prickle	20,41	10
epidermis with stomata	16,33	8
bud scale fragm.	12,24	6
reddish tissues	6,12	3
wood	6,12	3
leaf vein	4,08	2
epidermis	4,08	2
root epidermis	2,04	1
anther cf.	2,04	1
Varia (other remains, picked out)		
insect	22,45	11
Fungi cisti	4,08	2
undet remains	4,08	2
Fungi spore	2,04	1
macroremains not picked out		
small "stone"	46,94	23
charcoal	22,45	11
plant hairs	16,33	8
plant remains i.g.	6,12	3

Tab. 7.2 - continued

MICROREMAINS (<0.5 mm)

epidermis	91,84	45
plant hairs	79,59	39
pollen grain	75,51	37
"Fungi" spore	57,14	28
epidermis + stomata	46,94	23
vein	44,90	22
"stone"	38,78	19
brownish/reddish epidermis	34,69	17
star hairs	24,49	12
stomata	24,49	12
Bryophyta leaf	22,45	11
wood	16,33	8
leaf fragment	12,24	6
tracheids	12,24	6
Triticum sp. testa	10,20	5
Pteridophyta leaf	10,20	5
Pteridophyta sporangium	10,20	5
Fungi (stars)	8,16	4
glandular plant hairs	6,12	3
Pteridophyta spore	6,12	3
Fungi	6,12	3
insect remains	6,12	3
Pteridium aquilinum epidermis with stomata	4,08	2
epidermis + vein	4,08	2
pollen or spores massules	4,08	2
Cyperaceae/ Poaceae epidermis	2,04	1
cf Poaceae epidermis	2,04	1
Quercus pubescens leaf fragment	2,04	1
cf. *Hedera helix* leaf epidermis	2,04	1
epidermis with ondulate cells	2,04	1
leaf fragment with hairs	2,04	1
brownish/reddish epidermis + stomata	2,04	1
cf. anther fragment	2,04	1
Cerealia pollen grain	2,04	1
Abies alba pollen	2,04	1
Parasites	2,04	1
rhizome	2,04	1

Tab. 7.3 – Lucone D samples sieved for coprolites and number of coprolites found and analysed.

Samples with dung remains

fraction analysed: 4mm, 2 mm and 0.35 mm

SAMPLES	sample short name	sample volume litres	**goat/sheep coprolites (n.)**		**unidentif. dung fragments**	**carbonized dung fragments**	**n of analysed coprolite**
			complete or almost c.	fragments			
LUC07 N495 E496 US5	**c 1**	7	24	--	52	--	12
LUC08 N489 E494 US5 c107	**c 107**	7	8	--	2	--	8
LUC08 N489 E494 US5 c113	**c 113**	4	1	--	1	--	4
LUC10 N494 E485 US 127 c242	**c 242**	3	2	--	25%	--	
LUC11 N490 E491 US140 c304	**c 304**	3	2	--	--		
LUC11 N496 E485 US181 c320	**c 320**	3,5	3	--	3	--	10
LUC11 N490 E490 US196 c333	**c 333**	4	4	--	--	--	
LUC11 N489 E487 US198 c343	**c 343**	3,5	6		10%	--	
LUC11 N495 E485 US207 c372	**c 372**	3,5	24	1	1	--	2
LUC11 N496 E486 US235 c394	**c 394**	2,5	--	--	21	--	3
LUC11 N496 E486 US235 c397	**c 397**	3	1	--	8	--	1
LUC10 N496-5 E485 US127	**NN1**	5	10% (>500)	many	--	--	24
total	**13**		**>500**	**many**			**64**

Tab. 7.4 – Results of the Lucone D coprolites analysis (list of remains and their ubiquity values indicated as % and n. of coprolites in which the remains have been found).

Analysis of goat/sheep coprolites (n = 64)

MACROREMAINS (>0.5 mm)

Trees/shrubs	**%**	**n. sample**
Rosa/Rubus prickle, fragment	65,6	42,0
Rubus fruit fragment	35,9	23,0
Quercus epidermis	17,2	11,0
Hedera helix cf.	4,7	3,0
Hedera helix epidermis	4,7	3,0
Rubus gr *fruticosus* fruit	3,1	2,0
Rosa/Rubus prickle small, fragment	3,1	2,0
Quercus cf. *pubescens* epidermis	3,1	2,0
Hedera helix leaf edge	1,6	1,0
Quercus pericarp	1,6	1,0
Herbs		
Solanum seed	6,3	4,0
Chenopodium album seed	4,7	3,0
Origanum vulgare fruit	3,1	2,0
Chenopodium album seed fragment	1,6	1,0
Poaceae small fruit	1,6	1,0
Picris hieracioides fragment	1,6	1,0
Cultivated/collected plants		
Triticum testa	15,6	10,0
Maloidaea pericarp	14,1	9,0
Linum usitatissimum capsule	1,6	1,0
Pteridophyta		
Pteridium aquilinum leaf fragm with stomata	7,8	5,0
Pteridium aquilinum epidermis	3,1	2,0
Unidentified plant fossils		
tissue "thick"	98,4	63,0
tissue "thin"	46,9	30,0
leaf fragment	29,7	19,0
seed/fruit Indet	17,2	11,0
leaf vein	15,6	10,0
epidermis	10,9	7,0
red-brownish thick tissue	9,4	6,0
tissue very "thick" (pericarp?)	7,8	5,0
epidermis with huge cells, dark brown coloration	7,8	5,0
epidermis with numerous stellate trichomes	6,3	4,0
epidermis with longish, narrow cells, cell walls with flat and narrow undulations (cf. Poaceae glume)	4,7	3,0
epidermis with Stomata	3,1	2,0
herbaceous stem fragment	1,6	1,0
twig fragment	1,6	1,0
bud scale fragment	23,4	15,0
bud scale	9,4	6,0
prickle Indet	9,4	6,0
wood fragment	1,6	1,0
anther cf.	1,6	1,0
Varia (other remains, picked out)		
insects	9,4	6,0
macroremains not picked out		
minerogenic particle	28,1	18,0
charcoal	21,9	14,0
wood	9,4	6,0
plant hair	4,7	3,0
leaf fragment, very small	3,1	2,0
plant remain undet	3,1	2,0

Tab. 7.4 - continued

MICROREMAINS (<0.5 mm)		
Trees/shrubs		
Hedera helix epidermis with Stomata	10,9	7,0
Quercus epidermis	10,9	7,0
Quercus epidermis with stomata	9,4	6,0
Abies alba pollen	4,7	3,0
Quercus cf. *pubescens* leaf fragment/epidermis	3,1	2,0
cf *Ilex aquifolium* epidermis with stomata	3,1	2,0
Hedera helix epidermis	1,6	1,0
Rosa/rubus prickles fragm	1,6	1,0
Herbs		
Solanaceae seed	1,6	1,0
Cyperaceae/Poaceae epidermis	1,6	1,0
Cultivated plants		
Linum usitatissimum capsule	6,3	4,0
Triticum testa	6,3	4,0
Bryophyta/Pteridophyta		
Pteridium aquilinum epidermis	15,6	10,0
Bryophtyta leaf	7,8	5,0
Pteridophyta sporangium	6,3	4,0
Pteridium aquilinum epidermis with stomata	3,1	2,0
Bryophtyta stem	1,6	1,0
Pteridophyta epidermis	1,6	1,0
Unidentified plant fossils		
leaf vein	85,9	55,0
epidermis	82,8	53,0
plant hair	73,4	47,0
stellate trichome	57,8	37,0
pollen grain	48,4	31,0
minerogenic particle	45,3	29,0
wood	35,9	23,0
epidermis with stomata	25,0	16,0
leaf fragment	25,0	16,0
"Fungi" spores	25,0	16,0
epidermis with rounded reddish cells	21,9	14,0
epidermis with huge cells, dark brown coloration	15,6	10,0
epidermis with isodiametric cells, cell walls straight	14,1	9,0
epidermis with longish, narrow cells, cell walls straight	12,5	8,0
stomata, single	12,5	8,0
plant tissue with innumerous hairs including stellate trichomes	10,9	7,0
epidermis with longish cells, cell walls strongly undulate	10,9	7,0
prickle	6,3	4,0
epidermis with rounded cells	4,7	3,0
epidermis with longish, narrow cells, cell walls with flat and narrow undulations (cf. Poaceae glume)	4,7	3,0
leaf fragment with vein	4,7	3,0
plant tissue with huge, spongy cells	4,7	3,0
epidermis with longish cells, cell walls strongly undulate with stomata	3,1	2,0
Spores	3,1	2,0
leaf fragment with plant hair	1,6	1,0
glandular plant hair	1,6	1,0
seed/fruit Indet	1,6	1,0
parasite	1,6	1,0

Tab. 8.1.1 – The most abundant taxa (>800 remains), their extrapolated numbers and their ubiquities (= ubiq) in the EBA samples of Lavagnone - Sector A. For location of the sectors see Fig. 1.6.2.2.

Taxa >800 remains

taxa	preser.	type of remains	n. of remains	ubiq (%)
Fragaria vesca	u	seed/fruit	8362	**100**
Rubus aggr. fruticosus	u	seed/fruit	5396	**100**
Characeae	u	seed/fruit	3606	91
Scirpus radicans	u	seed/fruit	3267	**100**
Arenaria serpyllifolia	u	seed/fruit	3226	**100**
Chenopodium album	u	seed/fruit	2227	**100**
Triticum sp.	u	spikelet fork	1938	82
Triticum sp.	u	glume base	1708	45
Valerianella dentata	u	seed/fruit	1677	**100**
Triticum dicoccum	c	spikelet fork	1323	91
Hypericum perforatum	u	seed/fruit	1186	**100**
Hordeum vulgare	c	spikelet fork	1104	**100**
Verbena officinalis	u	seed/fruit	1080	**100**
Origanum vulgare	u	seed/fruit	1026	**100**
Brassicaceae	u	seed/fruit	1022	91
Pyrus sp.	u	stone cells	958	64
Triticum dicoccum	c	glume base	940	91
Triticum nn (new glume wheat)	c	spikelet fork	931	91
Cyperus glomeratus	u	seed/fruit	882	91
Cyperus flavescens	u	seed/fruit	879	82
Linum usitatissimum	u	capsule	853	**100**
Triticum sp.	u	testa frg	838	82

Tab. 8.1.2 – The most abundant taxa (>800 remains), their extrapolated numbers and their ubiquities (= ubiq) in the MBA samples of Lavagnone - Sector D. For location of the sectors see Fig. 1.6.2.2.

Taxa >800 remains

taxa	preser.	type of remains	n. of remains	ubiq (%)
Portulaca oleracea	u	seed/fruit	23876	**100**
Triticum nn (new glume wheat)	c	spikelet fork	23666	**100**
Triticum monococcum	c	spikelet fork	17419	**100**
Ranunculus sceleratus	u	seed/fruit	9616	**100**
Triticum nn (new glume wheat)	c	glume base	7865	**100**
Triticum sp.	c	spikelet fork	5322	**100**
Chenopodium album	u	seed/fruit	4883	**100**
Triticum dicoccum	c	spikelet fork	4666	**100**
Triticum sp.	c	glume base	4661	92
Characeae	u	seed/fruit	4403	92
Rubus aggr. fruticosus	u	seed/fruit	3793	**100**
Potentilla reptans	u	seed/fruit	3095	85
Triticum monococcum / T. nn	c	spikelet fork	2955	62
Triticum dicoccum	c	glume base	2652	**100**
Rumex maritimus	u	seed/fruit	2166	77
Triticum monococcum	c	glume base	2012	85
Legousia hybrida / L. speculum veneris	u	seed/fruit	1782	46
Urtica dioica	u	seed/fruit	1765	77
Scirpus radicans	u	seed/fruit	1705	92
Triticum sp.	c	ear uppermost part	1568	77
Triticum monococcum / T. nn	c	glume base	1328	46
Fragaria vesca	u	seed/fruit	1222	62
Verbena officinalis	u	seed/fruit	1208	69
Arenaria serpyllifolia	u	seed/fruit	1147	69
Schoenoplectus lacustris	u	seed/fruit	1142	46
Triticum sp.	c	rachis frg	1003	**100**
Valerianella dentata	u	seed/fruit	987	62
Triticum dicoccum / T. nn (new glume wheat)	c	spikelet fork	966	38
Hypericum perforatum	u	seed/fruit	821	69

Tab. 8.1.3 – The most abundant taxa (>800 remains), their extrapolated numbers and their ubiquities (= ubiq) in the 1st settlement phase samples of Lucone D.

Taxa >800 remains

taxa	preser.	type of remains	n. of remains	ubiq (%)
Pyrus sp.	u	stones	42309	50
Linum usitatissimum	c	seed/fruit	21081	63
Fragaria vesca	u	seed/fruit	20016	88
Chenopodium album	u	seed/fruit	12524	88
Ficus carica	u	seed/fruit	9933	75
Triticum dicoccum	c	spikelet fork	8301	**100**
Triticum nn (new glume wheat)	c	spikelet fork	8100	**100**
Characeae	u	seed/fruit	7287	75
Triticum sp.	u	spikelet fork	7163	38
Rubus gr fruticosus	u	seed/fruit	6712	**100**
Triticum dicoccum	c	glume base	4902	**100**
Portulaca oleracea	u	seed/fruit	3364	88
Triticum sp.	c	glume base	3358	**100**
Triticum sp.	u	glume base	3273	38
Hordeum vulgare	c	spikelet fork	3261	88
Linum usitatissimum	u	capsule	3009	50
Arenaria serpyllifolia	u	seed/fruit	2561	63
Physalis alkekengi	u	seed/fruit	2434	**100**
Triticum monococcum	c	spikelet fork	2416	**100**
Triticum sp.	c	spikelet fork	2320	88
Triticum monococcum	c	glume base	2247	50
Triticum nn (new glume wheat)	c	glume base	2202	**100**
Maloideae pericarp	u	<1/4	2093	38
Potentilla reptans	u	seed/fruit	1885	75
Cerealia	c	rachis	1787	38
Verbena officinalis	u	seed/fruit	1784	50
Valerianella dentata	u	seed/fruit	1772	75
Poaceae	u	seed/fruit	1049	25
Lapsana communis	u	seed/fruit	1031	75
Triticum nn (new glume wheat)	c	grain	926	50
Quercus sp.	u	pericarp fragm.> 5mm	868	50
Polygonum persicaria	u	seed/fruit	812	38

Tab. 8.1.4 – The most abundant taxa (>800 remains), their extrapolated numbers and their ubiquities (= ubiq) in the 2nd settlement phase samples of Lucone D.

Taxa >800 remains

taxa	preser.	type of remains	n. of remains	freq (%)
Rubus gr fruticosus	u	seed/fruit	38761	**100**
Triticum nn (new glume wheat)	c	spikelet fork	19757	**100**
Triticum dicoccum	c	spikelet fork	10995	93
Triticum sp.	c	spikelet fork	7157	**100**
Triticum dicoccum	c	glume base	5059	93
Triticum nn (new glume wheat)	c	glume base	5039	93
Triticum sp.	u	spikelet fork	5021	21
Hordeum vulgare	c	spikelet fork	4755	93
Triticum sp.	c	glume base	3871	79
Fragaria vesca	u	seed/fruit	3828	57
Triticum monococcum	c	spikelet fork	3509	93
Chenopodium album	u	seed/fruit	3501	93
Pyrus sp.	u	stones	2848	57
Triticum dicoccum / T. nn (new glume wheat)	c	spikelet fork	2839	93
Triticum sp.	u	glume base	2497	29
Ficus carica	u	seed/fruit	2331	50
Cerealia	u	spikelet fork	1843	21
Triticum nn (new glume wheat)	u	glume base	1810	7
Triticum monococcum	c	glume base	1507	64
Maloideae pericarp	u	<1/4	1162	50
Cornus mas	u	stone	1161	71
Potentilla reptans	u	seed/fruit	1011	50
Triticum sp.	c	rachis	1002	64
Physalis alkekengi	u	seed/fruit	861	93

Tab. 8.2.1 – Herbaceous taxa of open habitats found in the Lucone D and Lavagnone sites in EBA and MBA layers. Ecological indicator values according to Landolt (1977) are added (L = light, T = temperature, C = continentality of climate, U = umidity, water availability, R = soil reaction, N = nutrients, S = salinity). For the explanation of life form acronyms see the list of Abbreviations. The scientific nomenclature is reported according to Pignatti 1982.

Identified taxon	ecol grp	large ecol grp	pres	LUC EBA 1st ph items/l (8 smpl)	LUC EBA 2nd ph items/l (14 smpl)	LAV EBA items/l (11 smpl)	LAV MBA items/l (13 smpl)	possible corresponding taxon	growth height (cm)	life form	L	T	C	U	R	N	S
Avena sp.	2.1	WW	c	0,10	0,12		0,05	Avena sativa L.	60-150	T SCAP	8	7	6	5	6	6	0
Fallopia convolvulus	2.1	WW	c	0,10	0,02	1,02		Fallopia convolvulus (L.) Holub	10-80	T SCAP, li	8	7	4	4	5	3	0
Lathyrus cf aphaca	2.1 / 2.3	WW	c				0,07	Lathyrus aphaca L.	10-30	T SCAP	6	6	5	3	X	X	0
Scleranthus annuus	2.1	WW	c				0,28	Scleranthus annuus L.	5-15	T SCAP	6	5	5	X	2	4	0
Valerianella dentata	2.1	WW	c	0,27				Valerianella dentata (L.) Pollich	10-30	T SCAP	7	5	4	4	7	X	0
Vicia cf angustifolia	2.1 / 2.3	WW	c				0,02	Vicia sativa subsp angustifolia (Grufb) Gaudin	10-90	T SCAP	5	6	3	X	X	X	0
Aphanes arvensis	2.1	WW	u				9,12	Aphanes arvensis L.	5-15	T SCAP	6	5	5	6	4	5	0
Buglossoides arvensis	2.1 / 2.3	WW	u			0,12		Buglossoides arvensis (L.) Johnston	15-50	T SCAP	5	X	5	X	7	5	0
Camelina sativa	2.1	WW	u		0,08	1,64		Camelina sativa (L.) Crantz	30-90	T SCAP, H	7	6	6	5	5	3	0
Fallopia convolvulus	2.1	WW	u	1,71	6,04	**13,30**	3,19	Fallopia convolvulus (L.) Holub	10-80	T SCAP, li	8	7	4	4	5	3	0
Legousia hybrida / L. speculum veneris	2.1	WW	u				**31,64**	Legousia hybrida (L.) Delarbre	10-30	T SCAP	7	8	3	4	X	0	0
								Legousia speculum-veneris (L.) Chaix	10-40	T SCAP	7	7	5	4	8	3	0
Papaver argemone	2.1	WW	u			0,99	2,92	Papaver argemone L.	15-30	T SCAP	5	7	6	4	5	5	0
Papaver dubium	2.1	WW	u			1,69		Papaver dubium L.	30-80	T SCAP	6	6	6	4	5	5	0
Papaver rhoeas	2.1	WW	u	1,86		0,35		Papaver rhoeas L.	30-70	T SCAP	6	6	5	5	7	X	0
Scleranthus annuus	2.1	WW	u			1,34		Scleranthus annuus L.	5-15	T SCAP	6	5	5	X	2	4	0
Stachys annua	2.1	WW	u	0,55	0,46	1,53	5,98	Stachys annua (L.) L.	20-60	T SCAP	7	6	5	3	8	4	0
Torilis arvensis	2.1	WW	u	0,35	0,35	6,89		Torilis arvensis (Hudson) Link	30-120	T SCAP	7	8	5	4	7	6	0
Valerianella dentata	2.1	WW	u	**46,03**	**8,98**	**73,40**	**17,53**	Valerianella dentata (L.) Pollich	10-30	T SCAP	7	5	4	4	7	X	0
Valerianella locusta	2.1 / 2.3	WW	u				0,40	Valerianella locusta (L.) Laterrade	10-30	T SCAP	7	5	5	5	7	X	0
Valerianella rimosa	2.1	WW	u			0,04	0,40	Valerianella rimosa Bastard	10-30	T SCAP	6	7	4	4	7	X	0
Chenopodium album	2.2 / 2.3 / 2.4	SW	c	3,97				Chenopodium album L.	10-100	T SCAP	7	7	5	4	5	7	0
Portulaca oleracea	2.2	SW	c	4,94				Portulaca oleracea L.	5-20	T SCAP	7	8	5	4	7	7	0
Setaria viridis / S. verticillata	2.2	SW	c				0,92	Setaria verticillata (L.) Beauv.	20-60	T SCAP	7	8	5	4	X	8	0
								Setaria viridis (L.) Beauv.	20-60	T SCAP	7	6	X	4	X	7	0
Aethusa cynapium	2.2	SW	u	1,05	2,30			Aethusa cynapium L.	20-100	T SCAP	6	5	4	5	8	7	0
Anagallis arvensis	2.2	SW	u	2,08	2,14	2,71	1,43	Anagallis arvensis L.	5-30	T REPT	6	6	5	5	X	6	0
Anagallis arvensis / A. foemina	2.2	SW	u				4,19	Anagallis foemina Miller	5-30	T REPT	8	7	5	4	9	5	0
Atriplex hastata	2.2	SW	u			0,12		Atriplex latifolia Wahlenb.	30-80	T SCAP	9	X	X	6	X	9	0
Capsella bursa-pastoris	2.2 / 2.4	SW	u			0,35		Capsella bursa pastoris (L.) Medicus	4-40(70)	H BIENNE	7	X	5	5	5	4	0
Chenopodium album	2.2 / 2.3 / 2.4	SW	u	**325,31**	**69,33**	**97,49**	**86,73**	Chenopodium album L.	10-100	T SCAP	7	7	5	4	5	7	0
Chenopodium cf glaucum	2.2 / 2.3 / 2.4	SW	u	9,87				Chenopodium glaucum L.	10-50(100)	T SCAP	8	6	5	6	X	9	0
Chenopodium cf polyspermum	2.2	SW	u	0,27				Chenopodium polyspermum L.	15-60	T SCAP	6	5	5	6	4	8	0
Cirsium arvense	2.2	SW	u	0,09				Cirsium arvense (L.) Scop.	10-50(150)	G RAD	8	X	X	4	X	7	0
cf Eragrostis minor	2.2	SW	u	1,86		**13,04**		Eragrostis minor Host	10-40	T SCAP	8	8	5	3	6	2	0
Euphorbia helioscopia	2.2	SW	u				1,52	Euphorbia helioscopia L.	10-40	T SCAP	9	7	5	3	5	6	0
Fumaria officinalis	2.2	SW	u	0,03			1,31	Fumaria officinalis L.	10-30	T SCAP	7	7	5	4	5	6	0
Heliotropium europaeum	2.2 / 2.3	SW	u				3,50	Heliotropium europaeum L.	15-30	T SCAP	11	8	5	3	7	2	1
Lamium amplexicaule	2.2	SW	u	0,27			2,83	Lamium amplexicaule L.	10-25	T SCAP	7	7	5	4	5	7	0

Tab. 8.2.1 - continued

Identified taxon	ecol grp	large ecol grp	pres	LUC EBA 1st ph items/l (8 smpl)	LUC EBA 2nd ph items/l (14 smpl)	LAV EBA items/l (11 smpl)	LAV MBA items/l (13 smpl)	possible corresponding taxon	growth height (cm)	life form	L	T	C	U	R	N	S
Lamium purpureum	2.2	SW	u			0,35	0,95	Lamium purpureum L.	15-25	T SCAP	7	7	5	4	5	5	0
Lepidium graminifolium	2.2	SW	u			2,26		Lepidium graminifolium L.	30-70	H SCAP	8	8	5	3	X	3	0
Malva sylvestris	2.2	SW	u			2,39		Malva sylvestris L.	30-120	H SCAP	8	6	4	4	X	8	0
Oxalis corniculata	2.2	SW	u			0,77		Oxalis corniculata L.	10-30	CH REPT	7	7	0	4	X	6	0
Picris hieracioides	2.2	SW	u	1,86	0,17	0,98		Picris hieracioides L.	30-90	H SCAP	8	X	5	4	8	4	0
Portulaca oleracea	2.2	SW	u	**87,38**	3,34	**17,70**	**424,08**	Portulaca oleracea L.	5-20	T SCAP	7	8	5	4	7	7	0
Solanum nigrum	2.2 / 5.1	SW	u	6,47	1,39	1,97	0,55	Solanum nigrum L.	10-60	T SCAP	7	6	5	3	5	7	0
Stellaria media	2.2 / 2.3	SW	u	1,86		5,17	1,42	Stellaria media (L.) Vill.	5-40	T REPT	6	X	X	4	7	8	0
Stellaria neglletta / media	2.2 / 2.3	SW	u				0,30	Stellaria neglecta Weihe	20-80	T SCAP	6	7	5	4	5	8	0
Viola arvensis / V. Tricolor	2.2 / 2.3	SW	u	0,18		0,21		Viola arvensis Murray	10-20	T SCAP	5	5	5	X	X	X	0
								Viola tricolor L.	10-40(90)	T SCAP	7	X	5	5	X	6	0
Bromus sterilis / B. tectorum	2.4	RU	c				0,02	Bromus tectorum L.	10-40	T SCAP	8	6	7	3	8	4	0
cf Bromus sterilis	2.4	RU	c				0,22	Bromus sterilis L.	20-80	T SCAP	7	7	5	4	X	5	0
Lapsana communis	2.4	RU	c	0,18				Lapsana communis L.	20-120	T SCAP	5	X	5	5	X	7	0
Polygonum aviculare	2.4	RU	c	0,03				Polygonum aviculare L.	10-50(100)	T REPT	7	7	5	3	6	1	0
Potentilla reptans	2.4 / 4.2	RU	c				0,20	Potentilla reptans L.	5-20	H ROS	6	6	5	6	7	5	0
Ajuga reptans	2.4	RU	u	0,05			0,44	Ajuga reptans L.	10-30	CH REPT	6	X	4	6	X	6	0
Anthemis tinctoria	2.4	RU	u			2,78		Anthemis tinctoria L.	20-60	H BIENNE	8	6	5	2	6	4	0
Arctium minius / A. lappa	2.4 / 6.	RU	u	0,03				Arctium lappa L.	60-150	H BIENNE	9	5	5	5	7	9	0
Arctium minus / A. nemorosum	2.4 / 6.	RU	u				0,02	Arctium minus (Hill) Bernh.	60-120	H BIENNE	11	5	5	5	8	9	0
								Arctium nemorosum Lej. et Court.	60-180	H BIENNE	5	5	5	7	X	9	0
Bromus sterilis	2.4	RU	u				0,02	Bromus sterilis L.	20-80	T SCAP	7	7	5	4	X	5	0
Carex hirta	2.4	RU	u	0,95	0,11	0,56	0,88	Carex hirta L.	10-60	G RHIZ	7	6	4	6	X	5	0
Cuscuta sp	2.3	RU	u	0,27	0,17	0,31	3,21	Cuscuta europaea L.	--	T PAR	8	7	5	X	X	X	0
Dipsacus fullonum	2.4	RU	u	0,00	0,02			Dipsacus fullonum L.	100-200	H BIENNE	6	8	5	7	5	5	0
Galeopsis sp.	2.3	RU	u			0,12		Galeopsis tetrahit L.	(10)20-100	T SCAP	7	6	5	3	6	2	0
Lapsana communis	2.4	RU	u	**26,78**	0,74	1,22		Lapsana communis L.	20-120	T SCAP	5	X	5	5	X	7	0
Plantago major s.l.	2.4	RU	u	1,86			0,75	Plantago major L.	5-30	H ROS	8	X	X	5	X	7	0
Polycnemum arvense / P. majus	2.3	RU	u				0,75	Polycnemum arvense L.	10-20	T SCAP	8	7	7	3	2	1	0
Polycnemum sp.	2.3	RU	u				0,53	Polycnemum majus a.Braun	10-20	T SCAP	8	7	7	3	2	1	0
Polygonum aviculare	2.4	RU	u	0,78	0,97	**32,67**	5,56	Polygonum aviculare L.	10-50(100)	T REPT	7	7	5	3	6	1	0
Polygonum persicaria	2.3	RU	u	**21,09**		**24,10**	0,36	Polygonum persicaria L.	20-80	T SCAP	6	5	5	3	7	7	0
Potentilla reptans	2.4 / 4.2	RU	u	**48,96**	**20,03**	**19,89**	**54,98**	Potentilla reptans L.	5-20	H ROS	6	6	5	6	7	5	0
Ranunculus acris	2.4	RU	u	5,04				Ranunculus acris L.	30-100	H SCAP	7	X	5	X	X	X	0
Ranunculus acris / R. bulbosus	2.4	RU	u	0,18				Ranunculus bulbosus L.	10-50	H SCAP	8	6	5	3	7	3	0
Ranunculus repens	2.4	RU	u			0,09	1,49	Ranunculus repens L.	10-50	CH REPT	6	X	X	7	X	7	0
Sambucus ebulus	2.4	RU	u	5,38	1,15	0,90	4,77	Sambucus ebulus L.	50-200	G RHIZ	8	6	5	5	8	7	0
Silene alba	2.2 / 2.4 / 3.1	RU	u	0,09		0,66		Silene alba (Miller) Krause	30-90	H BIENNE	8	X	X	4	X	7	0
Stellaria pallida	2.3	RU	u				0,89	Stellaria pallida (Dumort.) pire	5-40	T SCAP	8	8	5	3	5	4	0
Urtica dioica	2.4	RU	u	6,74		1,65	**31,35**	Urtica dioica L.	50-120	H SCAP	X	X	X	6	X	8	0
Verbena officinalis	2.4	RU	u	**46,34**	2,02	**47,29**	**21,46**	Verbena officinalis L.	30-70	H SCAP	9	5	5	4	X	6	0
Ajuga chamaepytis	2.1 / 2.2 / 3.1	MP	c				0,20	Ajuga chamaepitys (L.) Schreber	5-20	T SCAP	7	8	5	4	9	2	0
Bromus cf hordeaceus	4.3	MP	c	0,03			0,28	Bromus hordeaceus L.	20-70	T SCAP	7	6	5	X	X	X	0
Daucus carota	3.1	MP	c	0,18	1,56			Daucus carota L.	30-100	H BIENNE	8	6	5	4	5	4	0
Phleum pratense	4.3	MP	c				0,37	Phleum pratense L.	40-100(150)	H CAESP	7	6	5	5	6	6	0

Tab. 8.2.1 - continued

Identified taxon	ecol grp	large ecol grp	pres	LUC EBA 1st ph items/l (8 smpl)	LUC EBA 2nd ph items/l (14 smpl)	LAV EBA items/l (11 smpl)	LAV MBA items/l (13 smpl)	possible corresponding taxon	growth height (cm)	life form	L	T	C	U	R	N	S
Plantago lanceolata	4.2	MP	c				1,21	Plantago lanceolata L.	10-40	H ROS	6	7	5	X	X	X	0
Rumex acetosa	4.3	MP	c				0,40	Rumex acetosa L.	30-100	H SCAP	8	X	X	X	4	5	0
Teucrium chamaedrys	4.1	MP	c				0,25	Teucrium chamaedrys L.	10-25	CH SUFFR	7	6	5	2	8	1	0
Acinos arvensis	4.1	MP	u			0,67		Acinos arvensis (Lam.) Dandy	10-40	T SCAP	11	X	5	2	7	1	0
Ajuga chamaepytis	2.1 / 2.2 / <u>3.1</u>	MP	u	1,08	2,81	1,12	4,56	Ajuga chamaepitys (L.) Schreber	5-20	T SCAP	7	8	5	4	9	2	0
Ajuga genevensis	4.1	MP	u	0,10	0,17		0,43	Ajuga genevensis L.	10-30	H SCAP	8	4	X	4	7	2	0
Arenaria serpyllifolia	3.1	MP	u	**66,52**	2,68	**141,24**	**20,37**	Arenaria serpyllifolia L.	5-20	T SCAP	9	5	X	4	X	X	0
Calamintha nepeta / C. sylvatica	4.3	MP	u		0,02			Calamintha sylvatica Bromf.	30-60	H SCAP	4	6	4	5	5	4	0
Calamintha cf nepeta	4.3	MP	u	1,32				Calamintha nepeta (L.) Savi		H SCAP	5	7	5	3	9	3	0
Campanula rapunculus	4.1	MP	u			0,67		Campanula rapunculus L.	30-90	H BIENNE	7	7	5	4	6	4	0
Carex caryophyllea	4.1	MP	u		1,78	1,02		Carex caryophyllea La Tourr.	10-30	H SCAP	8	5	5	4	X	2	0
Carex cf pallescens	4.3	MP	u			0,70		Carex pallescens L.	20-50	H CAESP	7	4	4	6	4	4	0
Carex mucronata	<u>3.1</u> / 4.1	MP	u			0,61	0,02	Carex mucronata All.	15-35	H CAESP	9	3	5	3	9	0	0
Carthamus cf lanatus	3.1	MP	u			0,04		Carthamus lanatus L.	20-60	T SCAP	11	8	5	3	5	6	0
Cerastium arvensis / C. fontanum	3.1	MP	u				0,25	Cerastium arvense L.	10-40	C, H SCAP, (T)	8	X	5	4	6	4	0
Cerastium holosteoides / C. fontanum	4.3	MP	u	**14,81**				Cerastium fontanum Baumg.	10-40	C, H SCAP, (T)	6	X	X	5	X	5	0
Daucus carota	3.1	MP	u	**17,26**	8,47	6,89	2,15	Daucus carota L.	30-100	H BIENNE	8	6	5	4	5	4	0
Dianthus cf deltoides	4.1	MP	u	1,86				Dianthus deltoides L.	10-30	H CAESP	7	5	5	3	2	2	0
Dianthus seguieri	4.1 / 4.3	MP	u		0,02			Dianthus seguieri Vill.	30-60	H SCAP	8	6	4	3	3	2	0
Dianthus seguieri / D. carthusianorum	4.1 / <u>4.3</u>	MP	u			0,35		Dianthus carthusianorum L.	(5)30-45	H SCAP	5	6	5	4	3	3	0
Knautia cf arvensis	4.3	MP	u		0,71	3,06		Knautia arvensis (L.) Coulter	30-100	H SCAP	7	5	5	4	5	3	0
Knautia sp.	4.3	MP	u		0,87	6,02		several taxa									
Leucanthemum vulgare	4.3	MP	u	0,27		0,62		Leucanthemum vulgare Lam.	20-50(80)	H SCAP	7	X	4	4	X	3	0
Linum cf catharticum	4.1 / 6.1	MP	u				0,61	Linum catharticum L.	5-30	T SCAP	7	X	5	X	X	1	0
Medicago minima	3.1	MP	u			0,39	3,02	Medicago minima (L.) Bartal.	10-30(70)	T SCAP	11	7	5	3	8	1	0
Nepeta cataria	3.1	MP	u	1,91	1,78	4,75		Nepeta cataria L.	40-100	H SCAP	7	7	4	4	7	2	0
Onopordum acanthium	3.1	MP	u				0,30	Onopordum acanthium L.	50-150	H BIENNE	11	7	6	4	7	8	0
Orlaya grandiflora	3.1	MP	u				0,63	Orlaya grandiflora (L.) Hoffm.	10-70	T SCAP	7	6	6	3	7	6	0
Pastinaca sativa	3.1	MP	u	0,03		0,04		Pastinaca sativa L.	30-100(250)	H BIENNE	8	6	5	4	8	5	0
Petrorhagia prolifera	3.1	MP	u	**12,11**	0,29	5,14	1,59	Petrorhagia prolifera (L.) Ball Et Heyw.	15-40	T SCAP	8	5	5	2	X	2	0
Petrorhagia saxifraga	4.3	MP	u			1,94		Petrorhagia saxifraga (L.) Link	10-25	H CAESP	9	8	7	2	8	3	0
cf Plantago media	4.1	MP	u			0,32		Plantago media L.	20-40	H ROS	7	X	7	4	8	3	0
Potentilla cf tabernaemontani	4.1	MP	u			0,35		Potentilla tabernaemontani Asch.	5-30	H SCAP	7	5	5	2	7	2	0
Potentilla rupestris	4.1	MP	u		0,49	0,31		Potentilla rupestris L.	20-60	H SCAP	9	3	7	2	2	1	0
Prunella vulgaris	<u>4.3</u> / 2.4	MP	u	1,86	1,04	2,04		Prunella vulgaris L.	10-20(30)	H SCAP	7	6	4	6	4	X	0
Rumex acetosa	4.3	MP	u			0,04		Rumex acetosa L.	30-100	H SCAP	8	X	X	X	4	5	0
Rumex acetosella	4.3	MP	u	0,08		1,96		Rumex acetosella L.	10-30	H SCAP	8	5	5	5	1	2	0
Sanguisorba minor	4.1	MP	u	0,09			0,18	Sanguisorba minor Scop.	20-50	H SCAP	7	6	5	3	8	2	0
Scabiosa columbaria	4.3	MP	u			0,09		Scabiosa columbaria L.	20-80	T SCAP	8	5	5	4	8	2	0
Silene nutans	4.1	MP	u			0,88		Silene nutans L.	25-80	H ROS	7	5	5	3	7	3	0
Silene vulgaris	4.1	MP	u	0,03		0,12		Silene vulgaris (Moench) Garcke	10-50	H SCAP	8	X	X	4	7	2	0
Stachys recta	4.1	MP	u	0,36				Stachys recta L.	20-60	H SCAP	7	6	4	3	8	2	0
Stellaria palustris	4.3	MP	u				0,53	Stellaria palustris Retz.		H SCAP	5	5	7	8	4	2	0
Teucrium chamaedrys	4.1	MP	u	5,65	1,12	8,38	0,44	Teucrium chamaedrys L.	10-25	CH SUFFR	7	6	5	2	8	1	0
Thymus sp.	4.1	MP	u			0,77		Thymus vulgaris L.	10-30	CH FRUT	8	8	4	2	7	1	0
Trifolium cf pratense	4.3	MP	u			0,35		Trifolium pratense L.	15-40	CH PULV	7	X	4	X	X	X	0
Trifolium repens	4.3	MP	u			0,83		Trifolium repens L.		CH REPT	8	X	X	X	X	7	0

Tab. 8.2.1 - continued

Identified taxon	ecol grp	large ecol grp	pres	LUC EBA 1st ph items/l (8 smpl)	LUC EBA 2nd ph items/l (14 smpl)	LAV EBA items/l (11 smpl)	LAV MBA items/l (13 smpl)	possible corresponding taxon	growth height (cm)	life form	L	T	C	U	R	N	S
Trifolium sp.	4.3	MP	u		0,38	0,35	0,75	several taxa									
Verbascum thapsus / V. crassifolium / V. densiflorum	3.1	MP	u			0,70		Verbascum densiflorum Bertol.	(30)50-100(130)	H BIENNE	8	6	5	4	8	5	0
								Verbascum thapsus subsp thapsus L.	50-120	H BIENNE	8	X	4	4	7	7	0
								Verbascum thapsus subsp crassifolium (Lam et DC) Murb.	50-120	H BIENNE	8	X	4	4	7	7	0

APPENDICES

APPENDIX 1

Soils types in Lavagnone and Lucone basins

Soil types and properties in the studied area (based on ERSAL Minnelli 1997). Maps are illustrated in Fig. 1.2.5. and Fig. 1.2.6.

Class Mollisols

Endoaquols, (ERSAL type 56). FAO – Gleyc cambisols

Acronym in the maps:**eAq**

Soils provided with a mollic epipedon, rich in humus, base-satured, persistently water-satured (aquic regime).

ERSAL Type 56 – Endoaquols (Class Mollisols). FAO – Gleyic cambisols	
Description/land qualities	The surface horizon is a mollic horizon rich in humus, it is base-saturated and the pH subalcaline or alcaline. This horizon lies over a gravelly substratum, but the thickness of the mollic horizon may be significant for traditional ploughing techniques (up to 100 cm at Lavagnone). Drainage is very slow; it requires specific practices to improve it.
Land capability - arability	level IV, as these soils are humus-rich. Strongly limited by water saturation for most of the year. 56a – slope aquic soils, only seasonally or occasionally inundated, may be partially drained through channelling. Fertility level may be higher than the type 56b. **eAq(d)** in Fig. 1.2.5. 56b – persistently inundated soils (waterlogged soils). However, prolonged phases of low-level of the phreatic water table may led these soils to be ploughed, as organic deposits may originate mollic surface horizons, soft and rich in water.
Limitation	flooding
Intervening alteration factors since the Bronze Age	This area was reclaimed. The today mollisol is preserved since the BA, although the limitations (flooding) were reduced after reclaiming
Location	Lavagnone: basin (lower area). Area of ca. 24 hectares (12 hectares were occupied by lake water during the Bronze Age). About 6 hectares belong to 56a. Lucone: basin (lower area). Extension of the area ca. 18 hectares (8 hectares were the arable lakeshore area).

Class Entisols

Udarent (ERSAL type 38, 52) FAO – haplic calcisols

Acronym in the maps: **uEnt(alf)**

Poorly-evolved soils, missing a diagnostic horizon (enti-), due to disruption of the thin original profile by ploughing. *Udarents*, however, preserve properties recalling the diagnostic horizons from where they derive. In the area they are considered to originate from a disruption of thin alfisols.

ERSAL Type 52 – Udarent (class Entisols). FAO – Haplic Calcisols	
Reference profile: Ap1 – Ap2 – BCt – CBk – Ck (120 cm) (see ERSAL, 1997, p. 152)	
Description/notes	Ploughing horizon A_p involving most of the clayey rubified illuvial horizon rich in skeleton (BC_t). Ap is overall rich in carbonates (pH 8, carbonate 7-15%). Deep horizons CB and C_k include carbonate concretions until a depth of 40 to 60 cm. Total thickness above C is ca. 40 cm. The profile is very rich in calcareous pebbles. The argillic, slightly rubified horizon (B_t) is thin and may be subject to a short summer water balance. B_t is too thin for the soil being classified among the alfisols, as it is mostly involved in the A_p.
Land capability - arability	level IV - arable with strong limitations due to coarse grain size and limited soil depth.
Limitation	Abundant skeleton, thin profile, overall texture unfavourable for many uses
Intervening alteration factors since the Bronze Age	Ploughing caused moderate erosional processes and substantial soil erosion, thus increasing stoniness and causing recalcification of surface horizon.
Proposed soil attribution for the BA	Thin alfisols
Location	Lavagnone: fluvioglacial plain surrounding the basin. This unit covers most of the area surrounding the basin border (about 116 hectares in 1 km radius from the basin border). Lucone: an intermorainic plain area extending mainly south- and westwards, outside the basin of Lucone (about 44 hectares in a 1 km radius from the basin).

Udorthent (ERSAL types 33, 34, 37, 44, 49). FAO – calcaric regosols.

Acronym in the maps: **uEnt (calc)**

Poorly-evolved soils, missing a diagnostic horizon (enti-), due to disruption of the thin original profile by ploughing. *Udorthents* do not preserve clear properties recalling diagnostic horizons from where they may derive. This is the case of slope soils deeply degraded by erosion after forest clearing, intensive and persistent pasture. The original illuvial horizons have been completely removed. In current woodlands, the recent pedogenesis allows the development of rendzina-type soils.

ERSAL Types 34 and 37 – Udorthent (class Entisols) FAO – calcaric regosols	
Reference profile (type 37): Ap – C – Cdg (base C at 80 cm) (see ERSAL, 1997, p. 169) Reference profile (CNR, 2010): O – A – C – C (base C at 40 cm) (see CNR 2013)	
Description/note	Ap is heavily carbonatated (pH 8.3, carbonate 53%). C is a skeletal silty sand, rich in carbonates. In woodland areas this C-horizon supports an A-horizon (rendzina type). Deep horizons include carbonate concretions at a depth of 40 to 60 cm. It may be considered a recent soil, which does not preserve any of the features of the natural forest soil at the onset of the Bronze Age.
Land capability - arability	III level (37) - arable but with limitation due to limited depth. IV (34)

Limitation	Abundant skeleton, thin profile, overall texture unfavourable for many uses
Intervening alteration factors since the Bronze Age	Intensive erosion processes caused by pasture practises truncated the BA soil, most probably an alfisol.
Location	Lavagnone: morainic hills East and South of the basin. This unit covers significant areas surrounding the basin border (about 120 hectares in 1 km radius from the basin border). Lucone: morainic hills East and South of the basin (covering an area of about 78 hectares in a 1 km radius area around the basin)

Class Inceptisols

Aquic Eutrochrepts (ERSAL Type 40, 54) FAO – calcaric regosols
Fluviaquentic Eutrochrepts (ERSAL Type 66) FAO – calcari-gleyc cambisols

Acronym in the maps:**aqInc**

ERSAL Type 54 – Aquic Eutrochrepts (class Inceptisols) FAO – calcaric regosols	
Description/note	Thickness 25-60 cm, sub-level ground (slope 1-3%), slow drainage and low permeability due to the deep clay layer.
Land capability - arability	Level III - arable but with limitations because of low drainage.
Limitation	Thickness less than 60 cm, low permeability and stoniness.
Intervening alteration factors since the Bronze Age	Ploughing and cultivation most probably since the Bronze Age. Intensive after the definitive reclamation of the Lucone basin (1458 AD).
Location	Lavagnone:a small area of about 6.5 hectares south of the basin. Lucone: northern sector of the basin (ca 32hectares).

Class Alfisols

Hapludalf (ERSAL Type 32, 31, 35, 41, 42, 47, 50). FAO – Calcic Luvisols (31, 32) Chromic Luvisols (35, 42, 50)

Acronym in the maps:**Alf**

Soils provided with a subsurface argillic horizon, well-drained and rubified (5 YR). Most of the current *hapludalf* in the surrounding of the Lavagnone site result from erosion of earlier argillic horizons along slopes, thus leading to significant carbonate recharge and increasing of the skeletal component. On the other hand, in the Lucone area also type 35 occurs, which is a less skeletal and not calcareous *hapludalf*.

Type 31, 32, 35 – Hapludalf (Class alfisols). FAO – Calcic Luvisols (31, 32) Chromic Luvisols (35).	
Reference profile: o (A) – Bt1 – Bt2 – Ck – Cd/C (140 cm; Bt is 60 cm thick) See ERSAL, 1997, p. 165	
Description/note	31-32:thick argillic horizon, base-satured and recalcified (pH 7.5-8) after colluvial processes on hill slopes. Occurrence of a calcic horizon slightly cemented (Ck) with medium-size concretions in the deeper profile section. Given the significant B_t thickness, these soils offer a good water-holding capacity. Significant limitation to ploughing is due to steepness. 35: due to lower sloping, this type differs by having a limited skeletal fraction and a lower content of carbonates.
Land capability - arability	Level III-(35) arable but subject soil erosion due to sloping 8-15%; level VI for steep slopes (31-32)- not arable because of sloping, only pasture or woodland possible
Limitation	High susceptibility to water erosion because of steep slopes (25-45%).
Intervening alteration factors since the Bronze Age	Significant sloping would promote erosional processes, but the pre-anthropic Holocene soil is mostly preserved as the forest cover was kept until now.
Location	31-32: small surfaces occurring in a radius of 1km from the border of the Lavagnone basin. Farther West of Lavagnone. 31-32-35: higher hills in the southern morainic amphitheatre e.g. *Monte Nuvolo, Crosere di Lonato, Lago di Polecra, Corno Gerardi.* 31-32: wide surfaces in a radius of 1km from the border of the Lucone basin. Type 35 also occurring close to Lucone basin.
Total surface of the Alfisols	<u>Lavagnone</u>: about 105 hectares in the area of 1 km radius surrounding the basin. <u>Lucone</u>: deep Alfisols extended for about 38 hectares, Alfisols on steep slope occupied an area of about 64 hectares.

Surface of the timber track-way

Organic horizon
(molli epipedon)

Gravelly parental material

Profile of the buried soil (mollisol type) found under the timber track-way of the Sector B in the Lavagnone site (year 2006).

APPENDIX 2

Modern floristic list of Lavagnone and Lucone basins

LAVAGNONE

Flora strictly related to the palustrine basin of Lavagnone according to Frattini 2008

Acer negundo L.
Acer pseudoplatanus L.
Achillea roseo-alba Ehrend.
Alisma plantago-aquatica L.
Alnus glutinosa (L.) Gaertner
Alopecurus myosuroides Hudson
Artemisia verlotiorum Lamotte
Athyrium filix-foemina (L.) Roth
Berula erecta (Hudson) Coville
Bidens frondosa L.
Bryonia dioica Jacq.
Calystegia sepium (L.) R. Br.
Carex acutiformis Ehrh.
Carex elata All.
Carex hirta L.
Carex otrubae Podp.
Carex pseudocyperus L.
Carex riparia Curtis
Carex vesicaria L.
Chenopodium polyspermum L.
Circaea lutetiana L.
Cirsium arvense (L.) Scop.
Cornus sanguinea L. subsp. *hungarica* (Kárpáti) Soó
Crataegus monogyna Jacq.
Cyperus flavescens L.
Cyperus fuscus L.
Cyperus glomeratus L.
Cyperus longus L.
Cyperus microiria Steudel
Dryopteris carthusiana (Vill.) H. P. Fuchs
Dryopteris filix-mas (L.) Schott
Echinochloa crus-galli (L.) Beauv.
Epilobium hirsutum L.
Epilobium parviflorum Schreber
Equisetum arvense L.
Equisetum palustre L.
Equisetum telmateja Ehrh.
Eupatorium cannabinum L.
Euphorbia platyphyllos L.
Ficus carica L.
Frangula alnus Miller
Galium aparine L.
Galium elongatum Presl
Galium mollugo L.
Galium palustre L.
Geum urbanum L.
Glechoma hederacea L.
Hedera helix L.
Holcus lanatus L.
Humulus lupulus L.
Hypericum tetrapterum Fries
Iris pseudacorus L.
Juncus articulatus L.
Lapsana communis L.
Lemna minor L.
Lemna minuta Humb. Bonpl. e Kunth
Lemna trisulca L.
Ligustrum lucidum Ait.
Ligustrum sinense Lour.
Ligustrum vulgare L.
Lychnis flos-cuculi L.
Lycopus europaeus L.
Lysimachia nummularia L.
Lysimachia vulgaris L.
Lythrum salicaria L.
Mentha aquatica L.
Mentha longifolia (L.) Hudson
Morus alba L.
Myosotis scorpioides L.
Oxalis fontana Bunge
Parietaria officinalis L.
Parthenocissus quinquefolia (L.) Planchon
Phragmites australis (Cav.) Trin.
Platanus ×hispanica Münchh.
*Polygonum hydropiper*L.
Polygonum mite Schrank
Polygonum persicaria L.
Populus alba L.
Populus ×canadensis L.
Potentilla reptans L.
Prunus avium L.
Prunus mahaleb L.
Pulicaria dysenterica (L.) Bernh.
Ranunculus acris L.
Ranunculus friesianus Jordan
Ranunculus repens L.
Ranunculus sceleratus L.

Rubus caesius L.
Rubus ulmifolius Schott
Rumex conglomeratus Murray
Salix alba L.
Salix cinerea L.
Salix triandra L.
Sambucus nigra L.
Schoenoplectus lacustris (L.) Palla
Solanum dulcamara L.
Solanum nigrum L.
Solidago canadensis L.
Solidago gigantea Aiton
Sparganium erectum L.
Symphytum officinale L.
Tamus communis L.
Thelypteris palustris Schott
Typha angustifolia L.
Typha latifolia L.
Typhoides arundinacea (L.) Moench
Ulmus minor Miller
Urtica dioica L.
Valeriana dioica L.
Verbena officinalis L.
Veronica anagallis-aquatica L.
Viburnum opulus L.
Vitis riparia Michx.

Furthermore the occurrence of the Hepatic species *Riccia fluitans* L. has been confirmed.

Species occurrence not confirmed after Bèguinot (1931)
Caldesia parnassifolia, discovered by Ugolini (1898)
Blackstonia perfoliata subsp.*serotina*
Gnaphalium luteo-album
Lotus tenuis
Myriophyllum verticillatum
Nuphar lutem
Nymphaea alba
Potamogeton gramineus
Potamogeton lucens
Potamogeton natans
Potamogeton pectinatus
Ranunculus lingua
Rorippa amphibia

Species occurrence not confirmed after Desfayes (1995)
Carex oederi
Oenanthe acquatica
Teucrium scordium
Leersia oryzoides *
*Ludwigia palustris**

* species not listed in Beguinot (1931)

LUCONE
Flora strictly related to the palustrine basin of Lucone according to Frattini 2008

Abutilon theophrasti Medicus
Acer campestre L.
Acer negundo L.
Alisma plantagoaquatica L.
Alliaria petiolata (Bieb.) Cavara et Grande
Alnus glutinosa (L.) Gaertner
Artemisia verlotiorum Lamotte
Athyrium filix-foemina (L.) Roth
Bidens frondosa L.
Brachypodium sylvaticum (Hudson) Beauv.
Bryonia dioica Jacq.
Calepina irregularis (Asso) Thell.
Callitriche obtusangula Le Gall.
Callitriche stagnalis Scop.
Calystegia sepium (L.) R. Br.
Carex acutiformis Ehrh.
Carex elata All.
Carex hirta L.
Carex panicea L.
Carex pendula Hudson
Carex pseudocyperus L.
Carex riparia Curtis
Circaea lutetiana L.
Cirsium arvense (L.) Scop.
Clematis vitalba L.
Cornus sanguinea L. subsp. *australis* (C.A.Meyer) Jáv.
Cornus sanguinea L. subsp. *hungarica* (Kárpáti) Soó
Crataegus monogyna Jacq.
Cyperus fuscus L.
Cyperus longus L.
Dactylis glomerata L.
Echinochloa crus-galli (L.) Beauv.
Epilobium hirsutum L.
Epilobium parviflorum Schreber
Equisetum arvense L.
Equisetum fluviatile L.
Equisetum palustre L.
Equisetum ramosissimum Desf.
Equisetum telmateja Ehrh.
Euonimus europaeus L.
Eupatorium cannabinum L.
Euphorbia platyphyllos L.
Festuca arundinacea Schreber
Fragaria vesca L.
Frangula alnus Miller
Galium aparine L.
Galium mollugo L.
Galium palustre L.
Geum urbanum L.
Glechoma hederacea L.
Groenlandia densa (L.) Fourr.
Hedera helix L.
Holcus lanatus L.
Humulus lupulus L.
Hypericum tetrapterum Fries
Juncus articulatus L.
Juncus bufonius L.
Lapsana communis L.
Lemna minor L.
Lemna minuta Humb. Bonpl. & Kunth
Lemna trisulca L.
Ligustrum vulgare L.
Lycopus europaeus L.
Lysimachia nummularia L.
Lysimachia vulgaris L.
Lythrum salicaria L.
Mentha aquatica L.
Mentha longifolia (L.) Hudson
Morus alba L.
Myosotis scorpioides L.
Myosoton aquaticum (L.) Moench
Nasturtium officinale R. Br.
Ornithogalum umbellatum L.
Oxalis fontana Bunge
Parietaria officinalis L.
Phragmites australis (Cav.) Trin.
Phytolacca americana L.
Platanus ×hispanica Münchh.
Poa palustris L.
Poa trivialis L.
Polygonum lapathifolium L.
Polygonum mite Schrank
Polygonum persicaria L.
Populus alba L.
Populus ×canadensis L.
Populus ×canescens (Aiton) Sm.
Populus nigra L.
Populus nigra L. cv. "*Italica*"

Potentilla erecta (L.) Rauschel
Potentilla reptans L.
Prunus avium L.
Prunus domestica L.
Ranunculus acris L.
Ranunculus repens L.
Robinia pseudoacacia L.
Rubus caesius L.
Rubus ulmifolius Schott
Rumex conglomeratus Murray
Salix alba L.
Salix cinerea L.
Sambucus nigra L.
Scrophularia nodosa L.
Scutellaria galericulata L.
Sicyos angulatus L.
Solanum dulcamara L.
Solanum nigrum L.
Sparganium erectum L.
Tamus communis L.
Thalictrum aquilegifolium L.
Thalictrum lucidum L.
Thelypteris palustris Schott
Typha latifolia L.
Ulmus minor Miller
Urtica dioica L.
Valeriana collina Wallroth
Valeriana dioica L.
Valeriana officinalis L.
Verbena officinalis L.
Veronica anagallis-aquatica L.
Veronica beccabunga L.
Veronica hederifolia L.
Veronica persica Poiret
Viburnum opulus L.

Furthermore the occurrence of the Algae genus *Chara* has been confirmed.

Species occurrence not confirmed after Desfayes (1995)
Ceratophyllum demersum
Cyperus flavescens
Juncus inflexus
Polygonum amphibium
Polygonum hydropiper
Myriophyllum verticillatum
Ranunculus lingua

APPENDIX 3

Description of the archaeological Stratigraphic Units (SU)

LAVAGNONE

Description of the archaeological Stratigraphic Units (US) and their archaeological context of the Lavagnone site are given in the following table. All the information have been extrapolated by the internal archaeological report (resp. Prof. R.C. de Marinis and Dr. M. Rapi, Dept. of Cultural Heritage and Environment, Università degli Studi di Milano). Only Stratigraphic Units yielding samples analysed for plant macroremains have been considered.

US	Description	Context / note	US over/ under	plan	Archeobot. samples
EBA IA cultural layers - Lavagnone 2 SECTOR A					
338d	Brown-yellowish and very fine organic layer at the bottom of the cultural deposit. It contains pottery fragments and charcoal remains. Burnt horizontal plank and post are laying on its top.	cumulus	US338e / US338c	plan57 (N-O), plan98 (P), plan76 (I-L)	c95, c270
338c	Thicker layer formed by the accumulation of organic remains (wood, plant remains and bones) and pottery finds (some of them complete and upright). Burnt plank and posts are laying at its top. At the contact with the 338d layer, the brushwood and wood remains have a bigger size.	cumulus	US338d / US338b	plan57 (N-O), plan98 (P), plan76 (I-L)	c98, c169, c195bis, c133, c143, c197, c258, E2, RP02, W04, c134, rr140, c135, c98, NN1, c136
338a	Silty and organic layer composed by abundant remains of wood, brushwood, twigs, burnt plank and cultural remains.	cumulus	US338b / US337	plan57 (N-O), plan98 (P), plan76 (I-L)	c76, c132, rr131, rr114, rr115, c168, E1
EBA IB cultural layers - Lavagnone 3 SECTOR A					
337		cumulus	US338a / US336	plan57 (N-O), plan98 (P), plan76 (I-L)	B102
472				(near plan278)	rr625
MBA III (=MBA IIC) cultural layers - SECTOR D					
4004	Organic layer with wood and bark remains, Cornelian cherry stones and other fruits, charcoal and pottery fragments.	Cultural layer	4003, 4007 / 4001		c4025, c4034
4006	Very dark brown, silty and organic layer with abundant wood elements, mostly represented by upright posts with broken ends. In the quadrant D3, abundant pebbles, rich-sand and silty fractions with pottery fragments have been found. In the quadrant B3, two burnt wood finds have been found.The rr4013 artefact dating to BMA III has been found in this layer.	Cultural layer	4011, 4012 / 4002, 4005, 4003	4004	c4063, c4064, c4065, c4069, c4073, c4074, c4075, c4076, c4078
4009	Thin (max 2-5 cm) and brown layer formed by abundant pebbles and wood remains, mostly concentrated in the quadrants A-B1. The layer is sloping from E to W. The occurrence of gravels in the sandy layers accounts for an anthropogenic origin.	Cultural layer.	4011, 4010 / 4003, 4008	4006	c4061
4010	Greysilty-sandy matrix layer with abundant pebbles (fine, middle and coarse) and small wood remains. It slopes westwards as SU4009. Scattered and abundant almost complete pottery finds occurred in the uppermost part of the layer. At the contact with SU4011 some pottery finds are aligned on the same level.	Cultural layer	4011 / 4009	4007	c4072

LUCONE

Description of the archaeological Stratigraphic Units (US) and their archaeological context of the Lucone D site are given in the following table. All the information have been extrapolated by the internal archaeological report (resp. Dr. M. Baioni, director of the Civico Museo Archeologico della Val Sabbia, Gavardo). Only Stratigraphic Units yielding samples analysed for plant macroremains have been considered.

US	Description	Context / note	US over/under	plan	Archeobot. samples
1st settlement phase					
4	Silty, dark brown layer with irregular thickness, including a huge amount of charcoal. The layer covers the whole area and is particularly thick in the N and central sector. In the N sector charred cereals are significantly abundant.	burnt layer	US3 / US5		c28, c33, c34, c34b, c35, c39, c51, c58
5	Peaty layers rich in plant material (stems, twigs, wood fragments and fruits). Pottery is not abundant.		US3-US4 / US6		c1, c46 (US4/5) c63, c107, c113
12	--	= US4			c28
2nd settlement phase					
46	Silty, dark grey-black layer with charcoal fragments, continuous, and with irregular thickness. The top of the layer includes small burnt daub and white crushed stones.	cumulus US160 (cumulus = dump of discharge material)	US67-US70-US69-US68 / US164	115-112-132-133-136	c307
71	Thin, silty, light brown layer including overcooked pottery fragments.	cumulus US160	--- / US161	146-214	c299
86	Layer (lens) with ash and charcoal including yellowish clayey components which homogenizing with another ash layer (US90)	cumulus US84	US87 / US52-US91-US90	147	c207
92	Layer (silty grey lens) rich of ash and charcoal with fragments of burnt daub, pottery and meal remnants (charred bones fragments). This thrown material partly formed the cumulus US84.	cumulus US84	US89 / US90	148	c238
97	Silty brown layer including sub-horizontal pottery	cumulus US84		148	c237
103	Silty, grey-dark brown layer with a lot of burnt daub, bones, pottery. Remains are strongly fragmented.		US94-US95 / US104	157	c220
112	Silty-clay, light grey layer with yellowish-orange inclusion, charcoal, few ash.		US53 / ---	158	c226
127	Silty-sandy, yellow-grey layer, rather chaotic, rich of bones, pottery, macro plant remains (hazel shells, twigs).The layer is laying under the cumulus US84 whose weight deformed the underlying stratigraphy. Apparently the layer ends over the cumulus.	Under the cumulus US84	US97-US122-US123 / ---	168	c242, cNN1
140	Silty black layer rich of wood fragments. In the quadrant 490N-49E it gets grey-yellowish likely due to the underlying and overlying yellow layers; it is less thick than in the rest of the excavated area and it has a less concentration of wood. Layer boundaries are not well defined.	Closed o the cumulus 88 (US116)	US116-US133 / US141		C304
159	Silty and dark grey lens on the top of the cumulus (US160). Not very thick (maybe left by the excavation of other stratigraphic units)	cumulus US160	--- / US160-US46	146-214	c300
161	Silty, dark layer with a small silty and light yellowish lens (498-499) whose thickness varies and grows thin towards the cumulus (US160).	cumulus US160	US46-US159-US71 / US160-	146-214	c313

			US161-US162		
162	Thick lens with a clay matrix. Large clay agglomerates. Pottery and faunal remains with a chaotic distribution. A big stone (10-15 cm) is also embedded.	cumulus US160	US161-US71 / ---	215-229	c302
163	Thick silty lens with lots of burnt daubs embedded in a silty matrix with much ash. Pottery and faunal remains with a chaotic distribution.	cumulus US160	US161 / US46	214-215	c301
164	Brown, very organic layer rich of many seeds and charred or not wood fragments. The inorganic fraction is lacking.	cumulus US160	US46-US184 / ---	232-214-218-234-236-238	c305
167	Compact silty grey layer with charcoal (at the bottom of the cumulus), burnt daubsand pottery.	cumulus US160	US46-US160 / US168	224	c310
171	Compact silty grey layer with a mixed composition, including big charcoal fragments, stones and a small accumulation of burnt daubs. At the bottom there is a discontinuous thin layer of ash of light colour. Big charcoal fragments are diffused.	cumulus US160	US160-US167 / ---	226-227	c311
174b	Grey layer with diffused ash subdivided in: 174A: silty layer and ash with small widespread charcoal fragments, several white / light grey ash lens 174B: brown lens of cm size and compact aggregates. 174C: brown layer with mm inclusions, likely = 174A but the organic fraction is less deteriorated (it grows grey from the centre of the cumulus outwards)		US176-US171 / US185	232-234	c325
181	Silty brown layer with many plant remains	= US189	US180-US195 / ---	235	c320
196	Silty layer with high percentage of plant remains and burnt daubsdust.				c333
198	Silty brown / dark grey layer with many plant remains and scattered charcoal fragments.		--- / US148-US197	235	c343
200	Layer composed by a silty white lens maybe in continuity with a black compact lens. Under the white lens there is a brown silty interface separating the lens from another yellow one.		US207 / US208-US209	244	c367
207	Silty dark brown layer particularly rich of plant remains in the western part. The layer covers white lens (US201) and is coalescent with other sandy lens.		US202 / US200-US201-US206	244	c372
231					
235	Silty layer with clay lens of different colours and thickness. It is subdivided in a thin layer with orange/green olive sandy-clay inclusions (maybe cooked) and a layer with thicker whitish inclusions which formed in the quadrant N495 E487 a pluri-stratified cumulus of small grey-whitish lens and thin brown layers. The cumulus is formed by many thin plastic layers and thin brown layers of organic matter.		US232 / US224	260	c394; c397

APPENDIX 4

List of analysed samples

LAVAGNONE (Desenzano del Garda, N-Italy)
List of analysed samples

sample name	short name	Stratigraphic Units	year	sample volume	method of analysis	analysed organic fractions (mm)
Sector A: EBA surface samples						
				volume (l)		
LAV96A US 338d qN4 sample 95	c95	338d	1996	1,50	RapScr	4, 2
LAV96A US 338c qL8-7 sample 98	c98	338c	1996	1,20	RapScr	4, 2
LAV97A US 338 qN7 sample RR 114	rr114	338a	1997	7,00	RapScr	4, 2
LAV97A US 338c qO7smple RR140	rr140	338c	1997	11,00	RapScr	4, 2
LAV97A US 338a qO7sample RR 131	rr131	338a	1997	4,80	RapScr	4, 2
LAV97A US 338a qO8 sample 132	c132	338a	1997	2,80	RapScr	4, 2
LAV97A US 338c qO6 sample 133	c133	338c	1997	0,50	RapScr	4, 2
LAV97A US 338c qO7 sample 134	c134	338c	1997	2,00	RapScr	4, 2, 0.35
LAV99A US 338a qP5 sample 168	c168	338a	1999	1,20	RapScr	4, 2
LAV02A US 338c qO6 sample 197	c197	338c	2002	1,10	RapScr	4, 2
LAV04A US 338a qO8 sample E1	E1	338a	2004	2,00	RapScr	4, 2
LAV04A US 338c qP6 sample E2	E2	338c	2004	2,00	RapScr	4, 2
LAV05A US 338c qP5 sample 258	c258	338c	2005	0,80	RapScr	4, 2
LAV05A US 338d qOP5-6 sample 270	c270	338d	2005	1,00	RapScr	4, 2
LAV96A US 338a qL8-9 sample 76	c76	338a	1996	1,70	RapScr / FullAnal	4, 2, 0.35
LAV96A US 338c qL8-7 sample NN1	NN1	338c	1996	3,00	RapScr / FullAnal	4, 2, 0.35
LAV97A US 338c qO9 sample 136	c136	338c	1997	2,50	RapScr / FullAnal	4, 2, 0.35
LAV97A US 338c qO8 sample 135	c135	338c	1997	2,00	RapScr / FullAnal	4, 2, 0.35
LAV97A US 338a qN5 sample RR115	rr115	338a	1997	2,50	RapScr / FullAnal	4, 2, 0.35
LAV97A US 338c qO6 sample 143	c143	338c	1997	2,00	RapScr / FullAnal	4, 2, 0.35
LAV99A US 338 qI6 sample 169	c169	338c	1999	1,80	RapScr / FullAnal	4, 2, 0.35
LAV02A US 338c qOP7 sample 195	c195bis	338c	2002	1,30	RapScr / FullAnal	4, 2, 0.35
LAV03A US 338 c/d qOP9 sample W04	W04	338c/d	2003	2,00	RapScr / FullAnal	4, 2, 0.35
LAV05A US 338c qP5 sample RP02	RP02	338c	2005	4,00	RapScr / FullAnal	4, 2, 0.35
LAV05A US 472 qO11 sample234 rr 625	rr625	472	2005	2,00	Full Anal	2, 0.35
Sector A: profile from section 98						
samples from BOX1 (40-90 cm):				volume (l)		
LAV04B1 04	B1/04	337	2004	0,40	Full Anal	4, 2, 0.35
LAV04B1 02	B1/02	338a	2004	0,30	Full Anal	4, 2, 0.35
samples from BOX2 (111-161 cm):						
LAV04B2 14	B2/14	338c	2004	0,58	Full Anal	4, 2, 0.35
LAV04B2 13	B2/13	338c	2004	0,30	Full Anal	2
LAV04B2 12	B2/12	338c	2004	0,50	Full Anal	4, 2, 0.35
LAV04B2 11	B2/11	338c	2004	0,14	Full Anal	4, 2
LAV04B2 09	B2/09	338c	2004	0,26	Full Anal	2
LAV04B2 07	B2/07	338c	2004	0,44	Full Anal	4, 2, 0.35
LAV04B2 03	B2/03	338c	2004	0,40	Full Anal	4, 2, 0.35

Sector D: MBA surface samples

				volume (l)		
LAV07D US4004 qE1 sample 4025	c4025	4004	2007	4,00	Full Anal	4, 2, 0.35
LAV07D US4004 qB1 sample 4034	c4034	4004	2007	3,80	Full Anal	4, 2, 0.35
LAV11D US4009 qA1 sample 4061	c4061	4009	2011	4,50	Full Anal	4, 2, 0.35
LAV11D US4006 qA5 sample 4063	c4063	4006	2011	5,00	Full Anal	4, 2, 0.35
LAV11D US4006 qC5 sample 4064	c4064	4006	2011	4,00	Full Anal	4, 2, 0.35
LAV11D US4006 qA3-A2 sample 4065	c4065	4006	2011	5,00	Full Anal	4, 2, 0.35
LAV11D US4006 qB4 sample 4069	c4069	4006	2011	5,50	Full Anal	4, 2, 0.35
LAV11D US4010 qE1 sample 4072	c4072	4010	2011	5,00	Full Anal	4, 2, 0.35
LAV11D US4006 qA2 sample 4073	c4073	4006	2011	6,50	Full Anal	4, 2, 0.35
LAV11D US4006 qE3 sample 4074	c4074	4006	2011	5,00	Full Anal	4, 2, 0.35
LAV11D US4006 qC3 sample 4075	c4075	4006	2011	5,00	Full Anal	4, 2, 0.35
LAV11D US4006 qE5 sample 4076	c4076	4006	2011	5,00	Full Anal	4, 2, 0.35
LAV11D US4006 qD4 sample 4078	c4078	4006	2011	4,00	Full Anal	4, 2, 0.35

Sector D: samples from the stratigraphic sequence

real depth	correlated depth		volume (ml)		
LAV37 55-60 cm	57,5	2010	96	Full Anal	1, 0.35
LAV37 60-65 cm	62,5	2010	96	Full Anal	1, 0.35
LAV37 65-70 cm	67,5	2010	96	Full Anal	1, 0.35
LAV37 70-77 cm	73,5	2010	135	Full Anal	1, 0.35
LAV37 73-78 cm	75,5	2010	96	Full Anal	1, 0.35
LAV37 78-83 cm	80,5	2010	96	Full Anal	1, 0.35
LAV37 83-88 cm	85,5	2010	96	Full Anal	1, 0.35
LAV37 88-93 cm	90,5	2010	96	Full Anal	1, 0.35
LAV37 93-98 cm	95,5	2010	96	Full Anal	1, 0.35
LAV37 98-103 cm	100,5	2010	96	Full Anal	1, 0.35
LAV37 103-108 cm	105,5	2010	96	Full Anal	1, 0.35
LAV37 108-113 cm	110,5	2010	96	Full Anal	1, 0.35
LAV37 113-118 cm	115,5	2010	96	Full Anal	1, 0.35
LAV37 118-123 cm	120,5	2010	96	Full Anal	1, 0.35
LAV37 123-128 cm	125,5	2010	96	Full Anal	1, 0.35
LAV37 128-133 cm	130,5	2010	96	Full Anal	1, 0.35
LAV37 133-138 cm	135,5	2010	96	Full Anal	1, 0.35
LAV37 138-142 cm	140	2010	77	Full Anal	1, 0.35
LAV37 146-151 cm	148,5	2010	96	Full Anal	1, 0.35
LAV37 151-156 cm	153,5	2010	96	Full Anal	1, 0.35
LAV37 156-161 cm	158,5	2010	96	Full Anal	1, 0.35
LAV37 161-166 cm	163,5	2010	96	Full Anal	1, 0.35
LAV37 166-171 cm	168,5	2010	96	Full Anal	1, 0.35
LAV37 171-176 cm	173,5	2010	96	Full Anal	1, 0.35
LAV37 176-181 cm	178,5	2010	96	Full Anal	1, 0.35
LAV37 181-186 cm	183,5	2010	96	Full Anal	1, 0.35
LAV37 186-191 cm	188,5	2010	96	Full Anal	1, 0.35
LAV37 191-196 cm	193,5	2010	96	Full Anal	1, 0.35
LAV37 196-201 cm	198,5	2010	96	Full Anal	1, 0.35
LAV37 201-206 cm	203,5	2010	96	Full Anal	1, 0.35
LAV37 206-211 cm	208,5	2010	96	Full Anal	1, 0.35

LAV37 211-215 cm	213	2010	96	Full Anal	1, 0.35
LAV37 224.5-229 cm	227	2010	87	Full Anal	1, 0.35
LAV37 229-234 cm	231,5	2010	96	Full Anal	1, 0.35
LAV37 234-239 cm	236,5	2010	96	Full Anal	1, 0.35
LAV37 239-244 cm	241,5	2010	96	Full Anal	1, 0.35
LAV37 244-249 cm	246,5	2010	96	Full Anal	1, 0.35
LAV37 249-254 cm	251,5	2010	96	Full Anal	1, 0.35
LAV37 254-260 cm	257	2010	115	Full Anal	1, 0.35
LAV37 260-265 cm	262,5	2010	96	Full Anal	1, 0.35
LAV37 265-270 cm	267,5	2010	96	Full Anal	1, 0.35
LAV37 270-275 cm	273,5	2010	96	Full Anal	1, 0.35
LAV37 275-280 cm	277,5	2010	96	Full Anal	1, 0.35
LAV37 280-285 cm	282,5	2010	96	Full Anal	1, 0.35
LAV37 285-288 cm	286,5	2010	58	Full Anal	1, 0.35
LAV37 290-294 cm	292	2010	77	Full Anal	1, 0.35
LAV37 294-299 cm (BT 297 cm)	296,5	2010	96	Full Anal	1, 0.35
LAV37 312-316 cm	299	2007	113,04	Full Anal	1, 0.35
LAV37 316-320 cm	303	2007	113,04	Full Anal	1, 0.35
LAV37 320-325 cm	307,5	2007	141,3	Full Anal	1, 0.35
LAV37 325-330 cm	312,5	2007	141,3	Full Anal	1, 0.35
LAV37 330-335 cm	317,5	2007	141,3	Full Anal	1, 0.35
LAV37 335-339 cm	322	2007	113,04	Full Anal	1, 0.35
LAV37 339-344 cm	326,5	2007	113,04	Full Anal	1, 0.35
LAV37 344-348 cm	331	2007	113,04	Full Anal	1, 0.35
LAV37 348-352 cm	335	2007	113,04	Full Anal	1, 0.35
LAV37 352-358 cm	340	2007	169,56	Full Anal	1, 0.35
LAV37 358-361 cm	344,5	2007	84,78	Full Anal	1, 0.35
LAV37 361-364 cm	347,5	2007	84,78	Full Anal	1, 0.35
LAV37 364-368 cm	351	2007	113,04	Full Anal	1, 0.35
LAV37 368-371,5 cm	354,75	2007	98,91	Full Anal	1, 0.35
LAV37 371,5-375 cm	358,25	2007	98,91	Full Anal	1, 0.35
LAV37 375-379 cm	362	2007	113,04	Full Anal	1, 0.35
LAV37 379-384 cm	366,5	2007	141,3	Full Anal	1, 0.35
LAV37 385-388 cm	371,5	2007	84,78	Full Anal	1, 0.35
LAV37 388-391 cm	374,5	2007	84,78	Full Anal	1, 0.35
LAV37 391-395 cm	378	2007	113,04	Full Anal	1, 0.35
LAV37 395-398,5 cm	381,75	2007	98,91	Full Anal	1, 0.35
LAV37 398,5-400 cm	384,25	2007	98,91	Full Anal	1, 0.35
LAV37 400-403 cm	386,5	2007	84,78	Full Anal	1, 0.35
LAV37 403-406 cm	389,5	2007	84,78	Full Anal	1, 0.35
LAV37 406-411 cm	393,5	2007	141,3	Full Anal	1, 0.35
LAV37 411-414,5 cm	397,75	2007	98,91	Full Anal	1, 0.35
LAV37 414,5-418 cm	401,25	2007	98,91	Full Anal	1, 0.35
LAV37 418-421 cm	404,5	2007	84,78	Full Anal	1, 0.35
LAV37 421-422,5 cm	406,75	2007	42,39	Full Anal	1, 0.35
LAV37 422,5-427 cm	409,75	2007	127,17	Full Anal	1, 0.35
LAV37 427-432 cm	414,5	2007	141,3	Full Anal	1, 0.35
LAV37 432-434 cm	418	2007	56,52	Full Anal	1, 0.35
LAV37 434-436 cm	420	2007	56,52	Full Anal	1, 0.35
LAV37 436-440 cm	423	2007	113,04	Full Anal	1, 0.35
LAV37 440-443 cm	426,5	2007	84,78	Full Anal	1, 0.35
LAV37 443-446,5 cm	429,75	2007	98,91	Full Anal	1, 0.35

LAV37 446,5-448,5 cm	432,5	2007	56,52	Full Anal	1, 0.35
LAV37 448,5-450 cm	434,25	2007	42,39	Full Anal	1, 0.35
LAV37 450-453 cm	436,5	2007	84,78	Full Anal	1, 0.35
LAV37 454-455,5 cm	440	2007	50,86	Full Anal	1, 0.35
LAV37 455,8-461,3 cm	443,55	2007	155,43	Full Anal	1, 0.35

LUCONE D (Polpenazze del Garda, N-Italy)
List of analysed samples

sample name	short name	sample volume	method of analysis	analysed organic fractions (mm)
Settlement phase 1				
		volume (l)		
LUC07 N495 E496 US5	LUC c1	9,00	RapScr / FullAnal	2-0,35
LUC07 N492 E493 US12 sample c28	LUC c28	5,00	RapScr	4, 2
LUC07 N491 E492 US4 sample c33	LUC c33	8,00	RapScr	4, 2
LUC07 N490 E494 US4 sample c34	LUC c34	1,00	RapScr / FullAnal	4, 2, 0.35
LUC07 N491 E493 US4 sample c34b	LUC c34b	4,00	RapScr	4, 2
LUC07 N491 E494 US4 sample c35	LUC c35	4,00	RapScr	4, 2
LUC07 N494 E492 US4 sample c39	LUC c39	4,00	RapScr	4
LUC07 N494 E494 US4/5 sample c46	LUC c46	5,00	RapScr / FullAnal	4, 2, 0.35
LUC07 N493E493 US4 sample c51	LUC c51	4,00	RapScr / FullAnal	4, 2, 0.35
LUC07 N495 E492 US4 sample c58	LUC c58	5,00	RapScr / FullAnal	4, 2, 0.35
LUC07 N497E492 US5 sample c63	LUC c63	1,50	RapScr / FullAnal	4, 2, 0.35
LUC08 N489 E494 US5 sample c107	LUC c107	7,00	RapScr / FullAnal	4, 2, 0.35
LUC08 N489 E494 US5 sample c113	LUC c113	4,20	RapScr / FullAnal	4, 2, 0.35
Settlement phase 2				
		volume (l)		
LUC10 N495 E486 US 86 sample c207	LUC c207	4,50	RapScr / FullAnal	4, 2, 0.35
LUC10 N498 E486 US 103 sample c220	LUC c220	4,00	RapScr / FullAnal	4, 2, 0.35
LUC10 N490 E486 US 112 sample c226	LUC c226	4,50	RapScr / FullAnal	4, 2, 0.35
LUC10 N494 E486 US 97 sample c237	LUC c237	5,00	RapScr / FullAnal	4, 2, 0.35
LUC10 N495 E486 US 92 sample c238	LUC c238	4,00	RapScr	4, 2
LUC10 N494 E485 US 127 sample c242	LUC c242	4,00	RapScr / FullAnal	4, 2, 0.35
LUC10 N496-5 E485 US127	LUC cNN1	5,00	RapScr / FullAnal	2, 0.35
LUC11 N498 E496 US71 c299	LUC c299	3,00	RapScr	4, 2
LUC11 N497 E496 US159 c300	LUC c300	4,00	RapScr	4, 2
LUC11 N497 E498 US163 c301	LUC c301	3,80	RapScr	4, 2
LUC11 N498 E496 US162 c302	LUC c302	4,50	RapScr	4, 2
LUC11 N490 E491 US140 c304	LUC c304	3,00	RapScr	4
LUC11 N495 E498 US164 c305	LUC c305	5,50	RapScr / FullAnal	4, 2, 0.35
LUC11 N496 E496 US46 c307	LUC c307	5,00	RapScr	4, 2
LUC11 N497 E497 US167 c310	LUC c310	4,00	RapScr / FullAnal	4, 2, 0.35
LUC11 N496 E496 US171 c311	LUC c311	3,00	RapScr	4, 2
LUC11 N497 E498 US161 c313	LUC c313	4,00	RapScr	2

LUC11 N496 E485 US181 c320	LUC c320	3,50	RapScr	4, 2
LUC11 N496 E496 US174B c325	LUC c325	4,20	RapScr / FullAnal	4, 2, 0.35
LUC11 N490 E490 US196 c333	LUC c333	4,00	RapScr	4, 2
LUC11 N489 E487 US198 c343	LUC c343	3,50	RapScr / FullAnal	4, 2, 0.35
LUC11 N496 E487 US200 c367	LUC c367	4,00	RapScr / FullAnal	4, 2, 0.35
LUC11 N495 E485 US207 c372	LUC c372	4,00	RapScr / FullAnal	4, 2, 0.35
LUC11 N496 E486 US235 c394	LUC c394	3,00	RapScr / FullAnal	4, 2, 0.35
LUC11 N496 E486 US235 c397	LUC c397	3,50	RapScr / FullAnal	4, 2, 0.35

Judgment samples(not studied in the present work)

	type of remains	
trench DT14 149-150 cm	charred ears and spikelet	
LUC11 N496 E489 US231 c408	charred ears portions (22)and spikelets (28)	*Triticum* nn
	charred spikelet (1)	Triticum nn / T. dicoccum
	charred ears portions (4) and spikelets (3)	*Triticum* cf nn
LUC11 N494-495 E489 US231	charred ears and spikelet	
LUC11 N496 E489 US231	charred ears and spikelet	
LUC11 N494 E488 US231 rr1360	charred ears (2), ear portions (13) and spikelets (15)	*Triticum* nn
	charred ears (4) and ear portions (18)	*Hordeum vulgare*
LUC11 N498 E491 US250	charred ears portions and single spikelets	
	charred cereal grains	
	charred acorns	
LUC08 N496 E495 US5 c119	charred ears and spikelet	
	charred acorns	
	charred flax seeds heap	
LUC11 N495 E491US244	charred *Hordeum* ear portions and spikelets	
	charred *Triticum* ear portions and spikelets	
	charred acorns	

APPENDIX 5

Tables of raw data of coprolites analysis: (a) Lavagnone, (b) Lucone D

Appendix 5a

LAVAGNONE (Desenzano del Garda, Brescia - Northern Italy)																																		
Analysis of goat/sheep coprolites																																		
sediment sample name			c258	c258	c258	c258	c258	c258	c258	c258	B2/12	B2/12	B2/12	B2/12	B2/12	B2/12	B2/18	c195bis	c195bis	c195bis	c195bis	c195bis	W04	E2	W04	E1	E2	c195	E1	E2	c168	B2/07	c195	c195
coprolite name (n= 49)			**LAV1**	**LAV2**	**LAV3**	**LAV4**	**LAV5**	**LAV6**	**LAV7**	**LAV8**	**LAV9**	**LAV10**	**LAV11**	**LAV12**	**LAV13**	**LAV14**	**LAV15**	**LAV16**	**LAV17**	**LAV18**	**LAV19**	**LAV20**	**LAV21**	**LAV22**	**LAV23**	**LAV24**	**LAV25**	**LAV26**	**LAV27**	**LAV28**	**LAV29**	**LAV30**	**LAV31**	**LAV32**
weight (g waterlogged)			0,172	0,1056	0,1206	0,1271	0,1467	0,093	0,0484	0,0491	0,078	0,0743	0,095	0,0905	0,0953	0,1406	0,035	0,1441	0,0442	0,059	0,1156	0,1893	0,2392	0,0505	0,0455	0,0464	0,158	0,1805	0,2144	0,0989	0,2354	0,1765	0,1527	0,1075
size (mm)																																		
length			12,4	11	10	10,7	10,5	9,8	6,7	6,1	6	7,5	8,5	8,8	9,5	12,3	7,6	9,5	7	8	7,9	9,4	11,2	7	5,9	6,2	11,5	7,8	9,1	08.09	12	13,5	9,2	7,8
width			8,9	7	8,4	6,6	7,8	6,7	5,2	4,7	6	6,3	5,6	6,5	7,7	8,3	6,1	6,6	5,6	6,2	7,8	7,4	8	4,1	3,8	5,4	7,1	7,5	6	6,2	5,5	8,5	7,2	7,5
height			4,6	3,8	4,1	4,8	5,2	3,7	3,6	4,2	4,5	4,5	4,5	4	3,7	3,2	1,7	5,5	2,5	2,8	4,5	6	5		3,4	2,9	3	5,5	7	2,8	4,5	3	4	4,2
remarks											upper-part (ca. half)		complete	half, flat	flat, compressed	flat, half	complete	not complete	not complete	not complete, flat	not complete, rounded	not complete	compl., flat	complete, pointed	complete, pointed	compl.	complete, weakly pointed	complete, pointed	almost complete, rounded	complete, flat	complete	complete, flat	almost complete	complete
MACROREMAINS (>0.5 mm)																																		
Trees/Shrubs	**%**	**n. sample**																																
Quercus sp. pericarp	4,08	2													48																		1	
Rubus cf *fruticosus* (fragm fruit)	6,12	3																																
Quercus sp. epidermis	8,16	4				3						1				6				1														
cf. *Hedera helix* epidermis	12,24	6				1	2									1		2			1	1												
Rubus sp. (fragm fruit)	12,24	6									24			1		2						3					5		1					
Rosa/Rubus prickle	32,65	16	6			2								2	1		1				1	1					1		1				1	
Herbs																																		
Arenaria serpyllifolia	4,08	2		1			5 (capsule 1)																											
Arenaria serpyllifolia (seed fragment)	4,08	2																																
Campanula cf. *bononiensis*	2,04	1																				1												
Caryophyllaceae fruits/seeds	4,08	2		1							2																							
Cyperaceae fruit	2,04	1												1																				
Fragaria vesca	2,04	1																																
Hypericum sp.	2,04	1																													1			
Juncus cf. *compressus*	2,04	1															1																	
Juncus sp.	2,04	1																												1				
Poa palustris	2,04	1																																
Polygonum sp. fragment	4,08	2		3			1																											
Potentilla cf. *reptans*	2,04	1																			1													
Ranunculus sceleratus	2,04	1																															1	
Verbena officinalis	4,08	2																										1 (fragm)		6 (fragm)				
Cultivated plants																																		
Triticum sp. testa	18,37	9		8									1	1		2		2										1				3		
Ferns/Mosses																																		
Pteridophyta epidermis	8,16	4				2										1			3			1												
Pteridophyta sporangium	2,04	1														1																		
Bryophyta leaf	4,08	2													4																			
Bryophyta stem	4,08	2																																
Unidentified plant fossils																																		
tissue "thin"	65,31	32	12	5		5	1	1	3	1	5	6	13	11	35	5	10		2	6	10	14	2	2	6	2	2		8			19		
tissue "thick"	100,00	49	32	41	45	75	85	85	117	121	44	29	67	71	147	132	92	116	39	71	65	40	55	50	43	8	51	35	22	22	48	90	33	25
reddish tissues	6,12	3																																
leaf fragment	40,82	20	4		2	1			3	6	3	3	5	4	1					1		21	1	1			4	3				9		5
leaf vein	4,08	2																																2
epidermis with stomata	16,33	8			1					1	1	3		1				3	1															
epidermis	4,08	2																9			1													
root epidermis	2,04	1																															1	
undet. seed/fruit fragm	38,78	19	4	3	4	6		8	1		8	2		1	18	12				1			1					1		2		1		
wood	6,12	3																7			5	3												
bud scale fragm.	12,24	6																2	1		2	1						1						
prickle	20,41	10									3			4	1			3	1	2		1	3					5		1				
anther cf.	2,04	1																1																
Varia (other remains, picked out)																																		
Fungi spore	2,04	1														1																		

Appendix 5a - continued

coprolite name (n= 49)			**LAV1**	**LAV2**	**LAV3**	**LAV4**	**LAV5**	**LAV6**	**LAV7**	**LAV8**	**LAV9**	**LAV10**	**LAV11**	**LAV12**	**LAV13**	**LAV14**	**LAV15**	**LAV16**	**LAV17**	**LAV18**	**LAV19**	**LAV20**	**LAV21**	**LAV22**	**LAV23**	**LAV24**	**LAV25**	**LAV26**	**LAV27**	**LAV28**	**LAV29**	**LAV30**	**LAV31**	**LAV32**
Fungi cisti	4,08	2																5									1							
insect	22,45	11	3				1							3			1		1			1	1				1			1				1
undet remains	4,08	2																																
macroremains not picked out																																		
plant remains i.g.	6,12	3	+		++++																													
plant hairs	16,33	8	+						+	++			1		3		2			2		1												
small "stone"	46,94	23	+	+ (qz)			+++ (qz)		+++	+				+		++	+	+	+	++	++	+	+					1 (qz)		+	+			+
charcoal	22,45	11	(+)	+	+				+							1											1				3	1		
MICROREMAINS (<0.5 mm)																																		
Triticum sp. testa	10,20	5		vn														1		3												1		
Cyperaceae/ Poaceae epidermis	2,04	1										1																						
cf Poaceae epidermis	2,04	1																																
Quercus pubescens leaf fragment	2,04	1																					1											
cf. *Hedera helix* leaf epidermis	2,04	1																						s										
Pteridium aquilinum epidermis with stomata	4,08	2																																2
Pteridophyta leaf	10,20	5																																n
Bryophyta leaf	22,45	11												1	s														s			s		
epidermis	91,84	45	vn	vn	n	vn	vn	s	vn	n	vn	vn	n	n	n	vn	n	vn	n	s	vn	vn	n		2	s	s	vn	s	n	s	n	1	
epidermis with ondulate cells	2,04	1																																
epidermis + stomata	46,94	23				2			1	1	s	n	1		1	n	s	3	3	3		s	2	n			2	s		n	1	s		
epidermis + vein	4,08	2																																
leaf fragment	12,24	6															1		1	1		2	2					1						
leaf fragment with hairs	2,04	1																					s											
vein	44,90	22																		1				2	2		n	s		s	s		n	s
brownish/reddish epidermis	34,69	17																			n	n			n	s						n		
brownish/reddish epidermis + stomata	2,04	1																																
plant hairs	79,59	39	vn	n	n	vn	vn	s	vn	n	vn	s	s	s	1	s	s	s	2	3		s	vn	2	s	n	vn			s	1	n		s
glandular plant hairs	6,12	3					1	1	n																									
star hairs	24,49	12																					s			1		s	1	s	s	n	1	
wood	16,33	8	n	vn	vn	vn	vn	n	vn	n																								
cf. anther fragment	2,04	1																						1										
stomata	24,49	12									3	s			1	n								vn	1	1	1	1	n			s		
Cerealia pollen grain	2,04	1																																
Abies alba pollen	2,04	1			1																													
Pteridophyta spore	6,12	3				1	2										2																	
Pteridophyta sporangium	10,20	5																				2					1		1					
pollen grain	75,51	37									vn	vn	2	1	s	vn		2		s	s		s	vn		s	vn	vn	vn	n	s	n	s	s
pollen or spores massules	4,08	2																															3	
Parasites	2,04	1																																
Fungi (stars)	8,16	4									3	2		s				1																
Fungi	6,12	3																						2	s	2								
"Fungi" spore	57,14	28												2	s	s		s		vn	n	2	s	1		n		vn	s	vn	vn	vn	n	n
rhizome	2,04	1																																
tracheids	12,24	6																															1	
insect remains	6,12	3																															2	
"stone"	38,78	19	n	vn	s		vvn	n	s	s													s			2		s		2				2

Legend microfossils
1,2,3 pieces
s: sporadic > 3
n: numerous > 10
vn: very numerous > 20

LAVAGNONE (Desenzano del Ga																	
Analysis of goat/sheep coprolites																	
sediment sample name	RP02	c258	c258	c195	W04	c132	c195	c76	B2/07	RP02	B1/02	B1/02	B1/02	B2/03	B2/03	108-113	c4075
coprolite name (n= 49)	**LAV33**	**LAV34**	**LAV35**	**LAV36**	**LAV37**	**LAV38**	**LAV39**	**LAV40**	**LAV41**	**LAV42**	**LAV43**	**LAV44**	**LAV45**	**LAV46**	**LAV47**	**LAV48**	**LAV49**
weight (g waterlogged)	0,0547	0,0908	0,1081	0,0593	0,0318	0,2247	0,0228	0,0451	0,0626	0,1081	0,0923	0,1395	0,0306	0,0335	0,1043	0,0619	0,0334
size (mm)																	
length	5,5	8	9	6,1	5,5	12,5	5	6	7,2	7,1	6	6,3	5	4,5	8	7	5
width	5	4,7	5	4,1	4	7,5	3,3	4	5	7,8	6,3	8,3	4,8	4,3	6,4	4,8	4
height	3,2	4,8	3,8	4	2,8	4,5	2,8	3	3,5	4,8	4,6	5,6	3	3,8	5,2	2,8	2
remarks	not complete, rounded	complete, pointed	complete, weakly pointed	almost complete	complete	not complete, partly broken	half	complete	not complete	not complete	complete	not complete (flat)	complete	complete	complete	complete, pointed	half
MACROREMAINS (>0.5 mm)																	
Trees/Shrubs																	
Quercus sp. pericarp																	
Rubus cf *fruticosus* (fragm fruit)	6		15							32							
Quercus sp. epidermis																	
cf. *Hedera helix* epidermis																	
Rubus sp. (fragm fruit)																	
Rosa/Rubus prickle			1						1	2		1	1		2		
Herbs																	
Arenaria serpyllifolia																	
Arenaria serpyllifolia (seed fragment)	1		1														
Campanula cf. *bononiensis*																	
Caryophyllaceae fruits/seeds																	
Cyperaceae fruit																	
Fragaria vesca	1																
Hypericum sp.																	
Juncus cf. *compressus*																	
Juncus sp.																	
Poa palustris												1					
Polygonum sp. fragment																	
Potentilla cf. *reptans*																	
Ranunculus sceleratus																	
Verbena officinalis																	
Cultivated plants																	
Triticum sp. testa	1														1		
Ferns/Mosses																	
Pteridophyta epidermis																	
Pteridophyta sporangium																	
Bryophyta leaf									1								
Bryophyta stem									2				2				
Unidentified plant fossils																	
tissue "thin"	2					1	1		7			2	1		1		
tissue "thick"	13	25	15	10	5	1	3	16	52	7	30	90	25	30	51	30	7
reddish tissues					7	1											16
leaf fragment			3							2							
leaf vein										1							
epidermis with stomata					1												
epidermis																	
root epidermis																	
undet. seed/fruit fragm										3	1				2		
wood																	
bud scale fragm.																	1
prickle																	
anther cf.																	
Varia (other remains, picked out)																	
Fungi spore																	

Appendix 5a - continued

coprolite name (n= 49)	**LAV33**	**LAV34**	**LAV35**	**LAV36**	**LAV37**	**LAV38**	**LAV39**	**LAV40**	**LAV41**	**LAV42**	**LAV43**	**LAV44**	**LAV45**	**LAV46**	**LAV47**	**LAV48**	**LAV49**
Fungi cisti																	
insect											1						
undet remains											1				1		
macroremains not picked out																	
plant remains i.g.	+																
plant hairs																	
small "stone"	++ (qz) mi	+				+++ (qz)					+++ (qz)		+++ (small	+++			
charcoal	+			+								1					
MICROREMAINS (<0.5 mm)																	
Triticum sp. testa	3																
Cyperaceae/ Poaceae epidermis																	
cf Poaceae epidermis			s														
Quercus pubescens leaf fragment																	
cf. *Hedera helix* leaf epidermis																	
Pteridium aquilinum epidermis with stomata										1							
Pteridophyta leaf			2					1	s	2							
Bryophyta leaf	1		1					1	n		s	3		s			
epidermis	3	n	s	1	3	s	s	2	vn	2	n	n	s		3		1
epidermis with ondulate cells																	s
epidermis + stomata								1		3		2					
epidermis + vein								1		1							
leaf fragment																	
leaf fragment with hairs																	
vein	3	n	vn	s			1	s	n	s	vn	vn	s	n	n		
brownish/reddish epidermis		s		s	s		s	n	n		s	s	2	s		1	n
brownish/reddish epidermis + stomata				1													
plant hairs	2	s	s	3				1	vn	s		vn	2	s	s		
glandular plant hairs																	
star hairs			1						s	2					vn		
wood																	
cf. anther fragment																	
stomata									s								
Cerealia pollen grain										2							
Abies alba pollen																	
Pteridophyta spore																	
Pteridophyta sporangium			3										1				
pollen grain	n	n	s	vn	2	s	n	vn	s	3	vn	vn	vn	s	s	s	vn
pollen or spores massules			s														
Parasites																	s
Fungi (stars)																	
Fungi																	
"Fungi" spore	s	vn			n	n		s	s	2	s		n	s		vn	
rhizome		1															
tracheids		1				1	1			s				s			
insect remains											2	1					
"stone"	vn		n			vn		vn		vn	vn		2				

Legend microfossils
1,2,3 pieces
s: sporadic > 3
n: numerous > 10
vn: very numerous > 20

Appendix 5b

LUCONE D (Polpenazze del Garda, Brescia - Northern Italy)																																		
Analysis of goat/sheep coprolites																																		
sediment sample name			c1	c1	c1	c1	c1	c1	c1	c1	c1	c1	c1	c1	c113	c107	c113	c113	c107	c113	c107	c107	c107	c107	c107	c107	NN1	NN1	NN1	NN1	NN1	NN1	NN1	NN1
coprolite name (n= 64)			**LUC1**	**LUC2**	**LUC3**	**LUC4**	**LUC5**	**LUC6**	**LUC7**	**LUC8**	**LUC9**	**LUC10**	**LUC11**	**LUC12**	**LUC13**	**LUC14**	**LUC15**	**LUC16**	**LUC17**	**LUC18**	**LUC19**	**LUC20**	**LUC21**	**LUC22**	**LUC23**	**LUC24**	**LUC25**	**LUC26**	**LUC27**	**LUC28**	**LUC29**	**LUC30**	**LUC31**	**LUC32**
weight (g waterlogged)			0,1774	0,2808	0,1505	0,069	0,112	0,1917	0,0388	0,158	0,1084	0,1662	0,1308	0,0627	0,1346	0,072	0,1148	0,0729	0,1272	0,0353	0,0703	0,0767	0,1081	0,047	0,0631	0,0435	0,2254	0,2196	0,2526	0,1604	0,169	0,1417	0,0753	0,2155
size (mm)																																		
length			9,1	15,2	10	7,5	12,1	10	8	10	10	8,2	8,3	6,9	11,5	4,5	8	6,9	8	4,5	7	7,2	7,9	5,8	6	8	12	10,5	12	9,5	11	10	8	10
width			8,7	7,8	8	4	6	7	4	7,8	7,5	8	4	4,8	7,4	4,5	5,5	6,3	6	4	4,5	4,5	4,8	3,9	4,5	3	7,5	7	8	6,5	5,5	7	5	5,5
height			4,2	4	4	3	2,8	3,8	2	3	3,2	3,1	3,8	2,8	3	4,5	3,8	3	3	2,5	2,8	2,2	3,5	2,5	3,5	2,2	4,5	4,5	4,5	4	4,5	3	2,3	6
MACROREMAINS (>0.5 mm)																																		
Trees/shrubs	**%**	**n. sample**																																
Hedera helix cf.	4,7	3			3	3				2																								
Hedera helix epidermis	4,7	3		1				2							1																			
Hedera helix leaf edge	1,6	1					3																											
Rubus gr fruticosus fruit	3,1	2																																
Rubus fruit fragment	35,9	23	43		26						38	20	13		1		20					31	1		8		11							
Rosa/Rubus prickle small, fragment	3,1	2									1	2																						
Rosa/Rubus prickle, fragment	65,6	42	4	7	1		2	6							3				7	2	1		1	1	1		2	12	8	7	2	3		5
Quercus cf. *pubescens* epidermis	3,1	2		2				10																										
Quercus epidermis	17,2	11	1		3			1		12	1 cf.	4			1							1	3	3		1								
Quercus pericarp	1,6	1											14																					
Herbs																																		
Chenopodium album seed	4,7	3											11									1												
Chenopodium album seed fragment	1,6	1																																
Origanum vulgare fruit	3,1	2	1									1																						
Poaceae small fruit	1,6	1	1																															
Picris hieracioides fragment	1,6	1																																
Solanum seed	6,3	4	2			1					6														1									
Cultivated/collected plants																																		
Linum usitatissimum capsule	1,6	1			2																													
Maloidaea pericarp	14,1	9	2		6					5		8															2							
Triticum testa	15,6	10	1		2		1	1		2	4	1	3		1																			
Pteridophyta																																		
Pteridium aquilinum epidermis	3,1	2			2	3																												
Pteridium aquilinum leaf fragm with stomata	7,8	5					1								5			1					4	3										
Unidentified plant fossils																																		
tissue "thick"	98,4	63	24	31	34		3	38	16	53	11	6	13	22	38	23	2	16	8	22	27	9	4	7	4	4	60	27	16	28	6	11	9	27
tissue "thin"	46,9	30	1	1	4			5	2		11	10				1						1	1		3	2	5	6	7					
tissue very "thick" (pericarp?)	7,8	5																																
epidermis	10,9	7									1	1				1				1	5	1		3										
epidermis with numerous stellate trichomes	6,3	4		4		13													v	v														
epidermis with longish, narrow cells, cell walls with flat and narrow undulations (cf. Poaceae glume)	4,7	3							6											1					1									
red-brownish thick tissue	9,4	6																																
epidermis with huge cells, dark brown coloration	7,8	5																															2	4
epidermis with Stomata	3,1	2										1			1																			
leaf fragment	29,7	19	2					3			7	3	1		2	2			1		2	1	1	3	1	3	7							1
leaf vein	15,6	10																									2						2	
seed/fruit Indet	17,2	11	17		3	13	1	2			1	1						4							2									
herbaceous stem fragment	1,6	1																									1							
twig fragment	1,6	1																																
wood fragment	1,6	1																																
bud scale	9,4	6			3																							1		1		1		
bud scale fragment	23,4	15																										4	2	5	1			1
prickle Indet	9,4	6	3	7	2		4	15		5																								
anther cf.	1,6	1													4																			
Varia (other remains, picked out)																																		
insects	9,4	6	2		1	1	2	1																										
macroremains not picked out																																		
charcoal	21,9	14	1							1	X	(X)		X	X			XX																
leaf fragment, very small	3,1	2									XX	X																						

Appendix 5b - continued

coprolite name (n= 64)			LUC1	LUC2	LUC3	LUC4	LUC5	LUC6	LUC7	LUC8	LUC9	LUC10	LUC11	LUC12	LUC13	LUC14	LUC15	LUC16	LUC17	LUC18	LUC19	LUC20	LUC21	LUC22	LUC23	LUC24	LUC25	LUC26	LUC27	LUC28	LUC29	LUC30	LUC31	LUC32
minerogenic particle	28,1	18		1		1		XX		XX	XX	(X)		XX	XXX	XXX		X	XX			X		X		X								
plant hair	4,7	3								1	X																							
plant remain undet	3,1	2									XXX	XXX																						
wood	9,4	6									XX	X															1 cf	3				3		4
MICROREMAINS (<0.5 mm)																																		
Trees/shrubs																																		
Abies alba pollen	4,7	3			1																													
Hedera helix epidermis	1,6	1					vn																											
Hedera helix epidermis with Stomata	10,9	7					n	1		2																		1	2		1			
Quercus cf. *pubescens* leaf fragment/epidermis	3,1	2			s					vvn																								
Quercus epidermis	10,9	7															s	s	2			2	vn	n										
Quercus epidermis with stomata	9,4	6																																
Rosa/rubus prickles fragm	1,6	1																																
cf *Ilex aquifolium* epidermis with stomata	3,1	2																																
Herbs																																		
Solanaceae seed	1,6	1				2 cf.																												
Cyperaceae/Poaceae epidermis	1,6	1																														1		
Cultivated plants																																		
Linum usitatissimum capsule	6,3	4			1 cf.					1 cf	1	1																						
Triticum testa	6,3	4										2																						
Bryophyta/Pteridophyta																																		
Bryophtyta leaf	7,8	5		2				1		1																			2					
Bryophtyta stem	1,6	1						1																										
Pteridium aquilinum epidermis	15,6	10		1	2			1		2		1					n	vn				n	n	s										
Pteridium aquilinum epidermis with stomata	3,1	2																																
Pteridophyta epidermis	1,6	1																																
Pteridophyta sporangium	6,3	4			1	1											1						1											
Unidentified plant fossils																																		
epidermis	82,8	53	vn	vn	vn	n	n	s	s	vn	s	n	s	s	n	s	n	n	n	s	n	n	n	n	n	n	s	s	n			s	s	
epidermis with huge cells, dark brown coloration	15,6	10				s																						1			1	s	s	
epidermis with isodiametric cells, cell walls straight	14,1	9		s																											1	s		1
epidermis with rounded reddish cells	21,9	14																																
epidermis with rounded cells	4,7	3																																
epidermis with longish, narrow cells, cell walls straight	12,5	8					1			2																								
epidermis with longish, narrow cells, cell walls with flat and narrow undulations (cf. Poaceae glume)	4,7	3																						1	s									
epidermis with longish cells, cell walls strongly undulate	10,9	7																									2	1						
epidermis with longish cells, cell walls strongly undulate with stomata	3,1	2																									2							
epidermis with stomata	25,0	16	s	n	n					n		2															3	2	3	1				
leaf fragment	25,0	16	1		n	s				n			s	vn	s		vn	vn	s	s	s	n	n	s		s								
leaf vein	85,9	55	s	s	s	s				vn	s	s	1	n	s		s	s	s		s	n	vn	s		s	n	vn	vn	s		vn	vn	s
leaf fragment with vein	4,7	3																									1							
leaf fragment with plant hair	1,6	1																																
minerogenic particle	45,3	29	s	s	n	n	n	n	s	s	n	n				n	s	s	s	s	s		n	s	n	n								
plant hair	73,4	47	s	vn	vn	s	vn	vn		n		vn	vn	n	vn		n	n	vn	vn	s	n	vn	n	s	s		vn	vn	s	vn	vn		vn
glandular plant hair	1,6	1																																
plant tissue with huge, spongy cells	4,7	3				s			s		s																							
plant tissue with innumerous hairs including stellate trichomes	10,9	7											n		n		s		vn			1	s							1				
prickle	6,3	4		2	3		2			2																								
seed/fruit Indet	1,6	1				1																												
stellate trichome	57,8	37		n	s		n	n		n	1	s			2		1		vn				vn				s	vn	vn	s	n	n		
stomata, single	12,5	8					s			vn							s	s	s				s	s										
pollen grain	48,4	31																										s	s	n	s	n	n	1
"Fungi" spores	25,0	16																									s			s			vn	
Spores	3,1	2																									1			vn				
parasite	1,6	1																																
wood	35,9	23	n	s	s	s	s	s		s	s	s	n	n	s	n	n	s	s	s	n	s	s	s	s	s								

Legend microfossils 1,2,3 pieces; s: sporadic > 3; n: numerous > 10; vn: very numerous > 20

LUCONE D (Polpenazze del Garda, Brescia - I																																
Analysis of goat/sheep coprolites																																
sediment sample name	NN1	NN1	NN1	NN1	NN1	NN1	NN1	NN1	NN1	NN1	NN1	NN1	NN1	NN1	NN1	NN1	c320	c320	c320	c320	c320	c320	c320	c320	c320	c320	c397	c372	c372	c394	c394	c394
coprolite name (n= 64)	**LUC33**	**LUC34**	**LUC35**	**LUC36**	**LUC37**	**LUC38**	**LUC39**	**LUC40**	**LUC41**	**LUC42**	**LUC43**	**LUC44**	**LUC45**	**LUC46**	**LUC47**	**LUC48**	**LUC49**	**LUC50**	**LUC51**	**LUC52**	**LUC53**	**LUC54**	**LUC55**	**LUC56**	**LUC57**	**LUC58**	**LUC59**	**LUC60**	**LUC61**	**LUC62**	**LUC63**	**LUC64**
weight (g waterlogged)	0,3008	0,0404	0,1848	0,2912	0,4034	0,2506	0,1807	0,3828	0,1643	0,2217	0,1968	0,1327	0,0916	0,3906	0,2446	0,2036	0,2419	0,1716	0,1657	0,047	0,0847	0,0613	0,1284	0,2087	0.1295	0,1468	0,0703	0,0656	0,0479	0,0558	0,07	0,1109
size (mm)																																
length	9,5	6	9,5	10,5	15,5	9,5	15,5	11	11,5	11	13	12	8,5	15	12,5	13	11	8	11	6	8	6	9	8	10	9,5	5	8	6,9	7,2	7,2	9
width	6,5	3,5	6,8	7	10	9,5	6,5	9	8	8	7	7	6,5	8	8	5,5	8	6	7	4,5	5,5	4	5,8	5,5	5,5	7	3,5	4,8	3,5	4,2	5,8	5,5
height	6	3	4,5	5	4,2	5	3,5	5,5	2,5	4	4	3	2,5	6	3	4	3	3	4	2,5	3	3,5	4	4	3	4	2	3	3,5	3	2,6	4
MACROREMAINS (>0.5 mm)																																
Trees/shrubs																																
Hedera helix cf.																																
Hedera helix epidermis																																
Hedera helix leaf edge																																
Rubus gr *fruticosus* fruit								1						2																		
Rubus fruit fragment	1			5		17		72		46	17			147		6		2						33							15	4
Rosa/Rubus prickle small, fragment																																
Rosa/Rubus prickle, fragment	15		2	4	2		2	5	9	2	6	3	5	4	6	2	5	3	3		2			2	3	8				2		2
Quercus cf. *pubescens* epidermis																																
Quercus epidermis																																
Quercus pericarp																																
Herbs																																
Chenopodium album seed																								5								
Chenopodium album seed fragment																								11								
Origanum vulgare fruit																																
Poaceae small fruit																																
Picris hieracioides fragment														2																		
Solanum seed																																
Cultivated/collected plants																																
Linum usitatissimum capsule																																
Maloidaea pericarp	15		1	2		4																										
Triticum testa																1																
Pteridophyta																																
Pteridium aquilinum epidermis																																
Pteridium aquilinum leaf fragm with stomata																																
Unidentified plant fossils																																
tissue "thick"	7	2	8	6	11	25	3	11	38	46	19	8	12	48	7	11	57	16	14	7	7	12	25	33	17	23	22	19	51	15	13	37
tissue "thin"	2		1	2	1		2	1	2	2			1	3			9	1						1	1							3
tissue very "thick" (pericarp?)										4	4	1		1		6																
epidermis																																
epidermis with numerous stellate trichomes																																
epidermis with longish, narrow cells, cell walls with flat and narrow undulations (cf. Poaceae glume)																																
red-brownish thick tissue									11				4				27		1	1	1											
epidermis with huge cells, dark brown coloration	7		10		1																											
epidermis with Stomata																																
leaf fragment	3							3																			1					
leaf vein	10	1	1				1	2																1			4		1			
seed/fruit Indet											1													6								
herbaceous stem fragment																																
twig fragment													1																			
wood fragment																				6												
bud scale																		1								2						
bud scale fragment					2		1	1	5				3			1	5		1						4	5						
prickle Indet																																
anther cf.																																
Varia (other remains, picked out)																																
insects	1																															
macroremains not picked out																																
charcoal				4				5			3	5	1	2		1																
leaf fragment, very small																																

Appendix 5b - continued

coprolite name (n= 64)	LUC33	LUC34	LUC35	LUC36	LUC37	LUC38	LUC39	LUC40	LUC41	LUC42	LUC43	LUC44	LUC45	LUC46	LUC47	LUC48	LUC49	LUC50	LUC51	LUC52	LUC53	LUC54	LUC55	LUC56	LUC57	LUC58	LUC59	LUC60	LUC61	LUC62	LUC63	LUC64
minerogenic particle												xxx											2 (qz)							xx	x	
plant hair										1																						
plant remain undet																																
wood																																
MICROREMAINS (<0.5 mm)																																
Trees/shrubs																																
Abies alba pollen				1								s																				
Hedera helix epidermis																																
Hedera helix epidermis with Stomata																									2							
Quercus cf. *pubescens* leaf fragment/epidermis																																
Quercus epidermis				1																												
Quercus epidermis with stomata			1	2		1		s								2			1													
Rosa/rubus prickles fragm											1																					
cf *Ilex aquifolium* epidermis with stomata			1		2																											
Herbs																																
Solanaceae seed																																
Cyperaceae/Poaceae epidermis																																
Cultivated plants																																
Linum usitatissimum capsule																																
Triticum testa			1	1								2																				
Bryophyta/Pteridophyta																																
Bryophtyta leaf																																2
Bryophtyta stem																																
Pteridium aquilinum epidermis																																
Pteridium aquilinum epidermis with stomata			1	1																												
Pteridophyta epidermis																														1		
Pteridophyta sporangium																																
Unidentified plant fossils																																
epidermis	n		1		n	n	n	n	n	s	s				s		s	s	s	s	s	s	n	1	n		s	s		s	s	s
epidermis with huge cells, dark brown coloration	1		1		n			1	s																							
epidermis with isodiametric cells, cell walls straight	2		s	1			3		1																							
epidermis with rounded reddish cells			2	1	3		3	1	n								s			2	s		vn	n	s	s	s					
epidermis with rounded cells				1	n		s																									
epidermis with longish, narrow cells, cell walls straight				1						1	1		1			1									1							
epidermis with longish, narrow cells, cell walls with flat and narrow undulations (cf. Poaceae glume)																	2															
epidermis with longish cells, cell walls strongly undulate	2	1					1									1														s		
epidermis with longish cells, cell walls strongly undulate with stomata												1																				
epidermis with stomata	3			1	1	2	2	1			1																					
leaf fragment																																
leaf vein	n	n	n	vn	n	n	n	s	n	n	s	s	1	n		n	n	s	n		1	s	n	vn	vn	n	vn	s	s	n	n	s
leaf fragment with vein										1						1																
leaf fragment with plant hair			1																													
minerogenic particle	vn	s	n	n		n	s			s	n	n																				
plant hair	vn	1	vn	vn		vn	vn	1	vn	s	vn	n	vn	n	s	s	vn				n				vn	vn				s		
glandular plant hair													s																			
plant tissue with huge, spongy cells																																
plant tissue with innumerous hairs including stellate trichomes																																
prickle																																
seed/fruit Indet																																
stellate trichome	vn		vn	vn	1	s	vn	3	s	2	vn	n	1		vn	vn	vn		vn		n				s	vn				s		
stomata, single																								1								
pollen grain	1	vn	n		vn		s		s	s	n	vn	1	1		n		1	n			vn	vn		n	n	vn	n	s	s	s	s
"Fungi" spores		2		1		1				vn				n				s	n		vn			n	1				n	1	s	
Spores																																
parasite																	1															
wood																																

Legend microfossils 1,2,3 pieces; s: sporadic > 3; n: numerous > 10; vn: very numerous > 20

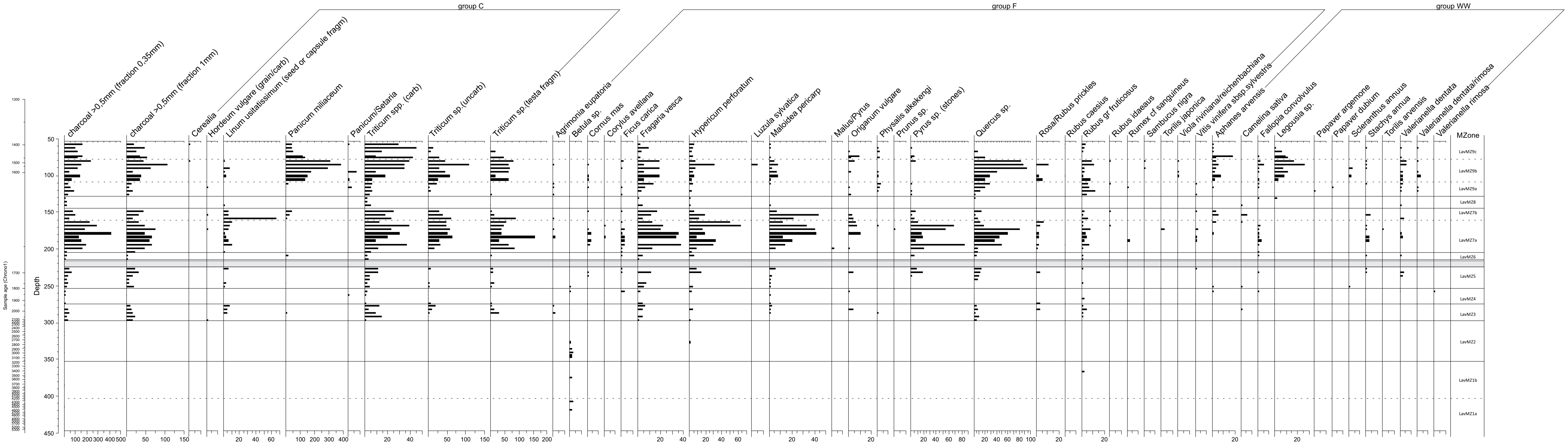
APPENDIX 6

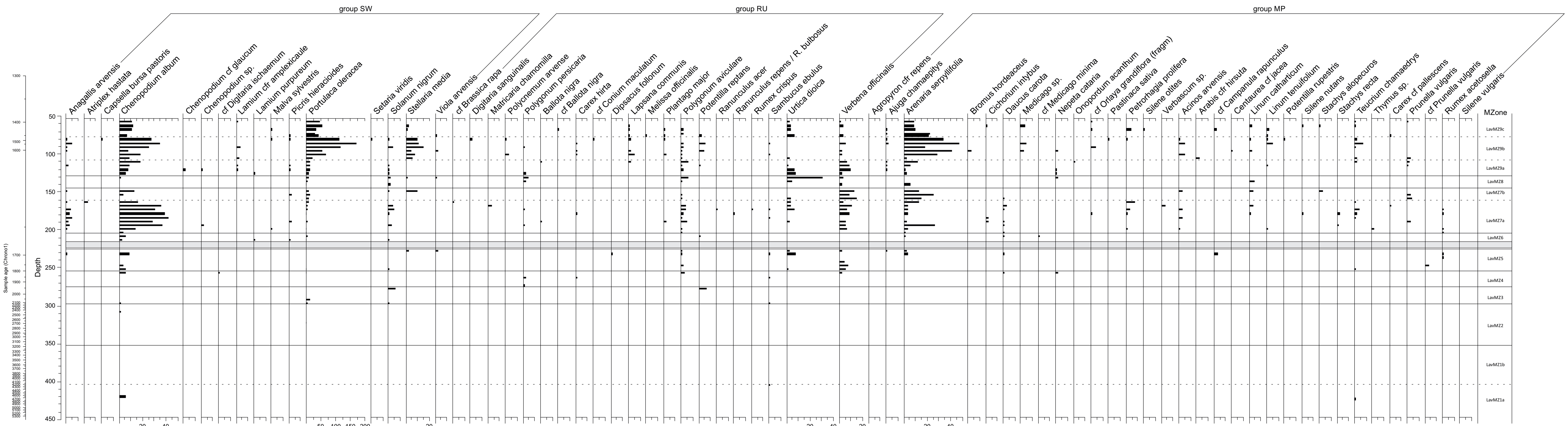
Diagrams of the stratigraphic samples analysis:

(a) complete concentration diagram of samples from core LAV37, Sector D Lavagnone;

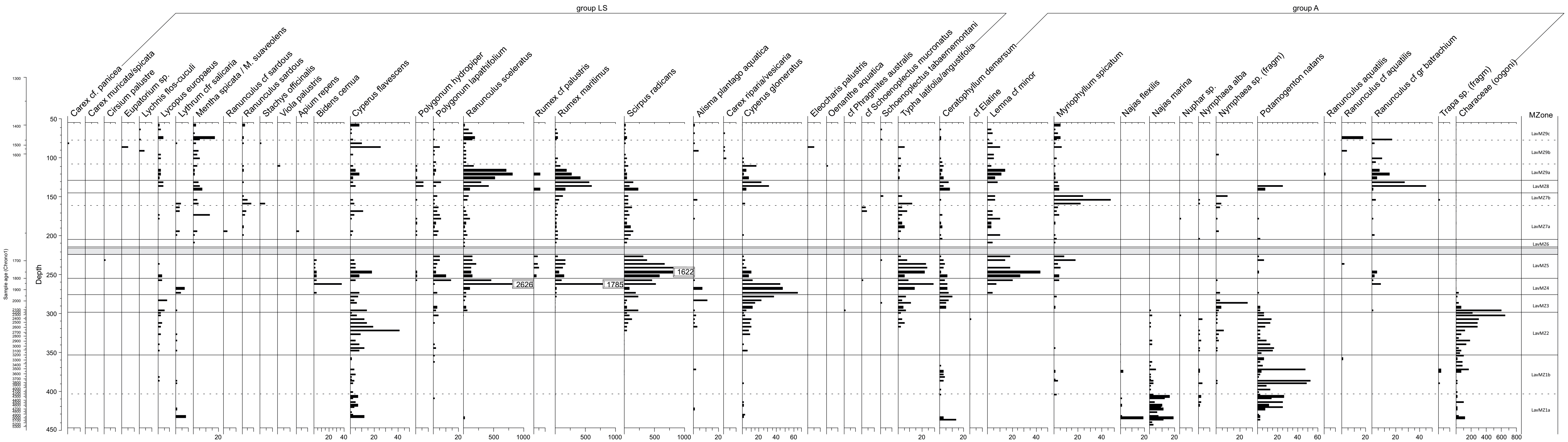
(b) complete concentration diagram samples from section 98, Sector A Lavagnone.

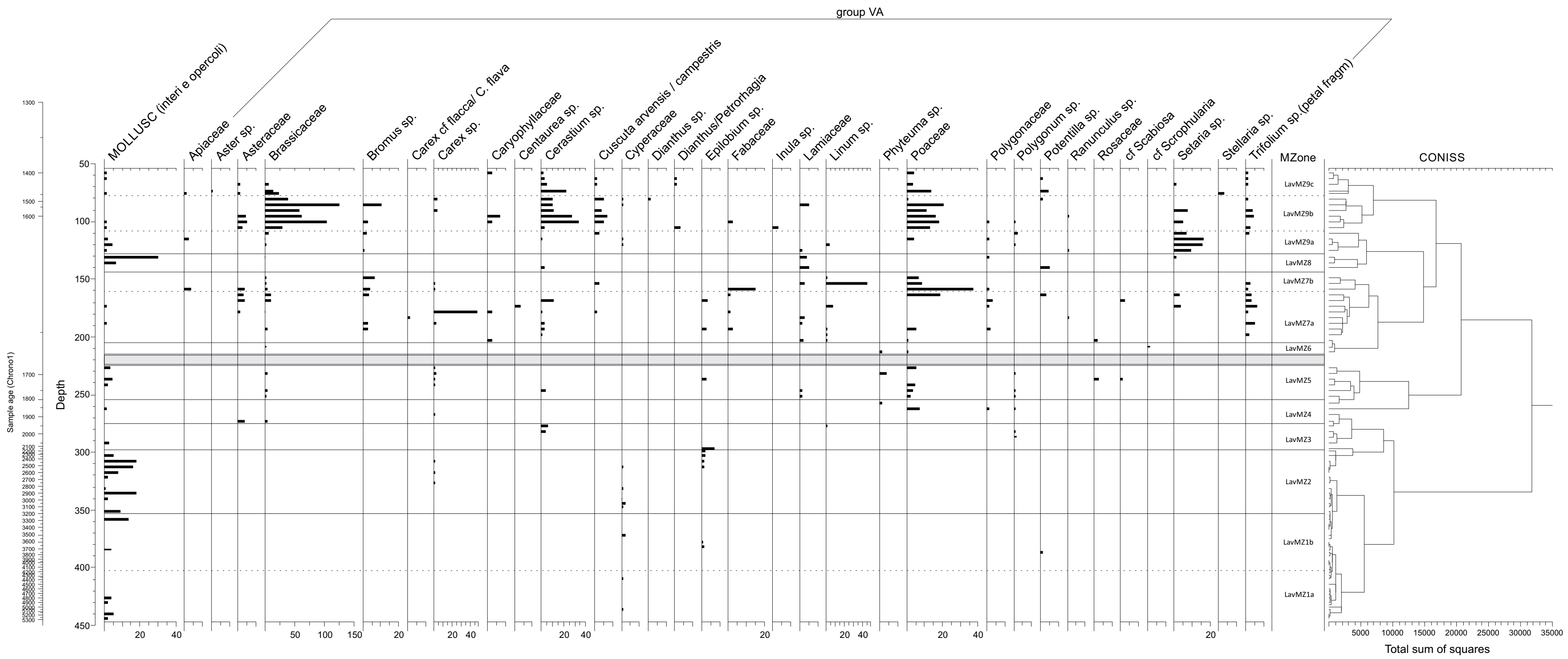
Appendix 6a


group C
group F
group WW
charcoal >0,5mm (fraction 0,35mm)
charcoal >0,5mm (fraction 1mm)
Cerealia
Hordeum vulgare (grain/carb)
Linum usitatissimum (seed or capsule fragm)
Panicum miliaceum
Panicum/Setaria
Triticum spp. (carb)
Triticum sp.(uncarb)
Triticum sp.(testa fragm)
Agrimonia eupatoria
Betula sp.
Cornus mas
Corylus avellana
Ficus carica
Fragaria vesca
Hypericum perforatum
Luzula sylvatica
Maloidea pericarp
Malus/Pyrus
Origanum vulgare
Physalis alkekengi
Prunus sp.
Pyrus sp. (stones)
Quercus sp.
Rosa/Rubus prickles
Rubus caesius
Rubus gr fruticosus
Rubus idaeus
Rumex cf sanguineus
Sambucus nigra
Torilis japonica
Viola riviniana/reichenbachiana
Vitis vinifera sbsp sylvestris
Aphanes arvensis
Camelina sativa
Fallopia convolvulus
Legousia sp.
Papaver argemone
Papaver dubium
Scleranthus annuus
Stachys annua
Torilis arvensis
Valerianella dentata
Valerianella dentata/rimosa
Valerianella rimosa
MZone
Sample age (Chrono1)
Depth
LavMZ9c
LavMZ9b
LavMZ9a
LavMZ8
LavMZ7b
LavMZ7a
LavMZ6
LavMZ5
LavMZ4
LavMZ3
LavMZ2
LavMZ1b
LavMZ1a


group SW
group RU
group MP
Anagallis arvensis
Atriplex hastata
Capsella bursa pastoris
Chenopodium album
Chenopodium cf glaucum
Chenopodium sp.
cf Digitaria ischaemum
Lamium cfr amplexicaule
Lamium purpureum
Malva sylvestris
Picris hieracioides
Portulaca oleracea
Setaria viridis
Solanum nigrum
Stellaria media
Viola arvensis
cf Brassica rapa
Digitaria sanguinalis
Matricaria chamomilla
Polycnemum arvense
Polygonum persicaria
Ballota nigra
cf Ballota nigra
Carex hirta
cf Conium maculatum
Dipsacus fullonum
Lapsana communis
Melissa officinalis
Plantago major
Polygonum aviculare
Potentilla reptans
Ranunculus acer
Ranunculus repens / R. bulbosus
Rumex crispus
Sambucus ebulus
Urtica dioica
Verbena officinalis
Agropyron cfr repens
Ajuga chamaepitys
Arenaria serpyllifolia
Bromus hordeaceus
Cichorium intybus
Daucus carota
Medicago sp.
cf Medicago minima
Nepeta cataria
Onopordum acanthum
cf Orlaya grandiflora (fragm)
Pastinaca sativa
Petrorhagia prolifera
Silene otites
Verbascum sp.
Acinos arvensis
Arabis cfr hirsuta
cf Campanula rapunculus
Centaurea cf jacea
Linum catharticum
Linum tenuifolium
Potentilla rupestris
Silene nutans
Stachys alopecuros
Stachys recta
Teucrium chamaedrys
Thymus sp.
Carex cf pallescens
Prunella vulgaris
cf Prunella vulgaris
Rumex acetosella
Silene vulgaris
MZone
Sample age (Chrono1)
Depth
LavMZ9c
LavMZ9b
LavMZ9a
LavMZ8
LavMZ7b
LavMZ7a
LavMZ6
LavMZ5
LavMZ4
LavMZ3
LavMZ2
LavMZ1b
LavMZ1a

Appendix 6a - continued





Appendix 6b

cultivated species
winter crop weeds
summer crop weeds
ruderals
grassland, meadows and pastures species
samples
Cerealia
Cerealia (carb)
Cerealia (uncarb)
Hordeum vulgare (carb)
Hordeum vulgare (uncarb)
Triticum sp. (carb)
Triticum sp. (uncarb)
Linum usitatissimum
Linum usitatissimum
Camelina sativa
cfr Scleranthus
cfr Scleranthus annuus
Fallopia convolvulus
Scleranthus annuus
Stachys annua
Stachys cfr annua
Torilis arvensis
Valerianella dentata
Valerianella dentata
cf Malva sylvestris
Chenopodium album
Chenopodium sp.
Picris hieracioides
Portulaca oleracea
Solanum nigrum
Solanum nigrum
Anthemis tinctoria
Anthemis type
Cannabis/Humulus
Fallopia cfr. dumetorum
Lapsana communis
Malvaceae
Plantago major
Polygonim aviculare
Polygonum aviculare
Polygonum persicaria
Polygonum persicaria
Potentilla reptans
Ranunculus cfr bulbosus
Sambucus ebulus
Sonchus asper
Sonchus oleraceus
Urtica
Urtica dioica
Verbena
Verbena officinalis
Achillea millefolium
Arenaria serpyllifolia
Asphodelus
Astragalus
Calamintha sp.
Centaurea nigra type
Centaurea scabiosa
Crepis biennis / froelichiana
Daucus carota
Dianthus carthusianorum
Helianthemum
Linum catharticum
Nepeta cataria
Petrorhagia prolifera
Petrorhagia saxifraga
Plantago lanceolata
Plantago media
Poa pratensis
Polygala vulgaris type
Prunella vulgaris
Rumex acetosella
Scrophulariaceae
Silene cf nutans
Stellaria graminea/palustris
Teucrium chamaedrys
Trifolium pratense
B1/04
B1/02
B2/14
B2/12
B2/07
B2/03
20
40
20
20
forest species
lakeshore vegetation species
samples
Abies alba
Acer
Agrimonia eupatoria
Alnus
Betula
Campanula cf trachelium
Carpinus betulus
Castanea
cf Origanum vulgare
cfr Clinopodium vulgare
cfr Corylus avellana
cfr Pyrus
Clinopodium vulgare
Cornus mas
Cornus mas
Corylus
Cuscuta
Ericaceae
Fagus
Ficus carica
Fragaria vesca
Frangula alnus
Fraxinus excelsior
Fraxinus Ornus
Hedera
Hypericum perforatum
Ilex aquifolium
Knautia cf drymeia
Lamiastrum galeobdolon
Larix
Maloideae pericarp
Malus cfr sylvestris
Malus sp.
Malus sylvestris
Malus/Pyrus
Origanum vulgare
Ostrya carpinifolia
Physalis alkekengi
Picea Abies
Pinus sylvestris/mugo
Populus
Pyrus cfr communis
Pyrus communis
Pyrus sp.
Quercus
Quercus ilex
Quercus sp.
Rosaceae
Rubus fruticosus
Salix
Solanum dulcamara
Stachys sylvatica
Taxus
Tilia
Torilis japonica
Ulmus
Vitis
Vitis vinifera sub. sylvestris
Alisma plantago-aquatica
cf Mentha arvensis
cfr Oenanthe aquatica
Cyperaceae
Cyperaceae
Cyperus cf glomeratus
Epilobium parviflorum
Filipendula
Juncus sp.
Lycopus europaeus
Mentha aquatica
Mentha arvensis
Mentha spicata / suaveolens
Myosoton aquaticum
Polygonum lapathifolium
Polygonum scoparium
Primula farinosa
Ranunculus sardous
Ranunculus sceleratus
Rumex maritimus
Schoenoplectus cf supinus
Schoenoplectus sp.
Scirpus radicans
Sparganium
Thalictrum
Typha
Typha latifolia/angustifolia
B1/04
B1/02
B2/14
B2/12
B2/07
B2/03
20
20
aquatics
varia
samples
Ceratophyllum demersum
Characeae
Lemna minor
Myriophyllum verticillatum
Myriophyllum spicatum
Nymphaea
Nymphaea alba
Nymphaea sp.
Nymphaeaceae
Potamogeton
Apiaceae
Artemisia
Aster type
Asteraceae
Boraginaceae
Brassicaceae
Campanulaceae
Carex bicarpellate
Carex sp.
Caryophillaceae
Caryophyllaceae
Cerastium sp.
cf Poaceae
cfr Stachys
Cichorioideae
Cirsium
Crepis sp.
Cruciferae
Dianthus sp.
Euphorbia
Fabaceae
Fabaceae
Galium type
Geranium
Gramineae
Hypericum
Hypericum sp.
Knautia
Knautia drymeia/arvensis
knautia sp
Labiatae
Lamium
Liliaceae
Lotus
Mentha type
Phyteuma
Plantaginaceae
Plantago coronopus
Plantago maritima
Poaceae
Poligonum viviparum
Polygonaceae
Polygonum sp.
Potentilla
Potentilla sp.
Primulaceae
Pulmonaria obscura
Ranunculaceae
Ranunculus sp
Rosa sp.
Rumex
Sambucus sp.
Saxifraga
Scabiosa
Scabiosa sp.
Sedum
Silene sp.
Solanaceae
Stachys sp
Trifolium
Trifolium sp.
Umbelliferae
B1/04
B1/02
B2/14
B2/12
B2/07
B2/03
20
20

APPENDIX 7

Catalogue of macroremains

The catalogue of plant remains

The catalogue includes descriptions of the most abundant and some important plant taxa found in Lavagnone (LAV) and Lucone D (LUC) dwelling sites. The plant taxa are grouped in Family ordered according to the botanical systematic (Pignatti 1982). Species belonging to the same family are listed alphabetically. Measurements averages refer to 10 items or less (for *Triticum* species a higher amount of remains has been measured). The measured parameters are L=length and W=width; for cereals, *Vitis* pips and *Staphylea* seeds measurements see relative drawings. Abbreviations: unc = waterlogged; c = charred; ph = settlement phase.

SPERMATOPHYTA
Angiospermae

Corylaceae
Corylus avellana L. and cf *Corylus avellana* L. hazel
Preservation: waterlogged, charred
Type of remains: nut, shell fragments
Life form: P, shrub
Ecology: group 5.1 (F). It is a common and fast growing shrub, widespread at the woodland edge, in clearings, along pathways and riverbanks. It is a common plant remains in Bronze Age sites as food sources.
Ubiquity: **LAV:** EBA (unc 83%, c 4%), MBA (unc 85%, c 23%), section 98 (unc 33%), lav37 (unc EBA II, MBA). **LUC:** 1st ph (unc 85%, c 7.7%), 2nd ph (unc 60%, c 4%).
Measurements (1 complete waterlogged nut): L: 12.3 mm; W: 11.3 mm (only one specimen was found complete, in sample LUCcNN1 from the 2nd settlement phase of Lucone D).
Photo: Plate 1
Description: Oval nut slightly pointed, and with a large scar area of husk attachment. Remains mainly consisted of shell fragments. The pericarp is woody and it shows, in transversal section, characteristic vesicles.
Bibliography: Renfrew 1973, Schoch *et al.* 1988

Fagaceae (beech family)
Fagus sylvatica L. beech
Preservation: waterlogged
Type of remains: shell fragments
Life form: P, tree
Ecology: group 5.1 (F). It grows both on acidic and basic soils and requires high atmospheric humidity. It avoids waterlogged soils and cold temperature as well as dry season.
Ubiquity: **LAV:** EBA (unc 4%). **LUC:** 1st ph (unc 38%), 2nd ph (unc 20%).
Measurements: no measurable items were found
Photo: Plate 1
Description: trigon nuts (beechnut) formed by three combined sides, each of them easily disarticulated in the fossil remains. Pointed on top, rounded below. Remains mainly consisted of shell fragments (often one nut side). The pericarp is woody and thin, the surface is smooth and lustrous.
Bibliography: Renfrew 1973, Schoch *et al.* 1988

Quercus sp. L. oak
Preservation: waterlogged, charred
Type of remains: shell fragments, acorn receptacle, cupule, kernels (1 or 2 cotyledons)
Life form: P, tree or shrub
Ecology: group 5.1 (F). Oaks are the dominant trees in the thermophilous woodland of the Garda region. The most representative species in the morainic amphitheatre are *Quercus pubescens* and *Q. cerris* – sporadic specimen of *Q. petraea* are also present – while along the Garda lake coast, the most common species is *Q. ilex*. According to Brullo & Guarino (1998), *Quercus virgiliana* occurred as well in the Garda region. This is a moderately thermophilous SE-European species growing on very well drained and leached soils.
Ubiquity: **LAV:** EBA (unc 100%, c 4%), MBA (unc 84.6%, c 30.7%), section 98 (unc 100%), lav37 (unc EBA IA IB IC, EBA II, MBA). **LUC:** 1st ph (unc 69.2%, c 61.5%), 2nd ph (unc 60%, c 28%).
Measurements (10 selected charred kernels): average L: 18.88 mm; average W: 8.53 mm

	L (mm)	W (mm)
LUC c 58	18.8	8.8
LUC c 58	21.3	8.1
LUC c 58	18.9	8.4
LUC c 58	18.8	8.4
LUC c 58	17.6	7.6
LUC c 58	18.0	9.3
LUC c 58	17.3	9.4
LUC c 58	19.0	9.1
LUC c 58	24.3	7.8
LUC c 58	15.0	8.5

Photo: Plate 1
Description: acorns show a marked overlap in characteristics between species. Identification beyond genus level was therefore impossible. The high nutritional value of acorns made them a potential human and animal food resource. The edibility depends on the tannin content whose concentration varies from one species to another (see table 1 in Mason 1995). The bulk of acorn finds in Lucone D burnt layers testified a large storage. It is not clear from the contexts, whether the acorns were used for human nutrition or for animal feed.
Bibliography: Renfrew 1973, Schoch *et al.* 1988, Primavera & Fiorentino 2014, Mason 1995

Moraceae (mulberry family)
Ficus carica L. fig
Preservation: waterlogged
Type of remains: nutlet
Life form: P, tree
Ecology: group 5.1 (F) (see also Chap. 8.3.1.). Fig grows in several different habitats from open places and deciduous woods to river valleys or stony slopes. Its modern distribution has been strongly driven by human influence. The plant often grows near water, on well-drained ground. The Mediterranean territory is assumed to be the centre of domestication (Zohary *et al.* 2012, p. 128-130). The fruits are very nutritious. Dried figs contain about 50% sugar.
Ubiquity: **LAV:** EBA (unc 62.5%), MBA (unc 77%), section 98 (unc 11%), lav37 (unc EBA IC, EBA II, MBA). **LUC:** 1st ph (unc 54%), 2nd ph (unc 24%).
Measurements (10 selected nutlets): average L: 1.12 mm; average W: 1.17 mm

	L (mm)	W (mm)
LUC c 113	1.3	1.1
LUC c 113	1.3	1.1
LUC c 113	1.1	1.3
LUC c 113	1.1	1.2
LUC c 113	1.25	1.2
LUC c 113	1.4	1.0
LUC c 113	1.4	1.2
LUC c 113	1.2	1.4
LUC c 113	1.2	1.2
LUC c 113	0.8	1

Photo: Plate 1
Description: It is not possible to differentiate the nutlets of the wild from the cultivated form. Nutlets are more or less rounded with an end often pointed and the other one broadly rounded. The surface is pitted. Shell hard, yellowish to light brown.
Bibliography: Renfrew 1973, Schoch *et al.* 1988, Riehl 1999.

Urticaceae (nettle family)
Urtica dioica L. and cf *Urtica dioica* L. common nettle
Preservation: waterlogged
Type of remains: nutlet

Life form: H scap
Ecology: group 2.4 (RU). Ruderal species spreading close to settlements on paths, nitrophilous spots, waste ground but also in alluvial forest, on hedge banks.
Ubiquity: **LAV:** EBA (unc 16.6%), MBA (unc 84.6%), section 98 (unc 22.2%), lav37 (unc EBA II, MBA). **LUC:** 1st ph (unc 5.3%).
Measurements (10 selected nutlets): average L: 1.10 mm; average W: 0.73 mm

	L (mm)	W (mm)
LAV c 4073	1.0	0.8
LAV c 4073	1.4	0.8
LAV c 4073	1.1	0.8
LAV c 4073	1.0	0.7
LAV c 4073	1.1	0.7
LAV c 4073	1.0	0.7
LAV c 4073	1.1	0.7
LAV c 4073	1.1	0.7
LAV c 4073	1.1	0.8
LAV c 4073	1.1	0.8

Photo: Plate 1
Description: nuts, oval in outline, slightly pointed on one end and rounded on the other end. The surface is finely punctate.
Bibliography: Schoch *et al.* 1988, Riehl 1999.

Polygonaceae (buckwheat family)
Fallopia convolvulus (L.) Holub and cf *Fallopia convolvulus* (L.) Holub (sin. *Polygonum convolvulus*)
black bindweed

Preservation: waterlogged and charred
Type of remains: nutlet
Life form: T scap
Ecology: group 2.1 (WW) (see also Chap. 8.3.3). It is a climbing species producing small quantities of fruits quite large when compared to other related species (belonging to the genus *Polygonum*). It is a moderately thermophilous species, infesting crops (Secalinetea and Chenopodietea) and ruderal habitats (disturbed soil; waste areas, roadsides, fields, urban landscapes). It grows on fertile and moderately humid soils.
In former time, black bindweed fruits were collected with food purposes, for the production of flour or mixed in addition to that of wheat or for preparation of soups. Such uses are documented in sites in northern Europe since the end of the Iron Age (van Zeit 1970; Renfrew 1973; Behre 2008). Behre (2008) reported indications of food use of this plant for the production of flour in recent times (early 19th c.) in the regions of Northern Germany. A discrete amount of these fruits were found in the megalithic site of Saint Martin des Corléans (AO, Northern Italy) dated to 4300-3830 BC (Castellano *et al.* 2010).
Ubiquity: **LAV:** EBA (unc 75%, c 8.3%), MBA (unc 46%), section 98 (unc 44.4%), lav37 (unc EBA IC, EBA II, MBA). **LUC:** 1st ph (unc 46%), 2nd ph (unc 28%).
Measurements (10 selected waterlogged nutlets): average L: 2.76 mm; average W: 1.91 mm

	L (mm)	W (mm)
LAV c WES04	3.0	1.8
LAV c NN1	2.4	1.8
LAV c NN1	2.6	1.8
LAV c NN1	2.6	1.7
LAV c NN1	2.6	1.8
LAV c NN1	2.8	2.3
LAV c NN1	2.9	2.1
LAV c 135	2.9	1.6
LAV c 135	3.3	2.5
LAV c 135	2.7	1.9

Photo: Plate 1
Description: 3-sided nutlet, pointed at both ends, black to black-brown. Surface with small bead-like nodules in longitudinal rows. Fragments of perianth can be preserved at the base of the fruit.
Bibliography: Schoch *et al.* 1988, Jacquat 1988.

Polygonum aviculare L. knotgrass
Preservation: waterlogged
Type of remains: nutlets
Life form: T rept
Ecology: group 2.4 (RU). Very common ruderal plant on all sorts of open ground.
Ubiquity: **LAV:** EBA (unc 62.5%), MBA (unc 38.5%), section 98 (unc 44.4%), lav37 (unc EBA IC, EBA II, MBA). **LUC:** 1st ph (unc 38.5%), 2nd ph (unc 8%).
Measurements (10 selected nutlets): average L: 2.26 mm; average W: 1.40 mm

	L (mm)	W (mm)
LAV c NN1	2.5	1.3
LAV c NN1	2.3	1.4
LAV c NN1	2.3	1.5
LAV c NN1	2.4	1.5
LAV c NN1	2.5	1.5
LAV c NN1	2.3	1.4
LAV c NN1	2.3	1.5
LAV c 135	2.1	1.3
LAV c 135	2.1	1.5
LAV c 135	2.1	1.3

Photo: Plate 1
Description: 3-sided nutlets, pointed at the upper end. Some of them may have one side narrower than the other two (asymmetric outline). The surface is shiny-punctate (pearly nodules arranged in longitudinal rows).
Bibliography: Renfrew 1973, Schoch *et al.* 1988, Stace 2010.

Polygonum lapathifolium L. pale persicaria
Preservation: waterlogged
Type of remains: nutlet, perianth
Life form: T scap
Ecology: groups 2.2 / 2.3 / 6.2 (LS). Widespread in different habitats, on waste spot, wet arable ground, muddy banks and ditches.
Ubiquity: **LAV:** EBA (unc 83.3%), MBA (unc 38.5%), section 98 (unc 44.4%), lav37 (unc EBA IA IB IC, EBA II, MBA). **LUC:** 1st ph (unc 30.8%), 2nd ph (unc 8%).
Measurements (10 selected nutlets): average L: 2.06 mm; average W: 1.64 mm

	L (mm)	W (mm)
LAV c NN1	2.4	1.8
LAV c NN1	2.3	1.8
LAV c NN1	1.8	1.3
LAV c NN1	2.1	1.7
LAV c NN1	2.3	1.9
LAV c NN1	2.3	1.8
LAV c NN1	2.2	1.7
LAV c NN1	1.6	1.5
LAV c 135	2.0	1.7
LAV c 135	1.8	1.4

Photo: Plate 1
Description: Two-sided or rarely three-sided nutlets. Oval to round in shape, pointed at the upper end and rounded at the base. Both sides are flat with a slight depression in the center and a longitudinal elevation. The surface is finely undulating, remains of involucral bracts with anchor-like terminations are often retained.

Bibliography: Renfrew 1973, Schoch *et al.* 1988, Stace 2010.

Polygonum persicaria L. redshank
Preservation: waterlogged
Type of remains: nutlets
Life form: T scap
Ecology: group 2.3 (RU). Widespread on nitrogenous waste, cultivated and open ground.
Ubiquity: **LAV:** EBA (unc 50%), MBA (unc 7.7%), section 98 (unc 33.3%), lav37 (unc EBA IB IC, EBA II, MBA). **LUC:** 1st ph. (unc 23%).
Measurements (10 selected nutlets): average L: 1.75 mm; average W: 1.26 mm

	L (mm)	W (mm)
LAV c NN1	2.2	1.7
LAV c NN1	1.7	1.1
LAV c 135	1.7	1.3
LAV c 135	1.7	1.3
LAV c 135	1.8	1.2
LAV c 143	2.2	1.7
LAV c 143	1.7	1.3
LAV c 143	1.8	1.1
LAV c 143	1.5	1.2
LAV c 143	1.4	1.0

Photo: Plate 1
Description: two-side, rarely distinctly three-sided fruit. Oval shape, pointed at the upper end. Both side flat or one side domed. Surface almost smooth, dark brown to black.
Bibliography: Renfrew 1973, Schoch *et al.* 1988, Stace 2010.

Rumex maritimus L. golden dock
Preservation: waterlogged
Type of remains: nutlet, perianth
Life form: T scap
Ecology: group 6.2 (LS). It grows on the margins of pools, lakes, rivers and ditches, in clay-pits and wet hollows in marshy fields. Its sites are usually waterlogged in winter, but it occasionally occurs on dry ground. It can tolerate mildly saline conditions.
Ubiquity: **LAV:** EBA (unc 83.3%), MBA (unc 77%), section 98 (unc 55.5%), lav37 (unc Neol, EBA IA IB IC, EBA II, MBA).
Measurements (10 selected nutlets): average L: 1.16 mm; average W: 0.56 mm

	L (mm)	W (mm)
LAV c NN1	1.1	0.5
LAV c NN1	1.3	0.5
LAV c NN1	1.4	0.6
LAV c NN1	1.2	0.6
LAV c NN1	1.1	0.6
LAV c 135	1.0	0.5
LAV c 4073	1.1	0.6
LAV c 4073	1.2	0.6
LAV c 4073	1.1	0.6
LAV c 4073	1.1	0.6

Photo: Plate 1
Description: nutlets with three sides, sharply angular edges. Elliptic in outline with the upper end pointed. Perianth with long, flexible, slender spines on the margins of each perianth-segments. It can be confused with *R. palustris* whose spines are rigid and a bit shorter.
Bibliography: Stace 2010, Online Atlas of the British and Irish flora 2014.

Chenopodiaceae (goosefoot family)
Chenopodium album L. fat-hen
Preservation: waterlogged
Type of remains: nutlets
Life form: T scap
Ecology: groups 2.2 / 2.3 / 2.4 (SW) (see also Chap. 8.3.3). A very common weed, growing mainly on fallow or cultivated fields. Due to its enormous fruit production, with high starch content, this plant was used in former times as an ingredient of flour for bread making (Behre 2008; Riehl 1999).
Ubiquity: **LAV:** EBA (unc 70.8%), MBA (unc 100%), section 98 (unc 66.6%), lav37 (unc Neol, Chal, EBA IA, IC, EBA II, MBA). **LUC:** 1st ph (unc 92.3%), 2nd ph (unc 48%).
Measurements (10 selected nutlets): average L: 1.26 mm; average W: 1.23 mm

	L (mm)	W (mm)
LAV c NN1	1.2	1.1
LAV c NN1	1.3	1.4
LAV c NN1	1.3	1.1
LAV c NN1	1.3	1.2
LAV c 135	1.3	1.0
LAV c 135	1.3	1.2
LAV c 135	1.1	1.0
LAV c 135	1.3	1.2
LAV c 135	1.3	1.2
LAV c 135	1.3	1.1

Photo: Plate 2
Description: nutlets round in outline with sharp border and lens-shape in cross-section. Pistill scar is located in the center of the upper surface, from this point fine grooves radiate.
Bibliography: Renfrew 1973, Schoch *et al.* 1988, Riehl 1999.

Polycnemum arvense L. / *Polycnemum majus* A. Braun, *Polycnemum arvense* L. and cf *Polycnemum* L.
field needleleaf / giant needleleaf
Preservation: waterlogged
Type of remains: nutlet
Life form: T scap
Ecology: group 2.3 (RU). Occurred in dry fields on sandy and gravelly grounds, often as a ruderal.
Ubiquity: **LAV:** MBA (unc 15.4%), lav37 (unc MBA). **LUC:** 1st ph (unc 7.7%).
Measurements (4 nutlets): average L: 1.29 mm; average W: 1.04 mm

	L (mm)	W (mm)
LAV c 4061	1.5	1.0
LAV37 98-103 cm	1.5	1.2
LAV37 78-83 cm	1.1	1.0
LUC c 113	1.1	1.0

Photo: Plate 2
Description: oval shaped nutlet, slightly compressed. The surface is densely tuberculate.
Bibliography: Riehl 1999, Bojňanský & Fargašová 2007.

Portulacaceae (purslane family)
Portulaca oleracea L. common purslane
Preservation: waterlogged and charred
Type of remains: seed
Life form: T scap
Ecology: group 2.2 (SW). It grows on cultivated ground and waste places. Widespread weed at crop field edges, orchard and vineyards.

Ubiquity: **LAV:** EBA (unc 37.5%), MBA (unc 100%), section 98 (unc 33.3%), lav37 (unc Chal, EBA IA IC, EBA II, MBA). **LUC:** 1st ph (unc 46%, c 7.7%), 2nd ph (unc 8%).
Measurements (10 selected seeds): average L: 0.93 mm; average W: 0.84 mm

	L (mm)	W (mm)
LUC c1	1.0	0.9
LUC c1	0.8	0.8
LUC c1	1.0	0.9
LUC c1	0.9	0.8
LUC c1	0.9	0.8
LUC c1	1.0	0.9
LUC c1	0.8	0.7
LUC c1	1.0	0.9
LUC c1	0.9	0.9
LAV c 4072	1.0	0.8

Photo: Plate 2
Description: Seed almost circular in its outline, laterally compressed, more rounded at the top and tapering at the bottom with a hilum delimited by a furrow. The surface is covered with small papillae, more prominent along the margins, and stellate tubercules on lateral surface.
Bibliography: Riehl 1999, Bojňanský & Fargašová 2007, Schoch *et al.* 1988.

Caryophyllaceae (pink family)
Arenaria serpyllifolia L. thyme-leaved sandwort
Preservation: waterlogged
Type of remains: seed, capsule
Life form: T scap
Ecology: group 3.1 (MP). Open ground on well drained soils, especially sand and limestone (fields, fallow, roadsides, pathway).
Ubiquity: **LAV:** EBA (unc 50%), MBA (unc 69%), section 98 (unc 66.6%), lav37 (unc EBA II, MBA). **LUC:** 1st ph (unc 30.7%), 2nd ph (unc 4%).
Measurements (10 selected seeds): average L: 0.60 mm; average W: 0.48 mm

	L (mm)	W (mm)
LAV c NN1	0.6	0.5
LAV c NN1	0.6	0.5
LAV c NN1	0.6	0.5
LAV c NN1	0.6	0.6
LAV c NN1	0.6	0.5
LAV c NN1	0.5	0.5
LAV c NN1	0.6	0.5
LAV c NN1	0.6	0.5
LAV c NN1	0.6	0.5
LAV c NN1	0.5	0.4

Photo: Plate 2
Description: small reniform seed, laterally slight-compressed, covered by very small papillae distributed in concentric rows. Fruit is a small pyriform capsule.
Bibliography: Jacquat 1988, Bojňanský & Fargašová 2007, Stace 2010.

Ranunculaceae (buttercup family)
Ranunculus sardous Crantz and *Ranunculus* cf *sardous* Crantz hairy buttercup
Preservation: waterlogged
Type of remains: achenes

Life form: T scap
Ecology: group 6.1 (LS). Widespread in arable fields and in nutrient-rich grasslands, watersides habitat and ditches.
Ubiquity: **LAV:** EBA (unc 66.6%), MBA (unc 30.7%), section 98 (unc 44.4%), lav37 (unc EBA II, MBA). **LUC:** 1st ph (unc 15.4%), 2nd ph (unc 4%).
Measurements (10 selected achenes): average L: 1.93 mm; average W: 1.62 mm.

	L (mm)	W (mm)
LAV c WES04	1.9	1.5
LAV c WES04	2.1	1.9
LAV c NN1	1.9	1.6
LAV c 135	2.0	1.6
LAV c 135	1.9	1.3
LAV c 143	2.1	1.6
LAV c 143	1.8	1.6
LAV c 4073	2.1	1.8
LAV c 169	1.7	1.5
LAV c 169	1.9	1.9

Photo: Plate 2
Description: achenes almost round in shape, laterally compressed, tapering at the base and with a short recurved beak. Lateral surfaces are delimited by a large border and covered by typical cell grooves and scattered protuberances.
Bibliography: Jacquat 1988, Schoch *et al.* 1988, Bojňanský & Fargašová 2007, Stace 2010.

Ranunculus sceleratus L. celery-leaved buttercup
Preservation: waterlogged
Type of remains: achenes
Life form: T scap
Ecology: group 6.1 / 6.2 (LS). Widespread in muddy soils, along lakeshore, streamsides, ponds, ditches, marshy fields,
Ubiquity: **LAV:** EBA (unc 66.6%), MBA (unc 100%), section 98 (unc 66.6%), lav37 (unc Neol, Chal, EBA IA IB IC, EBA II, MBA). **LUC:** 1st ph (unc 30.7%).
Measurements (10 selected waterlogged achenes): average L: 0.79 mm; average W: 0.64 mm

	L (mm)	W (mm)
LAV c 135	0.8	0.7
LAV c 135	0.8	0.7
LAV c 135	0.7	0.7
LAV c 4073	0.9	0.6
LAV c 4073	0.8	0.7
LAV c 4073	0.8	0.6
LAV c 4073	0.7	0.6
LAV c 4073	0.9	0.6
LAV c 4073	0.8	0.6
LAV c 4073	0.8	0.6

Photo: Plate 2
Description: achenes rounded in outline and flattish, with a large spongy border. Central area of the lateral surfaces with transversal ridges.
Bibliography: Schoch *et al.* 1988, Bojňanský & Fargašová 2007, Stace 2010.

Papaveraceae (poppy family)
Papaver argemone L. prickly poppy
Preservation: waterlogged
Type of remains: seeds
Life form: T scap
Ecology: group 2.1 (WW). Weed of arable fields, fallows, vineyards, waste grounds, on light soils, sandy and stony grounds.

Ubiquity: **LAV:** EBA (unc 8%), MBA (unc 23%), lav37 (unc MBA). **LUC:** 1st ph (unc 7.7%).
Measurements (9 seeds): average L: 0.82 mm; average W: 0.53 mm

	L (mm)	W (mm)
LAV c 135	0.9	0.6
LAV c 4061	0.8	0.6
LAV c 4061	0.7	0.5
LAV c 4061	0.8	0.5
LAV c 4034	0.9	0.6
LAV c 4065	0.7	0.5
LAV37 c 120,5cm	0.9	0.6
LAV37 c 100,5cm	1.0	0.6
LAV37 c 115,5cm	0.8	0.5
LAV c 135	0.9	0.6

Photo: Plate 2
Description: seeds elongated, reniform. Dorsal margin convex, ventral concave. The surface is characterized by a reticulum whose alveolus are a little deep, rectangular and arranged in concentric rows.
Bibliography: Jacquat 1988, Schoch *et al.* 1988, Bojňanský & Fargašová 2007, Stace 2010.

Papaver dubium L. long-headed poppy
Preservation: waterlogged
Type of remains: seeds
Life form: T scap
Ecology: group 2.1 (WW). Widespread on waste ground and in arable fields.
Ubiquity: **LAV:** EBA (unc 8%), MBA (unc 7.7%), lav37 (unc MBA).
Measurements (4 seeds): average L: 0.63 mm; average W: 0.47 mm

	L (mm)	W (mm)
LAV c 4072	0.6	0.5
LAV37 c 115.5cm	0.8	0.5
LAV c 135	0.6	0.5
LAV c 176	0.6	0.4

Photo: Plate 2
Description: seeds small, reniform, slight convex on the dorsal margin and narrowly concave on the ventral one. The surface cell pattern is characterized by an areolate to square or 6-angled reticulum. Alveolus are regularly distributed and arranged in concentric rows. The separation between *P. rhoeas* and *P. dubium* is difficult, small differences are observed in the outline shape and in the arrangement of the surface cells.
Bibliography: Jacquat 1988, Schoch *et al.* 1988, Bojňanský & Fargašová 2007.

Papaver rhoeas L. common poppy
Preservation: waterlogged
Type of remains: seed (1 item)
Life form: T scap
Ecology: group 2.1 (WW). Widespread on waste ground and in arable fields.
Ubiquity: **LAV:** EBA (unc 4%).
Measurements (1 seed): average L: 0.6 mm; average W: 0.5 mm
Photo: Plate 2
Description: seeds small, reniform, high convex on the dorsal margin and deep concave on the ventral one. Surface with less prominent network (compare to *P. dubium*). The reticulum is scalariform with quadrangular to elongated alveolus on the lateral side.
Bibliography: Jacquat 1988, Schoch *et al.* 1988, Bojňanský & Fargašová 2007.

Brassicaceae (mustard family)

Camelina sativa (L.) Crantz gold-of-pleasure

Preservation: waterlogged

Type of remains: seed (only 1), capsule fragments (silique)

Life form: T scap

Ecology: group 2.1 (WW) (see also Chap. 8.3.3). Weed in cultivated fields (cereals and flax). It is considered an ancient secondary crop as changed from a weed to an oil crop (likely from Late Bronze Age/Iron Age onwards).

Ubiquity: **LAV:** EBA (unc 16.6%), section 98 (unc 44.4%), lav37 (unc EBA IA, EBA II, MBA). **LUC:** 2nd ph (unc 8%).

Measurements (1 seed): L: 0.65 mm; W: 0.4 mm

Photo: Plate 2

Description: seed elliptic in outline and slight flattish. The radicle is clearly delimited by a narrow furrow and the tip is slightly curved. Surface with small papillae arranged in longitudinal direction. The silique valves are clearly identifiable for the characteristic nervation pattern.

Bibliography: Schoch *et al.* 1988, Jacquat 1988, Bojňanský & Fargašová 2007.

Rosaceae (rose family)

Agrimonia eupatoria L. agrimony

Preservation: waterlogged and charred

Type of remains: receptacle (hypanthium)

Life form: H scap

Ecology: group 5.1 (F). Widespread in clearings and forest edges, fallow, and meadows. It favours well-drained soils.

Ubiquity: **LAV:** EBA (unc 83.3%, c 4%), MBA (unc 7.7%), section 98 (unc 88.8%), lav37 (unc EBA IA IB, EBA II, MBA). **LUC:** 1st ph (unc 38.5%), 2nd ph (unc 32%, c 4%).

Measurements (10 selected receptacles): average L: 4.05 mm; average W: 3.95 mm

	L (mm)	W (mm)
LUC c 372	4.25	4.06
LUC c 372	3.88	3.88
LUC c 372	4.19	4.19
LUC c 372	4.69	3.75
LUC c 372	3.56	3.13
LUC c 372	3.94	3.63
LUC c 372	4.38	4.56
LUC c 372	3.88	4.5
LUC c 372	3.63	3.88
LUC c 372	4.13	3.94

Photo: Plate 2

Description: receptacle wood and grooved, with ten hairy ribs separated by deeply furrows. Numerous hooks (often only the bases are preserved in the fossil remains) crown the margin of the upper surface.

Bibliography: Schoch *et al.* 1988, Jacquat 1988.

Fragaria vesca L. strawberry

Preservation: waterlogged

Type of remains: nutlet

Life form: H rept

Ecology: group 5.1 (F). Widespread in clearings and forest edges, and along pathways in woodland.

Ubiquity: **LAV:** EBA (unc 70.8%), MBA (unc 61.5%), section 98 (unc 77.7%), lav37 (unc EBA IA IB IC, EBA II, MBA). **LUC:** 1st ph (unc 61.5%), 2nd ph (unc 16%).

Measurements (10 selected nutlets): average L: 1.32 mm; average W: 1.05 mm

	L (mm)	W (mm)
LAVWES04	1.4	1.3
LAVWES04	1.4	1.1
LAVWES04	1.3	1.0
LAVWES04	1.2	1.0

LAVWES04	1.3	1.0
LAVWES04	1.3	1.0
LAVWES04	1.4	1.0
LAVWES04	1.3	0.9
LAVWES04	1.3	1.2
LAVWES04	1.3	1.0

Photo: Plate 2
Description: more or less oval in outline, rounded at the base but tapering at the opposite end. The tip is hooked. The hilum is lateral. Several anastomosed veins run from the hilum.
Bibliography: Schoch *et al.* 1988, Jacquat 1988.

Potentilla reptans L. creeping cinquefoil
Preservation: waterlogged and charred
Type of remains: nutlets
Life form: H ros
Ecology: group 2.4 / 4.2 (RU). Ruderal on wet and fertile places, along roads, ditches, arable land and marshy fields.
Ubiquity: **LAV:** EBA (unc 62.5%), MBA (unc 84.6%, c 7.7%), section 98 (unc 22.2%), lav37 (unc EBA IB, EBA II, MBA). **LUC:** 1st ph (unc 46%), 2nd ph (unc 8%).
Measurements (10 selected nutlets): average L: 1.06 mm; average W: 0.70 mm

	L (mm)	W (mm)
LAV c WES04	1.1	0.8
LAV c WES04	1.0	0.7
LAV c WES04	1.1	0.6
LAV c RP02	1.2	0.9
LAV c RP02	1.0	0.7
LAV c RP02	1.3	0.8
LAV c RP02	1.0	0.7
LAV c RP02	0.9	0.6
LAV c 135	1.1	0.8
LAV c 135	0.9	0.6

Photo: Plate 2
Description: reniform nutlets, straight on the hilum side, slightly domed on lateral surfaces. Small round protuberances are recognizable on the surface.
Bibliography: Schoch *et al.* 1988, Jacquat 1988.

Prunus spinosa L. and *Prunus* cf *spinosa* L. blackthorn
Preservation: waterlogged
Type of remains: stone
Life form: P, shrub or small tree
Ecology: group 5.1 (F). Widespread in light woodlands, thickets, forest edges, pastureland and waste places.
Ubiquity: **LAV:** EBA (unc 8.3%), MBA (unc 84.6%). **LUC:** 1st ph (unc 15.4%), 2nd ph (unc 8%).
Measurements (9 stones): average L: 8.14 mm; average W: 6.76 mm

	L (mm)	W (mm)
LAV c 4061 4 mm	8.73	7.2
LAV c 4025	8.1	6.75
LUC c NN1	9.0	7.2
LAV c 195	8.28	7.47
LUC c 107	9.45	7.92
LAV c 4034	8.1	6.57
LAV c 4025	6.3	5.67
LAV c 4025	6.75	4.68
LAV c 4025	8.55	7.38

Photo: Plate 3
Description: stones roughly oval in outline, rounded at the hilum side and pointed at the opposite side, laterally flattened. A suture delimited the ventral side, while a deep groove marked the dorsal side. The surface is coarsely wrinkled.
Bibliography: Schoch *et al.* 1988, Jacquat 1988, Bojňanský & Fargašová 2007.

Pyrus pyraster Burgsd. and cf *Pyrus communis* L. and *Pyrus* sp. wild pear and common pear
Preservation: waterlogged
Type of remains: pip, calyx tube remnants, cell stones, pericarp, stalk fragment.
Life form: P, tree
Ecology: group 5.1 (F). Wild pear grows in humid open woods, thickets and hedges, and also as isolated tree.
Ubiquity: **LAV:** EBA (unc 50%), MBA (unc 31%), section 98 (unc 77.7%), lav37 (unc EBA II, MBA). **LUC:** 1st ph (unc 77%), 2nd ph (unc 44%).
Measurements (10 selected pips): average L: 8.11 mm; average W: 4.91 mm

	L (mm)	W (mm)
LUC c 394	8.82	4.86
LUC c 394	8.19	4.23
LUC c 394	5.76	4.41
LUC c 394	9.0	5.22
LUC c 394	7.65	4.95
LUC c 394	9.45	5.4
LUC c 394	8.1	5.22
LUC c 394	6.75	5.13
LUC c 394	9.45	5.4
LUC c 394	7.92	4.32

Photo: Plate 3
Description: pips are obovoid, rounded on top and tapering below, longer and more slender than those of *Malus.* The hilum is oblique, while in apple lies at the extremity. Flat on one side, domed on the other one. *P. pyraster* has a longitudinal ridge more or less pronounced on the domed side. Elliptical verrucae punctuate *P. pyraster*'s surface. *P. communis* pips are larger and more elongate. Calyx tube remnants and stone cells are not distinguishable and determined as *Pyrus* sp.
Bibliography: Renfrew 1973, Schoch *et al.* 1988, Jacquat 1988, Bojňanský & Fargašová 2007.

Rubus gr *fruticosus* blackberry
Preservation: waterlogged and charred
Type of remains: endocarp
Life form: P, shrub
Ecology: group 5.1 (F). Widespread in light forest, forest edges and clearings.
Ubiquity: **LAV:** EBA (unc 100%), MBA (unc 100%), section 98 (unc 66.6%), lav37 (unc Neol, EBA IA IB IC, EBA II, MBA). **LUC:** 1st ph (unc 100%, c 15.4%), 2nd ph (unc 88% c 4%).
Measurements (10 waterlogged selected endocarps): average L: 2.99 mm; average W: 1.88 mm

	L (mm)	W (mm)
LAV NN1	2.7	1.8
LAV NN1	2.9	2.0
LAV NN1	3.3	2.1
LAV NN1	2.9	2.0
LAV NN1	3.3	2.0
LAV NN1	2.8	1.7
LAV NN1	2.8	1.8
LAV NN1	3.1	1.7
LAV NN1	3.0	1.8
LAV NN1	3.2	1.8

Photo: Plate 3

Description: endocaprs more or less oval in outline, with ventral side straight or slightly domed. Surface with irregular and strongly deep pits. Size is highly variable.
Bibliography: Schoch *et al.* 1988, Jacquat 1988, Bojňanský & Fargašová 2007.

Fabaceae (pea family)
CROP LEGUMES
Vicia faba L. var. *minor* Beck horsebean, broad bean
Preservation: charred
Type of remains: seeds
Life form: T scap
Ecology: group 1.1 (C). It grows well on heavy, deep soils with subalkaline pH. It requires abundant water, especially during ripening period.
Ubiquity: **LAV:** MBA (c 31%).
Measurements (4 seeds): average L: 6.67 mm; average W: 5.1 mm; average H: 4.77 mm

	L (mm)	W (mm)	H (mm)
LAV c 4073	7.0	5.8	5.8
LAV c 4074	7.0	5.6	5.0
LAV c 4076	6.9	5.0	4.8
LAV c 4072	5.8	4.0	3.5

Photo: Plate 3
Description: seeds variable in size and shape: from round to elliptic, flattened or almost circular in section, and generally of small size compare to modern reference collections. The hilum is elongated, large, but rarely preserved. A characteristic depression is present at the hilar end. Fossil charred seeds are often split into the two cotyledons or many fragments without any coat.
Bibliography: Renfrew 1973, Jacquat 1988, Schoch *et al.* 1988, Zohary *et al.* 2012.

Oxalidaceae
Oxalis corniculata L. procumbent yellow-sorrel
Preservation: waterlogged
Type of remains: 1 seed
Life form: H rept
Ecology: group 2.2 (SW). Widespread as a weed of gardens, paths, walls and waste ground.
Ubiquity: **LAV:** EBA (unc 4%).
Measurements (1 seed): L: 1.2 mm; W: 0.9 mm
Photo: Plate 2
Description: seeds flat, elliptic to obovoid in outline with an obtuse apex. Surface with transversal, parallel ridges.
Bibliography: Bojňanský & Fargašová 2007, Stace 2010.

Linaceae (flax family)
Linum usitatissimum L. flax
Preservation: waterlogged, charred
Type of remains: seeds, capsules, fibres
Life form: T scap
Ecology: group 1.1 (C). It grows well on fertile, deep, well-drained loams and silty clays,
Ubiquity: **LAV:** EBA (unc 66.6% c 8.3%), section 98 (unc 88.8%), lav37 (unc EBA IA IB, EBA II, MBA). **LUC:** 1st ph (unc 38.5%, c 54%), 2nd ph (unc 25%, c 8%).
Measurements (10 selected waterlogged seeds): average L: 3.46 mm; average W: 1.92 mm; (10 selected charred seeds): average L: 3.13 mm; average W: 1.67 mm

Waterlogged seeds	L (mm)	W (mm)
LAV c RP02	3.0	2.2
LAV c RP02	3.6	2.2
LAV c RP02	3.9	2.2

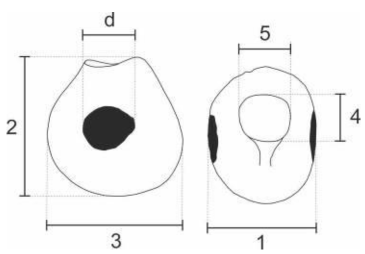
LAV c RP02	3.9	2.1
LAV c RP02	3.1	1.6
LAV c RP02	3.6	1.8
LAV c RP02	3.5	1.7
LAV c RP02	3.1	1.8
LAV c RP02	3.7	1.8
LAV c RP02	3.4	2.0

Charred seeds	L (mm)	W (mm)
LUC c 1	3.4	1.36
LUC c 1	2.8	1.4
LUC c 1	2.8	1.48
LUC c 1	3.92	1.92
LUC c 1	2.76	1.96
LUC c 1	3.4	1.96
LUC c 1	2.52	1.28
LUC c 1	3.4	1.88
LUC c 1	3.64	2.08
LUC c 1	2.68	1.4

Photo: Plate 3
Description: seeds more or less oval in outline, flat, slightly tapering at one end with a characteristic lateral depression closed to the apex (apparently curved). The surface is characterized by a distinctive pattern of rounded and pitted cells. Capsules are globose and composed by ten segments. Single segments are common in fossil finds. Stem fragments (fiber) are strongly compressed, of light color and with longitudinal streaks.
Bibliography: Renfrew 1973, Jacquat 1988, Schoch *et al.* 1988.

Staphyleaceae
Staphylea pinnata bladder-nut
Preservation: waterlogged, charred
Type of remains: seeds
Life form: P, small tree
Ecology: group 5.1 (F). It is a shade tolerance species, restricted to alluvial and basic soils in the understory of thermophilous deciduous forests, and in thickets along river banks, in moist ravines, or on the shore of lakes.
Number of remains: **LUC:** 1st ph (unc 1 seed + 13 seeds in one necklace + 1 seed in a second necklace), 2nd ph (c 1 seed).
Measurements: measures of the *Staphylea pinnata* seeds forming the necklace found in Lucone layers

measure (mm) / seed	1	2	3	4	5	d *right hole*		d *left hole*	
1	7.5	10.1	10	4.5	5	3	2	3	2
2	8	10	10	3.9	4	4	3.5	3.3	3.8
3	8	11.6	11.8	3.4	3.8	5	3.8	6.6	5.5
4	7.7	10	9.7	3.8	3.2	3.5	3	4.7	5
5	8	11	10.5	4.4	2.8	5.3	4.3	3.7	4
6	7.7	10	9.6	4.4	3.6	4.6	4.6	2.8	2.6
7	7	10.7	10.8	4.4	3.8	4.8	5.3	5	4.5
8	8	10.5	10	4.4	3.6	3.8	3.8	5	4.7
9	7.5	10.5	9.6	4.6	4.2	3.8	3.8	4.7	4
10	8	10.6	10	5	3	5	4	3.3	3.7
11	--	--	--	3.7	3.8	--	--	--	--
12	7.8	11.3	10	3	3.6	5.5	4.7	4	3.7
13	7	10	10	4	2.7	4.3	5	5.3	5.5

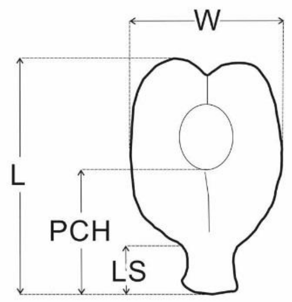


average	7.7	10.5	10.2	4.1	3.6	4.4	4.0	4.3	4.1
st. dev.	0.4	0.5	0.6	0.5	0.6	0.8	0.9	1.1	1.1

Photo: Plate 4
Description: Seeds almost spherical, ca 10 mm in diameter, glabrous, and shiny with hard seed coats. The hilum is large, more or less rounded and surrounded by a rim.
Bibliography: Latalowa 1994

Vitaceae
Vitis vinifera L. subsp. *sylvestris* (Gmelin) Hegi and *Vitis* sp. wild grape
Preservation: waterlogged, charred
Type of remains: fruit (1 item), pips, tendril
Life form: P lian
Ecology: group 5.1 (F). It is a creeper species favouring light humid forest, clearings or edges. It is common in alluvial forest.
Ubiquity: **LAV:** EBA (unc 95.8%), MBA (unc 84.6%, c 7.7%), section 98 (unc 55.5%), lav37 (unc EBA II, MBA). **LUC:** 1st ph (unc 61.5%), 2nd ph (unc 60%, c 8%).
Measurements (10 waterlogged selected pips): average L: 9.68 mm; average W: 6.87 mm; average LS (Length of Stalk): 1.61 mm; average PCH (Position of Chalaza): 4.61 mm

	L (mm)	W (mm)	LS (mm)	PCH (mm)	W/L *100 [1]
LUC c 394	10.4	6.66	2.52	5.31	64.04
LUC c 394	9.54	6.48	1.35	5.31	67.92
LUC c 394	9.27	6.75	1.8	4.5	72.81
LUC c 394	10.4	7.56	2.52	5.4	72.69
LUC c 394	9.45	6.75	1.17	3.6	71.43
LUC c 394	9.72	6.75	1.08	4.5	69.44
LUC c 394	9	6.21	1.53	4.32	69.00
LUC c 394	9	7.29	1.17	3.6	81.00
LUC c 394	9	7.11	0.9	3.6	79.00
LUC c 394	11.1	7.11	2.07	5.94	64.05



[1] Stummer's index

Photo: Plate 5
Description: pips are rounded, with short truncated stalk. The dorsal side is domed with a circular chalazal scar in the center, while the ventral side is flattened with two narrow, deep furrows running parallel each other.
Bibliography: Renfrew 1973, Jacquat 1988, Schoch *et al.* 1988.

Violaceae
Viola riviniana Rchb. / *V. reichenbachiana* Jordan ex Boreau common dog-violet/early dog-violet
Preservation: waterlogged
Type of remains: seeds
Life form: H scap
Ecology: group 5.1 (F). Widespread in woods, hedgebanks and grasslands, in shady places.
Ubiquity: **LAV:** lav37 (unc MBA). **LUC:** 1st ph (unc 7.7%).
Measurements (3 seeds): average L: 1.65 mm; average W: 1.09 mm

	L (mm)	W (mm)
LUC c 1	2.1	1.4
LAV37 c 95,5cm	1.7	1.2
LAV37 c 80,5cm	1.1	0.7

Photo: Plate 2

Description: seeds obovoid to lightly piriform. A longitudinal fissure runs from the tip (hilum) to the basal area. Surface lustrous and reticulate.
Bibliography: Bojňanský & Fargašová 2007.

Cornaceae
Cornus mas L. Cornelian cherry
Preservation: waterlogged and charred
Type of remains: stones
Life form: P, shrub or small tree
Ecology: group 5.1 (F). It grows in light forest or at forest edges on sunny places. It favours calcareous soils substratum and thermophilous conditions.
Ubiquity: **LAV:** EBA (unc 79%), MBA (unc 100%), section 98 (unc 33.3%), lav37 (unc EBA II, MBA). **LUC:** 1st ph (unc 70%, c 15.4%), 2nd ph (unc 60%, c 4%).
Measurements (10 waterlogged selected stones): average L: 9.54 mm; average W: 5.25 mm

	L (mm)	W (mm)
LUC c 4072	10.6	5.0
LUC c 4072	9.0	4.4
LUC c 4072	10.6	4.8
LUC c 4072	11.1	5.1
LUC c 4072	10.8	5.6
LUC c 4072	9.4	4.8
LUC c 4072	11.0	5.1
LUC c 4072	8.6	4.9
LUC c 4072	10.3	4.4
LUC c 4072	4.0	8.5

Photo: Plate 5
Description: elongate, barrel-shaped stones with round cross-section. Surface mat with two main furrows running from the tip to 1/3 of the stone, and four ridges in the bottom part of the stone. In cross-section two large seed chambers are present, in addition to several small depressions.
Bibliography: Schoch *et al.* 1988, Bojňanský & Fargašová 2007.

Apiaceae (parsley family)
Orlaya grandiflora (L.) Hoff. and cf *Orlaya grandiflora* (L.) Hoff. white lace flower
Preservation: waterlogged
Type of remains: mericarp fragments
Life form: T scap
Ecology: group 3.1 (MP). Widespread in dry meadows on calcareous, clayey soils. It grows also in stony scrubland, fallows, light wood or as a weed on crop fields edges.
Ubiquity: **LAV:** MBA (unc 15.3%), lav37 (unc EBA II, MBA).
Measurements: no measurable items were found
Photo: Plate 5
Description: mericarps ovoid to ellipsoid in outline, dorso-ventrally compressed with five primary ridges (3 dorsal, 2 lateral) with short bristles and four secondary ridges with prominent spines.
Bibliography: Perego *et al.* 2012, Bojňanský & Fargašová 2007.

Verbenaceae (teak family)
Verbena officinalis L. vervain
Preservation: waterlogged, charred
Type of remains: nutlet
Life form: H scap
Ecology: group 2.4 (RU). Widespread as a weed on waste ground, fallow land and along paths.
Ubiquity: **LAV:** EBA (unc 58.3%, c 4%), MBA (unc 69.2%), section 98 (unc 66.6%), lav37 (unc EBA IC, EBA II, MBA). **LUC:** 1st ph (unc 30.7%), 2nd ph (unc 4%).

Measurements (10 selected waterlogged nutlets): average L: 1.77 mm; average W: 0.59 mm

	L (mm)	W (mm)
LAV c NN1	1.6	0.6
LAV c NN1	1.8	0.7
LAV c NN1	1.9	0.6
LAV c NN1	1.8	0.7
LAV c NN1	2.0	0.5
LAV c 135	1.7	0.6
LAV c 135	1.6	0.5
LAV c 135	1.6	0.5
LAV c 135	1.8	0.6
LAV c 135	1.9	0.6

Photo: Plate 5
Description: rod-shaped nutlet. The dorsal side is domed with longitudinal ribs branched close to one end. The ventral side is roof-like.
Bibliography: Jacquat 1988, Schoch *et al.* 1988.

Lamiaceae (mint family)
Ajuga reptans L. common bugle
Preservation: waterlogged
Type of remains: nutlets
Life form: H rept
Ecology: group 2.4 (RU). Common on shady places in wet meadows and waste ground.
Ubiquity: **LAV:** MBA (unc 7.7%). **LUC:** 1st ph (unc 2.6%).
Measurements (4 nutlets): average L: 1.95 mm; average W: 1.375 mm

	L (mm)	W (mm)
LUC c1	2.2	1.4
LUC c1	2.1	1.5
LAV c4034	2	1.5
LAV c4034	1.5	1.1

Photo: Plate 5
Description: nutlets ovate with a large hilum area on ventral side. Surface reticulate-foveate forming a coarse network.
Bibliography: Jacquat 1988, Schoch *et al.* 1988, Bojňanský & Fargašová 2007.

Lycopus europaeus L. gypswort
Preservation: waterlogged
Type of remains: nutlets
Life form: H scap (I rad)
Ecology: group 6.1 (LS). Common on watersides, ditches, reed swamps, wet fields, flooded places and marshy woodlands.
Ubiquity: **LAV:** EBA (unc 50%), MBA (unc 30.7%), section 98 (unc 44.4%), lav37 (unc Neol, Chal, EBA IA IC, EBA II, MBA). **LUC:** 1st ph (unc 7.7%), 2nd ph (unc 12%).
Measurements (10 selected nutlets): average L: 1.30 mm; average W: 0.96 mm

	L (mm)	W (mm)
LAV c 135	1.1	0.8
LAV c 135	1.3	0.9
LAV c 4073	1.1	0.8
LAV37 c 135,5cm	1.3	0.9
LAV37 c 130,5cm	1.3	1.0
LAV37 c 130,5cm	1.3	1.2
LAV37 c 251,5cm	1.4	0.9

LAV37 c 62,5cm	1.4	1.0
LAV c 76	1.4	1.0
LAV c 169	1.6	1.0

Photo: Plate 5
Description: nutlets trapeziform with broader apex and narrow base. The dorsal side is slight convex, while the ventral side is nearly flat. Margins are thick and broad. The hilum at the lower end is rounded and prominent.
Bibliography: Jacquat 1988, Schoch *et al.* 1988, Bojňanský & Fargašová 2007.

Mentha aquatica L. / *M. arvensis* L. water mint/field mint
Preservation: waterlogged
Type of remains: nutlets
Life form: H scap
Ecology: group 6.1 (LS). It grows on damp places, wet fields and meadows, ditches, along riverbanks or at margins of still water.
Ubiquity: **LAV:** EBA (unc 4%), section 98 (unc 22.2%). **LUC:** 1st ph (unc 15.4%).
Measurements (10 selected nutlets): average L: 0.81 mm; average W: 0.56 mm

	L (mm)	W (mm)
LAV c 135	0.8	0.6
LAV c 113	0.8	0.5
LAV c 136	0.8	0.6
LAV c 136	0.8	0.6
LUC c 107	0.8	0.5
LAV c RR115	0.9	0.6

Photo: Plate 5
Description: nutlets ovate to elliptic (sometimes triangular) with convex dorsal side and rooflike ventral side. The apex is round while the base is characterized by two small depressions. Separation between *M. arvensis* and *M. aquatic* is based on surface cell patterns. The former is finely pitted with large grooves, the latter present smaller and more numerous pits. Anyway, this differentiation is often hard to note.
Bibliography: Jacquat 1988, Schoch *et al.* 1988, Bojňanský & Fargašová 2007.

Solanaceae (nightshade family)
Physalis alkekengi L. Japanese-lantern
Preservation: waterlogged and charred
Type of remains: seeds
Life form: H scap
Ecology: groups 6.3 / 5.1 (F). Widespread in woods, riverbanks and lakeshore belt.
Ubiquity: **LAV:** EBA (unc 79%), MBA (unc 15.3%), section 98 (unc 44.4%), lav37 (unc EBA IA, MBA). **LUC:** 1st ph (unc 84.6%, c 23%), 2nd ph (unc 44%, c 4%).
Measurements (10 selected waterlogged seeds): average L: 1.74 mm; average W: 1.51 mm

	L (mm)	W (mm)
LAV c NN1	2.0	1.6
LAV c NN1	2.1	1.7
LAV c 135	2.3	2.1
LAV c 135	1.6	1.3
LAV c 135	1.7	1.4
LAV c W04	1.5	1.1
LAV c W04	1.2	1.3
LAV c W04	1.9	1.6
LAV c W04	1.8	1.7
LAV c W04	1.6	1.3

Photo: Plate 5

Description: more or less elliptic to slightly reniform and laterally flat seeds, characterized by a reticulate surface pattern. Surface alveolus have highwalled and ondulate margins, coarser than in *Solanum* species.
Bibliography: Jacquat 1988, Riehl 1999, Schoch *et al.* 1988, Bojňanský & Fargašová 2007.

Plantaginaceae (plantain family)
Plantago major L. greater plantain
Preservation: waterlogged
Type of remains: seeds
Life form: H ros
Ecology: group 2.4 (RU). Common on open ground, along paths and pastures. It is a resistant to treading plant.
Ubiquity: **LAV:** MBA (unc 7.7%), lav37 (unc EBA II, MBA). **LUC:** 1st ph (unc 7.7%).
Measurements (5 selected seeds): average L: 1.02 mm; average W: 0.68 mm

	L (mm)	W (mm)
LAV c 4072	1.0	0.7
LUC c 107	1.0	0.8
LAV37 c 67,5cm	0.9	0.7
LAV37 c 75,5cm	1.3	0.8
LAV37 c 188,5cm	0.9	0.6

Photo: Plate 5
Description: seeds ellipsoid, flat with central hilum on ventral side from which fine undulated folds radiate. Folds on dorsal side run parallel in longitudinal direction.
Bibliography: Jacquat 1988, Schoch *et al.* 1988.

Valerianaceae (spikenard family)
Valerianella dentata (L.) Pollich cornsalad
Preservation: waterlogged and charred
Type of remains: nutlet
Life form: T scap
Ecology: group 2.1 (WW). It grows in arable fields, at path margins and rough land.
Ubiquity: **LAV:** EBA (unc 75%), MBA (unc 61.5%), section 98 (unc 55.5%), lav37 (unc EBA IC, EBA II, MBA). **LUC:** 1st ph (unc 38.5%, c 7.7%), 2nd ph (unc 24%).
Measurements (10 selected nutlets): average L: 1.70 mm; average W: 1.03 mm

	L (mm)	W (mm)
LAV c WES04	1.8	1.1
LAV c WES04	1.4	0.8
LAV c NN1	1.8	1.0
LAV c NN1	1.9	1.0
LAV c NN1	1.8	1.0
LAV c NN1	2.0	1.1
LAV c NN1	1.8	1.1
LAV c NN1	1.6	1.1
LAV c NN1	1.4	0.9
LAV c NN1	1.8	1.1

Photo: Plate 6
Description: nutlets drop-shaped, pointed at one end with clear margins. The dorsal side is domed with a fine longitudinal ridge running in the middle. The ventral side is porous and bordered by a small bulge.
Bibliography: Jacquat 1988, Riehl 1999, Schoch *et al.* 1988.

Dipsacaceae

Dipsacus fullonum L. wild teasel

Preservation: waterlogged

Type of remains: achenes

Life form: H bienn (T scap)

Ecology: group 2.4 (RU). Widespread as ruderal weed in marginal habitats, rough and waste ground. It can grow as well in fields.

Ubiquity: **LAV:** lav37 (unc EBA II). **LUC:** 2nd ph (unc 4%).

Measurements (3 achenes): average L: 3.2 mm; average W: 1.1 mm

	L (mm)	W (mm)
LAV37 231.5cm	2.9	1.0
LAV c 76	3.5	1.6
LUC c NN1	3.3	0.8

Photo: Plate 6

Description: achenes narrowly prismatic with truncate apex and hilum in the center. Longitudinal ribs run on lateral surface.

Bibliography: Bojňanský & Fargašová 2007.

Knautia arvensis (L.) Coulter field scabious

Preservation: waterlogged

Type of remains: achenes

Life form: H scap/H bienn

Ecology: group 4.3 (MP). It grows in dry grassy places on light soils, along paths, in open woods.

Ubiquity: **LAV:** EBA (unc 41.6%). **LUC:** 2nd ph (unc 4%).

Measurements (5 achenes): average L: 3.38 mm; average W: 1.22 mm

	L (mm)	W (mm)
LUC c 397	4.08	1.44
LAV c RR115	3.2	1.44
LAV c 135	3.6	1.2
LAV c W04	2.92	1.2
LAV c W04	3.12	0.8

Photo: Plate 6

Description: achenes ovoid-elongate, composed by four parts separated by more or less distinct longitudinal ribs. Toward the apex, the ribs raised and joined together forming a ring. Surface cell patterns show very fine longitudinal streaks. The four elements are often disarticulated in the fossil remains.

Bibliography: Jacquat 1988, Bojňanský & Fargašová 2007.

Campanulaceae

Legousia hybrida (L.) Delarbre / *L. speculum veneris* (L.) Chaix and *Legousia* sp.

Venus's-looking-glass/ Large Venus's-looking-glass

Preservation: waterlogged

Type of remains: seeds

Life form: T scap

Ecology: group 2.1 (WW). Widespread as a weed in arable fields, mostly on calcareous soils.

Ubiquity: **LAV:** EBA (unc 4%), MBA (unc 46%), lav37 (unc MBA).

Measurements (10 selected seeds): average L: 1.07 mm; average W: 0.67 mm

	L (mm)	W (mm)
LAV37 c 100,5cm	1.1	0.7
LAV37 c 100,5cm	1.2	0.8
LAV37 c 100,5cm	1.2	0.8
LAV37 c 130,5	1.1	0.6

LAV c 4061	1.1	0.7
LAV c 4061	1.1	0.7
LAV c 4061	1.0	0.7
LAV c 4061	1.1	0.6
LAV c 4061	0.9	0.6
LAV c 4061	1.0	0.6

Photo: Plate 6
Description: seeds ovoid to ellipsoid, biconvex, slightly compressed. Surface smooth and glossy with faint longitudinal furrow, more evident in *L. speculum veneris*. Seeds of the two species are hardly distinguishable.
Bibliography: Bojňanský & Fargašová 2007, Stace 2010.

Asteraceae (daisy family)
Anthemis tinctoria L. yellow chamomile
Preservation: waterlogged
Type of remains: achenes
Life form: H bienn/Ch suffr
Ecology: group 2.4 (RU). It grows on pastures, waste ground, rough and marginal land.
Ubiquity: **LAV:** EBA (unc 12.5%), section 98 (unc 22.2%).
Measurements (5 achenes): average L: 1.72 mm; average W: 0.71 mm

	L (mm)	W (mm)
LAV c 169	1.6	0.6
LAV c RR115	1.5	0.7
LAV c RR115	1.9	0.8
LAV c W04	2.1	0.8
LAV c 76	1.5	0.7

Photo: Plate 6
Description: achenes prismatic, rod-shaped, scarcely ribbed not tuberculate, with apical rim.
Bibliography: Jacquat 1988, , Bojňanský & Fargašová 2007, Stace 2010.

Carthamus cf. *lanatus* L.
Preservation: waterlogged
Type of remains: achenes
Life form: T scap
Ecology: group 3.1 (MP). The plant grows today on dry slopes and in fallow fields. In the Garda area it was observed by the author in dry meadow on the Rocca di Manerba.
Ubiquity: **LAV:** EBA (unc 8.3%), MBA (unc 7.7%).
Measurements (2 achenes): average L: 5.04 mm; average W: 3.92 mm

	L (mm)	W (mm)
LAV c 4061	7.2	5.1
LAV c NN1	2.9	2.7

Photo: Plate 6
Description: achenes similar to those of *C. tinctorius* but shorter and with a very pronounced and angled collar at the apical end.
Bibliography: Kroll 1990, Marinova & Riehl 2009, Bojňanský & Fargašová 2007.

Carthamus tinctorius L. and *C.* cf *tinctorius* safflower
Preservation: waterlogged
Type of remains: achenes
Life form: T scap (H bienn)
Ecology: group 1.1 (C). The plant is native of the southwest Asia. It is nowadays cultivated in warm climate areas all over the world. It requires dry climate, especially during ripening time.

Ubiquity: **LAV:** EBA (unc 20.8%). **LUC:** 1st ph (unc 38.5%), 2nd ph (unc 20%).
Measurements (5 achenes): average L: 5.11 mm; average W: 3.33 mm

	L (mm)	W (mm)
LAV c 76	4.95	2.79
LAV c 168	4.95	3.42
LUC c 107	4.5	3.6
LUC c NN1	5.58	3.42
LUC c 372	5.58	3.42

Photo: Plate 6
Description: the achenes of *C. tinctorius* are characterized by high variability, depending on the position in the flower head. The dimensions of fossil ones are smaller than the modern reference material, but they match the typical morphology of the species. Two main morphotypes can be described: a slender smoothed-surfaced type clearly attributed to *C. tinctorius* (similar to the modern achenes of safflower), and a second type bordered by a distinct rim or "collar" which resemble in some way to *C. lanatus* as suggested by Kroll (1990) who provided a detailed description of the differences between the two species.
Achenes are obovate with truncated apex and hilum at the base located in an indentation, smooth and four-sided, characterized by four longitudinal and differently pronounced ribs. The apical end is quadrangular and bordered by a slightly pronounced collar. The pericarp is woody and thick. Achenes are white in the modern material and light brown in the fossil waterlogged material.
Bibliography: Kroll 1990, Marinova & Riehl 2009, van Zeist and Bakker-Heeres 1988.

Cirsium arvense (L.) Scop. creeping thistles
Preservation: waterlogged
Type of remains: achenes
Life form: G rad
Ecology: group 2.2 (SW). It grows in arable fields, grasslands, waste and rough ground.
Ubiquity: **LAV:** EBA (unc 4%). **LUC:** 1st ph (unc 7.7%).
Measurements (2 achenes): average L: 2.30 mm; average W: 0.85 mm

	L (mm)	W (mm)
LUC c 113	2.5	0.9
LAV c 136	2.2	0.8

Photo: Plate 6
Description: achenes slight conic, tapering at lower end, laterally flattened with angular and bowed margins. The apex is oval in section and slightly oblique, with a low corona and a protuberance in the middle (style residue). Surface mat, with fine longitudinal stripes.
Bibliography: Jacquat 1988, Schoch *et al.* 1988, Bojňanský & Fargašová 2007.

Lapsana communis L. nipplewort
Preservation: waterlogged
Type of remains: achenes
Life form: T scap
Ecology: group 2.4 (RU). Common in fertile and shady places on waste ground and fallow land, spreading also in hedgesrow and open woods.
Ubiquity: **LAV:** EBA (unc 8.3%), section 98 (unc 11.1%), lav37 (unc MBA). **LUC:** 1st ph (unc 46%).
Measurements (10 selected achenes): average L: 2.74 mm; average W: 0.67 mm

	L (mm)	W (mm)
LAV37 c 100,5cm	3.3	0.9
LAV37 c 62,5cm	2.3	0.8
LAV c RP02	2.9	0.7
LAV c 169	2.9	0.7
LUC c 1	2.7	0.6
LUC c 1	3.1	0.6

LUC c 1	2.5	0.7
LUC c 1	2.6	0.6
LUC c 1	2.7	0.6
LUC c 1	2.5	0.6

Photo: Plate 6
Description: achenes elongated, slightly flattened, a little bowed, and tapering at the lower end. Surface with several close longitudinal ribs, the central and lateral ones broader than the others. Fossil achenes are often longitudinally fragmented.
Bibliography: Jacquat 1988, Schoch *et al.* 1988, Bojňanský & Fargašová 2007.

Onopordum acanthium L. cotton thistle
Preservation: waterlogged
Type of remains: achenes
Life form: H bienn
Ecology: group 3.1 (MP). It grows in fields, waste and rough ground, stony places, often closed to sheep shelter.
Ubiquity: **LAV:** MBA (unc 15.3%), lav37 (unc MBA).
Measurements (1 achene): average L: 4.52 mm; average W: 2.72 mm
Photo: Plate 6
Description: achenes ellipsoid, with four main indistinct ribs. The apex has a faint corona and a conical protuberance in the middle. Surface with large transversal wrinkles.
Bibliography: Bojňanský & Fargašová 2007.

Alismataceae (water plantain family)
Caldesia parnassifolia (Bassi) Parl. Parnassus-leaved water-plantain
Preservation: waterlogged
Type of remains: endocarp (stone)
Life form: I rad
Ecology: group 6.3 (LS). It grows in wet places, often on waterside.
Ubiquity: **LAV:** EBA (unc 9%), MBA (unc 7.7%).
Measurements (2 stones): L: -- mm; average W: 1.45 mm

	L (mm)	W (mm)
LAV c 169	2.3	1.4
LAV c 4025	--	1.5

Photo: Plate 6
Description: woody endocarp obovate, flattened. Surface finely reticulate, spongy-like.
Bibliography: Bojňanský & Fargašová 2007.

Poaceae (grass family)
cf *Eragrostis minor* Host small love-grass
Preservation: waterlogged
Type of remains: grain
Life form: T scap
Ecology: group 2.2 (SW). Xerothermophilous weed of summer cereal crop, it can also grow on fallow land, walls, waste ground in dry condition. In the Garda region, it was observed by the author on the Rocca di Manerba top (Chap. 1.2.1) in a large stony area, strongly browsed, characterized by a cover of low herbs.
Ubiquity: **LAV:** EBA (unc 25%). **LUC:** 1st ph (unc 7.7%).
Measurements (10 items): average L: 0.73 mm; average W: 0.42 mm

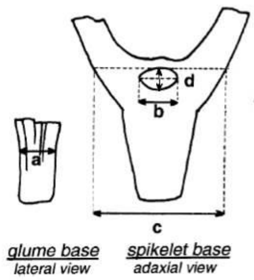
	L (mm)	W (mm)
LAV c 135	0.7	0.5
LAV c 135	0.8	0.5
LAV c 135	0.8	0.5

LAV c 136	0.7	0.4
LAV c 136	0.6	0.4
LAV c NN1	0.8	0.4
LAV c 76	0.7	0.4
LAV c 76	0.7	0.4
LAV c 136	0.8	0.4
LAV c RR115	0.7	0.5

Photo: Plate 7
Description: very small oval grains, round in section, with indistinct longitudinal furrow and large embryo area at the base. The grains are smaller and more roundish than *Eragrostis pilosa*, the embryo is flat and smaller than *E. pilosa*.
Bibliography: Riehl 1999, Bojňanský & Fargašová 2007.

CEREALS

Measurements points of *Triticum* chaff remains are modified after Kohler-Schneider 2003 (see figure below). The measurements and numerical parameters of the complete ears are according to Jacomet 2006.



a width of glume base
b width of disarticulation scar
c width of spikelet base
measured along the upper rim of the disarticulation scar
d depth of disarticulation scar

Cerealia cereals
Preservation: waterlogged, charred
Type of remains: glume base, rachis, embryo, spikelet fork, ear uppermost part, glume frag, culm fragm, first rachis segments, testa fragm, grain.
Life form: T scap
Ecology: group 1.1 (C).
Ubiquity: **LAV:** EBA (unc 25%, c 87.5%), MBA (unc 7.7%, c 100%), section 98 (unc 88.8%, c 66.6%), lav37 (unc MBA). **LUC:** 1st ph (unc 23%, c 92.3%), 2nd ph (unc 8.3%, c 20%).
Description: cereal remains not identifiable because of bad preservation, high fragmentation or absence of diagnostic features.

Hordeum vulgare L. six-row barley
Preservation: waterlogged, charred
Type of remains: spikelet fork, rachis segments, grain, ear (only in LUC)
Life form: T scap
Ecology: group 1.1 (C). Barley can grow in drier condition and on poorer soils than any wheat cultivar.
Ubiquity: **LAV:** EBA (c 87.5%), MBA (c 100%), section 98 (c 66.6%, unc 11%), lav37 (c grains EBA IA, EBA II, MBA). **LUC:** 1st ph (c 92.3%), 2nd ph (c 92%).
Photo: Plate 8, 9
Description: the preservation of complete ear in Lucone layers, leaded to the identification of six-row barley, particularly the dense-eared variety (var. *hexastichum*). Six-row barley could also be detected by the majority of rachis segments morphology with well-formed bases of the side florets (in both Lavagnone and Lucone remains). The identification of dense-eared variety on the base of rachis segments or spikelets morphology was not so clear, most of the rachis segments are wide, but slim and sharply tapering morphotypes are also recorded.
Grains in ventral or dorsal view are spindle-shaped and tapering at both ends. In lateral view are relatively flat with the highest point in the middle. In several grains, lemna and palea are closely attached. As no clear naked grains have been found is likely that we deal with hulled barley.

Bibliography: Jacomet 2006, Riehl 1999, Zohary *et al.* 2012.

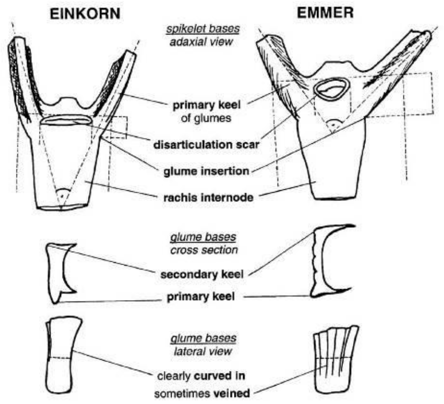
Panicum miliaceum L. broomcorn millet
Preservation: waterlogged, charred
Type of remains: glume base, grain
Life form: T scap
Ecology: group 1.1 (C).
Ubiquity: **LAV:** MBA (unc 54%, c 100%), lav37 (unc EBA II, MBA.
Measurements (10 selected grains): average L: 1.67 mm; average W: 1.5 mm; average H: 1.01 mm

	L (mm)	W (mm)	H(mm)
LAV c 4069	1.7	1.8	1.4
LAV c 4069	1.7	1.1	0.7
LAV c 4072	1.3	1.5	0.5
LAV c 4072	1.8	1.4	1.0
LAV c 4072	1.6	1.3	1.2
LAV c 4025	1.8	2.0	1.2
LAV c 4034	1.8	1.4	0.8
LAV c 4065	2	1.7	1.5
LAV c 4065	1.3	1.6	0.8
LAV c 4065	1.7	1.2	1.0

Photo: Plate 7
Description: charred grains broadly ovate, domed on both sides with embryo cavity (scutellum) very large with divergent edges reaching the half of the grain length. Glumed grains slightly pointed at both end. Lemma strongly domed enclosing part of the palea. Surfac e of lemma and palea is smooth and lustrous, with longitudinal stripes. Epidermal cells of the glumes are rectangular and with undulated margins (visible in waterlogged remains).
Bibliography: Jacomet 2006, Jacquat 1988, Schoch *et al.* 1988.

Triticum aestivum L. and *Triticum* cf. *aestivum* L. and and cf. *Triticum aestivum* bread wheat
Preservation: charred
Type of remains: rachis
Life form: T scap
Ecology: group 1.1 (C).
Ubiquity: **LAV:** EBA (c 21%), MBA (c 7.7%). **LUC:** 1st ph (c 38.5%), 2nd ph (c 8%).
Photo: Plate 8
Description: free-threshing wheat (hexaploid naked wheat). Rachis remains do not show any swelling underneath the glume attachment points, but only a narrow ridge below glume insertion. Glume parts are completely broken off. Rachis internodes are curved on the sides edges and are longitudinally striated.
The grains were designated as *Triticum aestivum/durum/turgidum*, because of the problems in differentiation of grains of hexa-and tetraploid naked wheat, largely discussed in literature (see Jacomet 2006).
Bibliography: Jacomet 2006

Triticum dicoccum Schrank and *T.* cf *dicoccum* emmer
Preservation: waterlogged, charred
Type of remains: spikelet fork, glume base, grain, ear uppermost part
Life form: T scap
Ecology: group 1.1 (C).
Ubiquity: **LAV:** EBA (unc 4%, c 95.8%), MBA (unc 15.3%, c 100%). **LUC:** 1st ph (unc 15.3%, c 100%), 2nd ph (unc 12%, c 84%).
Measurements average values. **LAV_EBA**: a: 0.85 mm (33 items); b: 0.98 mm (33 items); c: 2.19 mm (32 items); d: 0.55 mm (31 items). **LAV_MBA**: a: 0.79 mm (41 items); b: 0.81 mm (31 items); c: 1.82 mm (30 items); d: 0.42 mm (31 items). **LUC_EBA**: a: 0.85 mm (30 items); b: 0.88 mm (30 items); c: 2.25 mm (30 items); d: 0.47 mm (30 items).
Photo: Plate 8, 9
Description: charred grains have narrow shape with the maximum lateral height closely behind the embryo and a flat to lightly concave ventral side. Some emmer grains were of the drop shaped type (lower end pointed). The ventral furrow is narrow and deep. Chaff remains fit the features described by Kohler-Schneider (2003) and summed up in the figure below.



	EINKORN	EMMER
disarticulation scar	linear, broad und shallow	round, narrow and deep
glume insertion	appr. at same height as disarticulation scar	below disarticulation scar
primary keel of glume bases	very prominent, projecting abaxially, arising very close to disarticulation scar	less prominent, projecting more laterally, arising below and further off disarticulation scar
secondary keel	very prominent	less prominent
glume bases cross section	massive, width of glume bases: low	less massive, width of glume bases: high
glume bases lateral view	usually curved in, not veined	usually not or slightly curved in, sometimes veined
angle between glume bases	usually narrow (no reliable feature)	usually wide (no reliable feature)
rachis internodes	parallel sided	tapering towards the base, variable

(after Kohler-Schneider 2003)

Possible confusions can subsist with einkorn, spelt and the new glume wheat. Remains of large size specimen of emmer may look very similar to spelt remains, especially in case of glume base fragments. Morphologies of robust specimen of einkorn or two-grained einkorn (with larger angle of glume insertion) could resemble to emmer. Emmer spikelet forks with a larger and deeper upper scar or with a more prominent primary keel remind features diagnostic for the 'new glume wheat'.
Bibliography: Jacomet 2006, Kohler-Schneider 2003.

Lavagnone – EBA samples

samples	type of remains	a	b	c	d	b:c x 100
cRR140	spikelet fork	1.17	1.08	2.52	--	42.86
cRR140	spikelet fork	0.72	0.99	2.07	0.63	47.83
cRR140	spikelet fork	0.99	1.08	2.88	0.72	37.50
cRR140	spikelet fork	1.08	1.26	2.61	0.72	48.28
cRR140	spikelet fork	1.08	0.99	2.43	0.54	40.74
cRR140	spikelet fork	0.72	0.90	1.98	0.27	45.45
cRR140	spikelet fork	0.99	1.17	2.52	0.36	46.43
cRR140	spikelet fork	0.72	0.99	2.25	0.99	44.00
cRR140	spikelet fork	0.72	1.08	2.16	--	50.00
cRR140	spikelet fork	0.81	1.08	2.25	0.63	48.00
cRR140	spikelet fork	0.99	0.90	1.89	0.54	47.62
cRR140	spikelet fork	0.81	0.90	1.98	0.45	45.45
cRR140	spikelet fork	0.99	1.17	2.43	0.81	48.15
cRR140	spikelet fork	0.99	0.99	2.16	0.72	45.83
cRR140	spikelet fork	0.63	0.72	1.98	0.45	36.36
cRR140	spikelet fork	0.81	0.81	2.07	0.54	39.13
cRR115	spikelet fork	1.08	0.99	2.34	0.63	42.31
cRR115	spikelet fork	0.72	0.72	2.07	0.36	34.78
cRR115	spikelet fork	0.72	0.99	2.07	0.36	47.83
cRR115	spikelet fork	0.99	0.90	2.16	0.63	41.67
cRR115	spikelet fork	0.72	0.81	2.16	0.54	37.50
cRR115	spikelet fork	0.99	1.17	2.16	0.72	54.17

cRR115	spikelet fork	0.72	0.90	1.80	0.54	50.00
cRR115	spikelet fork	0.54	0.99	2.07	0.54	47.83
cRR115	spikelet fork	0.90	1.17	2.16	0.72	54.17
cRR115	spikelet fork	0.63	0.81	2.16	0.36	37.50
cRR115	spikelet fork	1.08	0.99	2.07	0.54	47.83
cRR115	spikelet fork	0.90	1.08	2.43	0.45	44.44
cRR115	spikelet fork	0.81	0.99	2.07	0.63	47.83
cRR115	spikelet fork	0.63	0.81	1.89	0.54	42.86
cRR115	spikelet fork	0.81	0.99	2.07	0.36	47.83
cRR115	spikelet fork	0.81	0.72	--	0.36	--
cRR115	spikelet fork	0.72	1.08	2.16	0.45	50.00

Lavagnone – MBA samples						
samples	**type of remains**	**a**	**b**	**c**	**d**	**b:c x 100**
c4078	spikelet fork	0.90	0.81	1.8	0.36	45.00
c4078	spikelet fork	0.99	0.99	2.25	0.45	44.00
c4078	spikelet fork	0.72	0.99	1.89	0.45	52.38
c4078	spikelet fork	0.72	0.81	1.71	0.36	47.37
c4078	spikelet fork	0.99	0.63	1.89	0.45	33.33
c4078	spikelet fork	0.90	0.99	1.98	0.45	50.00
c4078	spikelet fork	0.54	0.63	1.71	0.36	36.84
c4078	spikelet fork	0.72	0.63	1.71	0.36	36.84
c4078	spikelet fork	0.99	0.72	1.35	0.54	53.33
c4078	spikelet fork	0.72	0.81	1.8	0.54	45.00
c4078	spikelet fork	0.72	0.81	1.8	0.27	45.00
c4065	spikelet fork	0.72	0.72	1.8	0.36	40.00
c4065	spikelet fork	0.90	0.9	1.53	0.45	58.82
c4065	spikelet fork	0.99	0.99	2.34	0.36	42.31
c4065	spikelet fork	0.63	0.72	1.8	0.36	40.00
c4065	spikelet fork	0.9	0.99	2.07	0.54	47.83
c4065	spikelet fork	0.63	0.72	1.98	0.36	36.36
c4065	spikelet fork	0.54	0.72	1.35	0.27	53.33
c4065	spikelet fork	0.63	0.9	1.53	0.27	58.82
c4065	Spikelet fork	0.99	0.9	1.98	0.54	45.45
c4065	Spikelet fork	0.81	0.81	1.98	0.36	40.91
c4065	Spikelet fork	0.63	0.72	1.62	0.27	44.44
c4064	spikelet fork	0.63	0.72	1.98	0.63	36.36
c4064	spikelet fork	0.99	1.08	1.98	0.36	54.55
c4064	spikelet fork	0.99	0.99	1.89	0.54	52.38
c4064	spikelet fork	0.72	0.72	1.98	0.54	36.36
c4064	spikelet fork	0.63	0.81	1.89	0.36	42.86
c4063	spikelet fork	0.81	0.63	1.62	0.36	38.89
c4063	spikelet fork	0.72	0.72	1.62	0.54	44.44
c4063	spikelet fork	0.81	0.72	1.8	0.45	40.00

c4063	spikelet fork	0.90	0.9	--	0.45	--
c4063	spikelet fork	0.72	--	--	--	--
c4063	spikelet fork	0.63	--	--	--	--
c4063	glume base	0.9	--	--	--	--
c4063	glume base	0.63	--	--	--	--
c4063	glume base	0.63	--	--	--	--
c4063	glume base	0.90	--	--	--	--
c4063	glume base	0.99	--	--	--	--
c4063	glume base	0.81	--	--	--	--
c4063	glume base	0.81	--	--	--	--
c4063	glume base	0.99	--	--	--	--

Lucone D – EBA samples						
samples	**type of remains**	**a**	**b**	**c**	**d**	**b:c x 100**
c1	spikelet fork	0.99	0.72	2.07	0.36	34.78
c1	spikelet fork	0.99	1.08	2.34	0.54	46.15
c1	spikelet fork	1.08	0.9	2.79	0.72	32.26
c1	spikelet fork	1.08	0.63	2.25	0.54	28.00
c1	spikelet fork	0.90	0.99	2.25	0.45	44.00
c1	spikelet fork	0.81	0.45	1.98	0.36	22.73
c1	spikelet fork	1.08	0.9	2.16	0.54	41.67
c1	spikelet fork	0.63	0.9	2.43	0.45	37.04
c1	spikelet fork	0.72	0.81	2.07	0.36	39.13
c1	spikelet fork	0.72	0.63	1.98	0.27	31.82
c1	spikelet fork	0.81	0.9	2.7	0.45	33.33
c1	spikelet fork	0.90	0.9	2.61	0.45	34.48
c1	spikelet fork	0.81	0.99	1.98	0.45	50.00
c1	spikelet fork	0.81	0.9	1.98	0.36	45.45
c1	spikelet fork	0.72	1.08	2.52	0.54	42.86
c1	spikelet fork	0.90	0.99	2.43	0.54	40.74
c1	spikelet fork	0.45	0.81	1.98	0.54	40.91
c1	spikelet fork	0.81	0.99	2.16	0.54	45.83
c1	spikelet fork	1.08	1.08	2.52	0.54	42.86
c1	spikelet fork	0.72	0.72	1.89	0.36	38.10
c1	spikelet fork	0.72	0.99	1.98	0.54	50.00
c1	spikelet fork	0.99	1.08	2.34	0.54	46.15
c1	spikelet fork	0.63	0.72	1.8	0.36	40.00
c1	spikelet fork	0.90	1.17	2.43	0.63	48.15
c1	spikelet fork	0.99	0.99	2.16	0.36	45.83
c1	spikelet fork	0.90	0.99	2.7	0.54	36.67
c1	spikelet fork	0.81	0.9	2.43	0.45	37.04
c1	spikelet fork	0.81	0.99	2.34	0.54	42.31
c1	spikelet fork	0.81	0.54	2.07	0.27	26.09
c2	spikelet fork	0.81	0.63	2.25	0.54	28.00

Triticum durum Desf. */ T. turgidum* L. maccaroni wheat / rivet wheat
Preservation: waterlogged, charred
Type of remains: rachis
Life form: T scap
Ecology: group 1.1 (C).
Ubiquity: **LAV:** EBA (c 46%), MBA (c 7.7%). **LUC:** 1st ph (unc 7.7%), 2nd ph (c 88%).
Photo: Plate 8, 9
Description: free-threshing wheat (tetraploid naked wheat). Rachis remains show a swelling underneath the glume attachment points with part of the glume still attached to the rachis. Side edges of the rachis internode are straight and there are no longitudinal striation.
The grains were designated as *Triticum aestivum/durum/turgidum*, because of the problems in differentiation of grains of hexa-and tetraploid naked wheat, largely discussed in literature (see Jacomet 2006).
Bibliography: Jacomet 2006

Triticum monococcum L. and *T.* cf *monococcum* einkorn
Preservation: waterlogged, charred
Type of remains: spikelet fork, glume base, grain, spikelets with 2 grains (only in LAV).
Life form: T scap
Ecology: group 1.1 (C).
Ubiquity: **LAV:** EBA (c 70.8%), MBA (unc 15.3%, c 100%). **LUC:** 1st ph (c 100%), 2nd ph (c 64%).
Measurements average values. **LAV_EBA**: a: 0.74 mm (39 items); b: 1.03 mm (32 items); c: 1.87 mm (30 items); d: 0.58 mm (32 items). **LAV_MBA**: a: 0.60 mm (68 items); b: 0.71 mm (38 items); c: 1.51 mm (31 items); d: 0.34 mm (35 items). **LUC_EBA**: a: 0.65 mm (50 items); b: 0.85 mm (32 items); c: 1.64 mm (23 items); d: 0.40 mm (33 items).
Photo: Plate 8
Description: charred grains are slim and pointed at the ends, in lateral view high backed with ventral outline convex. The highest part of the grain is in the middle. The ventral furrow is narrow and deep. Chaff remains fit the features described by Kohler-Schneider (2003) and summed up in the figure above.
Despite spikelets with 2 grains were found in Lavagnone samples, no clear grains from 2-grained einkorn were identified. They show strong similarities with emmer grains (especially those from the apical part of the ear); therefore, a possible confusion is to be considered. Morphologies of robust specimen of einkorn or two-grained einkorn (with larger angle of glume insertion) could resemble to emmer.
Bibliography: Jacomet 2006, Kohler-Schneider 2003.

Lavagnone – EBA samples						
samples	**type of remains**	**a**	**b**	**c**	**d**	**b:c x 100**
c135	spikelet fork	0.68	0.84	1.68	0.48	50.00
c135	spikelet fork	0.68	1.12	1.80	0.52	62.22
c169	spikelet fork	0.80	1.12	1.92	0.72	58.33
c169	spikelet fork	0.72	0.92	--	0.64	--
c169	spikelet fork	0.84	1.16	--	0.48	--
c169	spikelet fork	0.72	0.88	1.88	0.44	46.81
cRR131	spikelet fork	0.64	0.92	1.56	0.40	58.97
cRR131	spikelet fork	0.72	1.04	1.80	0.48	57.78
cRR131	spikelet fork	0.64	0.84	1.64	0.52	51.22
cRR131	spikelet fork	0.76	0.80	1.92	0.52	41.67
cRP02	spikelet fork	0.72	1.08	1.92	0.52	56.25
cRP02	spikelet fork	0.72	1.16	1.92	1.12	60.42
cRP02	spikelet fork	0.80	1.00	1.88	0.56	53.19
cRP02	spikelet fork	0.84	1.04	1.80	0.76	57.78

cRR115	spikelet fork	1.00	1.36	2.40	0.92	56.67
cRR115	spikelet fork	0.72	1.04	2.00	0.60	52.00
cRR115	spikelet fork	0.44	0.88	1.72	0.44	51.16
cRR115	spikelet fork	0.76	0.92	2.32	0.44	39.66
cNN1	spikelet fork	0.80	1.32	2.00	0.72	66.00
cNN1	spikelet fork	0.64	0.68	1.68	0.28	40.48
cNN1	spikelet fork	0.60	1.12	1.92	0.68	58.33
c134	spikelet fork	0.80	1.00	1.68	0.68	59.52
c134	spikelet fork	0.64	1.08	1.60	0.48	67.50
c134	spikelet fork	0.92	1.36	2.40	0.88	56.67
c134	spikelet fork	--	1.20	--	1.08	--
c134	spikelet fork	0.72	1.12	1.60	0.48	70.00
cE2	spikelet fork		1.12	1.60	0.48	70.00
c136	spikelet fork	0.88	1.20	1.92	0.64	62.50
c136	spikelet fork	--	--	2.00	--	--
c136	spikelet fork	1.08	0.88	2.00	0.44	44.00
cRR140	spikelet fork	0.64	0.80	1.80	0.40	44.44
cRR140	spikelet fork	0.72	0.92	2.00	0.72	46.00
cRR140	spikelet fork	0.72	0.96	1.68	0.60	57.14
c135	glume base	0.60	--	--	--	--
c169	glume base	0.72	--	--	--	--
cRR131	glume base	0.76	--	--	--	--
cRP02	glume base	0.84	--	--	--	--
cRP02	glume base	0.88	--	--	--	--
cRP02	glume base	0.48	--	--	--	--
cRP02	glume base	0.76	--	--	--	--
cRP02	glume base	0.80	--	--	--	--
cNN1	glume base	0.84	--	--	--	--

Lavagnone – MBA samples						
samples	**type of remains**	**a**	**b**	**c**	**d**	**b:c x 100**
c4078	spikelet fork	0.54	--	--	--	--
c4078	spikelet fork	0.54	0.69	--	0.46	--
c4078	spikelet fork	0.61	0.46	1.78	0.38	25.95
c4078	spikelet fork	0.46	0.62	--	--	--
c4078	spikelet fork	0.61	0.62	1.46	0.23	42.10
c4078	spikelet fork	0.61	--	--	--	--
c4078	spikelet fork	0.61	--	--	--	--
c4078	spikelet fork	0.54	--	--	--	--
c4078	spikelet fork	0.57	--	--	--	--
c4078	spikelet fork	0.77	--	--	--	--
c4078	spikelet fork	0.84	1.16	1.85	0.54	62.50
c4078	spikelet fork	--	0.92	--	0.39	--
c4078	spikelet fork	0.54	0.54	1.39	0.23	38.77

c4078	spikelet fork	0.61	--	--	--	--
c4078	spikelet fork	0.46	0.62	--	--	--
c4078	spikelet fork	0.54	0.62	1.39	0.38	44.44
c4078	spikelet fork	0.61	--	--	--	--
c4078	spikelet fork	0.46	--	--	--	--
c4078	spikelet fork	0.54	0.85	1.46	0.46	57.89
c4078	spikelet fork	0.61	0.46	1.39	0.38	33.33
c4078	spikelet fork	0.61	0.77	1.54	0.39	50.00
c4078	spikelet fork	0.54	0.77	1.16	0.39	66.66
c4078	spikelet fork	0.77	0.85	--	0.39	--
c4078	spikelet fork	0.61	0.85	--	0.38	--
c4078	spikelet fork	0.70	0.85	1.62	0.54	52.38
c4034	spikelet fork	0.54	0.69	1.16	0.39	60.00
c4034	spikelet fork	0.61	--	--	--	--
c4034	spikelet fork	0.54	--	--	--	--
c4034	spikelet fork	0.54	--	--	--	--
c4034	spikelet fork	0.54	--	--	--	--
c4034	spikelet fork	0.61	--	--	--	--
c4034	spikelet fork	0.77	--	--	--	--
c4034	spikelet fork	0.61	0.62	1.16	0.38	53.33
c4034	spikelet fork	0.70	--	--	--	--
c4034	spikelet fork	0.61	0.77	--	--	--
c4034	spikelet fork	0.61	--	--	--	--
c4025	spikelet fork	0.25	0.63	1.44	0.22	43.47
c4025	spikelet fork	0.50	0.5	1.56	0.25	32.00
c4025	spikelet fork	0.62	0.31	1.56	0.19	20.00
c4025	spikelet fork	0.31	0.81	1.69	0.38	48.14
c4025	spikelet fork	0.75	0.75	1.69	0.44	44.44
c4025	spikelet fork	0.75	0.75	1.69	0.44	44.44
c4025	spikelet fork	--	0.64	1.60	0.20	40.00
c4025	spikelet fork	0.68	0.84	1.6	0.28	52.50
c4025	spikelet fork	0.52	0.64	1.36	0.32	47.06
c4025	spikelet fork	0.56	0.64	1.40	0.36	45.71
c4025	spikelet fork	0.72	0.64	1.48	0.28	43.24
c4025	spikelet fork	0.52	0.68	1.48	0.32	45.94
c4025	spikelet fork	0.72	0.72	1.52	0.28	47.36
c4025	spikelet fork	0.64	0.68	1.56	0.24	43.58
c4025	spikelet fork	0.64	0.68	1.44	0.24	47.22
c4025	spikelet fork	0.64	0.76	1.64	0.32	46.34
c4025	spikelet fork	0.6	0.72	1.68	0.24	42.85
c4025	spikelet fork	--	0.88	1.72	0.36	51.16
c4078	glume base	0.70	--	--	--	--
c4078	glume base	0.54	--	--	--	--
c4078	glume base	0.61	--	--	--	--
c4078	glume base	0.77	--	--	--	--
c4078	glume base	0.46	--	--	--	--

c4078	glume base	0.61	--	--	--	--
c4078	glume base	0.54	--	--	--	--
c4078	glume base	0.46	--	--	--	--
c4034	glume base	0.46	--	--	--	--
c4034	glume base	0.77	--	--	--	--
c4034	glume base	0.61	0.85	1.23	0.39	68.75
c4034	glume base	0.54	--	--	--	--
c4034	glume base	0.54	--	--	--	--
c4034	glume base	0.54	--	--	--	--
c4034	glume base	0.54	--	--	--	--
c4034	glume base	0.61	--	--	--	--
c4034	glume base	0.61	--	--	--	--

Lucone D – EBA samples						
samples	**type of remains**	**a**	**b**	**c**	**d**	**b:c x 100**
c1	spikelet fork	0.69	0.92	--	0.31	--
c1	spikelet fork	0.54	0.85	--	0.54	--
c1	spikelet fork	--	0.92	--	0.62	--
c1	spikelet fork	0.69	0.85	1.54	0.23	55.00
c367	spikelet fork	0.54	0.77	1.54	0.23	50.00
c367	spikelet fork	0.62	0.77	1.46	0.39	52.63
c367	spikelet fork	--	0.92	--	0.31	--
c367	spikelet fork	--	0.77	1.46	0.46	52.63
c367	spikelet fork	--	0.77	1.62	0.31	47.62
c367	spikelet fork	--	1.08	1.93	0.62	56.00
c367	spikelet fork	0.46	--	--	--	--
c367	spikelet fork	0.69	--	--	--	--
c367	spikelet fork	--	1.00	--	0.54	--
c367	spikelet fork	0.62	1.08	1.77	0.54	60.87
c367	spikelet fork	0.62	1.00	1.31	0.46	76.47
c1	spikelet fork	0.54	0.92	1.69	0.54	54.55
c1	spikelet fork	0.69	1.00	1.85	0.39	54.17
c1	spikelet fork	0.69	0.77	1.39	0.46	55.56
c1	spikelet fork	0.62	0.85	2.00	0.62	42.31
c1	spikelet fork	--	0.85	--	0.31	--
c1	spikelet fork	0.77	0.62	1.39	0.23	44.44
c1	spikelet fork	0.69	0.92	1.62	0.31	57.14
c1	spikelet fork	0.77	0.85	1.69	0.31	50.00
c1	spikelet fork	0.54	0.69	--	0.23	--
c1	spikelet fork	0.62	0.69	--	0.23	--
c310	spikelet fork	0.69	1.00	--	0.39	--
c310	spikelet fork	0.62	1.08	1.77	0.54	60.87
c310	spikelet fork	0.77	--	--	--	--
c310	spikelet fork	0.62	0.92	2.00	0.54	46.15

c310	spikelet fork	0.69	--	--	0.54	--
c310	spikelet fork	0.69	0.77	1.62	0.23	47.62
c310	spikelet fork	0.54	0.69	1.77	0.31	39.13
c310	spikelet fork	0.62	0.77	1.69	0.31	45.45
c310	spikelet fork	0.62	0.77	1.62	0.46	47.62
c310	spikelet fork	0.77	0.77	1.69	0.39	45.45
c310	spikelet fork	0.46	0.69	1.39	0.23	50.00
c1	glume base	0.85	--	--	--	--
c1	glume base	0.69	--	--	--	--
c1	glume base	0.77	--	--	--	--
c1	glume base	0.85	--	--	--	--
c1	glume base	0.54	--	--	--	--
c1	glume base	0.62	--	--	--	--
c367	glume base	0.69	--	--	--	--
c367	glume base	0.69	--	--	--	--
c367	glume base	0.69	--	--	--	--
c367	glume base	0.62	--	--	--	--
c367	glume base	0.62	--	--	--	--
c367	glume base	0.69	--	--	--	--
c367	glume base	0.69	--	--	--	--
c367	glume base	0.69	--	--	--	--
c367	glume base	0.54	--	--	--	--
c310	glume base	0.69	--	--	--	--
c310	glume base	0.62	--	--	--	--
c310	glume base	0.62	--	--	--	--
c310	glume base	0.62	--	--	--	--
c310	glume base	0.62	--	--	--	--
c310	glume base	0.62	--	--	--	--

Triticum nn and *Triticum* cf nn new glume wheat (NGW)
Preservation: waterlogged, charred
Type of remains: spikelet fork, glume base, grain, ear (only in LUC)
Life form: T scap
Ecology: group 1.1 (C).
Ubiquity: **LAV:** EBA (c 83.3%), MBA (unc 30.7%, c 100%). **LUC:** 1st ph (unc 7.6%, c 100%), 2nd ph (unc 8%, c 88%).
Measurements average values. **LAV_EBA**: a: 0.89 mm (33 items); b: 1.00 mm (33 items); c: 2.13 mm (33 items); d: 0.65 mm (31 items). **LAV_MBA**: a: 0.86 mm (31 items); b: 0.78 mm (31 items); c: 1.93 mm (31 items); d: 0.47 mm (30 items). **LUC_EBA**: a: 1.00 mm (30 items); b: 1.08 mm (31 items); c: 2.20 mm (31 items); d: 0.73 mm (31 items).

The measurements and numerical parameters of the two almost complete ears:

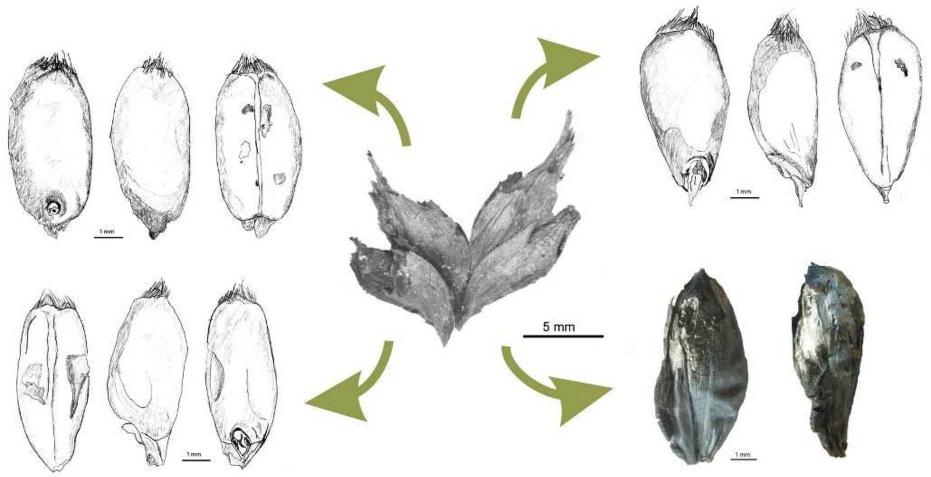
	specimen 1	specimen 2
Length of the ear (A)	38*	39*
Width of the ear (axial view) (B)	14	16
Width of the ear (lateral view) (C)	6	7
Number of spikelets	18*	19*
Number of well developed grains	28*	26*

(measurement points according to Jacomet 2006) * measures/numbers affected by ear incompleteness.

Photo: Plate 8, 9
Description: The identification of 'new glume wheat' grains was carried out according to Kohler-Schneider (2003) and our observations on cereal finds of Lucone where complete ears have been recovered (present work).
Ears. So far, two almost intact ears and some ear parts were found in the burnt cultural layers of Lucone D. The parts of

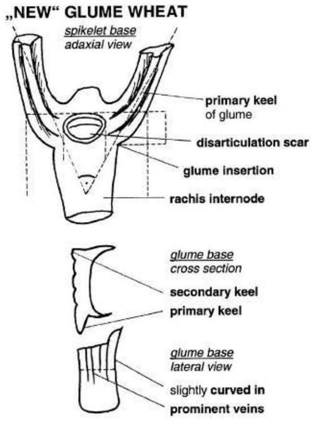
the ears mainly consist of middle and lower spikelets. The ears are bearded, erect, and laterally compressed. They are composed by two-seeded spikelets. The lowest ones can produce only one well-developed grain or even no grains at all.

Grains. The majority of the "new" glume wheat grains matched the diagnostic features described by Kohler-Schneider (2003): a flat or slightly concave ventral side, a rather rounded apex end and a slightly attenuated embryo end. The dorsal side is also flat and straight and runs more or less parallel to the ventral side. The height of the grains is relatively modest. Nevertheless, a certain variability has been observed: the embryo end could be more tapering; the compression lines on lateral sides are not always clearly marked.



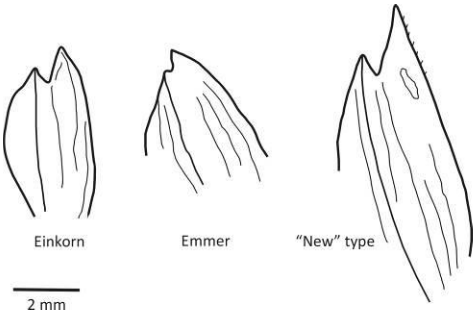
Grains trashed out from a single ear portion of 4 spikelets.

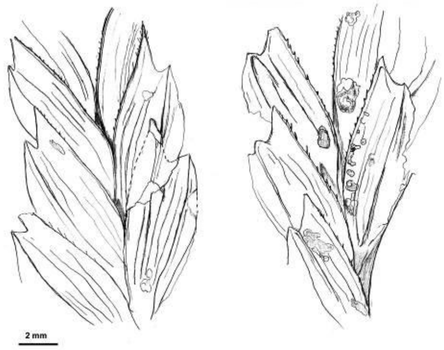
Chaff remains fit the features described by Kohler-Schneider (2003) and summed up in the figure below.



„NEW" GLUME WHEAT	
disarticulation scar	round and deep (similar to emmer), rather large
glume insertion	appr. at same height as disarticulation scar (as in einkorn), very abrupt insertion of glumes into the rachis, U-shaped
primary keel of glume bases	extremely prominent, projecting abaxially (as in einkorn), arising at same level and very close to disarticulation scar (as in einkorn) but extending laterally before ascending, U-shaped
secondary keel	very prominent (as in einkorn)
glume bases cross section	rather massive (similar to einkorn), width of glume bases as in emmer
glume bases lateral view	slightly curved in (as in einkorn), clearly veined
angle between glume bases	usually between „typical" einkorn and „typical" emmer, no reliable feature; U-shaped insertion of glume bases
rachis internodes	rather tapering towards the base (more like emmer), variable

Glumes. The primary keel of the middle spikelets is ciliate. It is very prominent and runs from the base to the apex ending in a long acute tooth. Other nerves on the glume surface are: one or two small nerves on the inner half of the glume; a stronger nerve on the outer half of the glume (secondary keel) converging towards the base of the apical tooth and forming a clearly distinct secondary tooth as in einkorn; from 3 to 4 nerves can be counted between primary and secondary keel and one more in the outermost position beyond the secondary keel. The glume tip is asimmetrically 2-pointed with the main apical tooth longer than in emmer or einkorn and usually straight.





Einkorn: 5-nerved (besides 1st and 2nd keels, one on the inner side, and three on the broad outer half); 2-pointed apex (the primary keel ends in a long tooth, while the secondary keel converges in a shorter one).

Emmer: 7-nerved (in addition to 1st and 2nd keels, a small one is present on the inner side, and three on the broad outer half); usually one-pointed apex (the primary keel runs from base to apex ending in a straight or more often curved tooth, the secondary keel ends near the base of apical tooth rarely forming a point).

'new' type: 7-9-nerved (1 or 2 small nerves on the inner side, 1stkeel, 3 or 4 nerves, 2nd keel and 1 small nerve on the outermost side); 2-pointed apex (the 1stkeel ends in a very long tooth).

Rachis internodes. The rachis is flattened and smooth and has a few hairs along the margins as well as a tuft between the glumes on frontal view. As previous authors, we distinguish two different morphologies of the rachis internodes (morphotypes 1 and 2). Observing the ears, we can confirm that the internodes morphology varies throughout the ear rachis: the lowest internodes belong to morphotype 2, while the upper ones to morphotype 1.
The finds of Lavagnone and Lucone D confirm the main diagnostic features of both chaff and grain remains of the "new" glume wheat defined by previous authors. The new morphological features described corroborate the hypothesis that the "new" type might correspond to modern *Triticum timopheevi*.
Emmer spikelet forks with a larger and deeper upper scar or with a more prominent primary keel remind features diagnostic for the 'new glume wheat'.
Bibliography: Jacomet 2006. Kohler-Schneider 2003

Lavagnone – EBA samples						
samples	**type of remains**	**a**	**b**	**c**	**d**	**b:c x 100**
c134	spikelet fork	1.31	1.50	2.81	0.63	53.33

c134	spikelet fork	0.63	0.94	2.13	0.69	44.12
c134	spikelet fork	1.00	1.06	2.13	0.69	50.00
c134	spikelet fork	0.94	1.13	2.50	--	45.00
c134	spikelet fork	0.75	0.75	1.81	0.63	41.38
c134	spikelet fork	0.75	0.94	2.13	--	44.12
c134	spikelet fork	0.81	1.06	2.50	0.75	42.50
c134	spikelet fork	0.88	0.75	2.31	0.50	32.43
c134	spikelet fork	1.06	1.38	2.56	0.88	53.66
cRP02	spikelet fork	1.00	0.81	2.00	0.63	40.63
cRP02	spikelet fork	1.00	0.94	2.25	0.69	41.67
cRP02	spikelet fork	1.00	0.81	1.81	0.44	44.83
cRP02	spikelet fork	1.00	1.25	2.50	0.75	50.00
cRP02	spikelet fork	0.94	0.81	1.88	0.63	43.33
cRP02	spikelet fork	0.94	1.06	2.06	0.63	51.52
cRP02	spikelet fork	0.81	0.81	1.69	0.69	48.15
cRP02	spikelet fork	0.75	0.94	1.75	0.50	53.57
cNN1	spikelet fork	0.88	1.00	1.81	0.88	55.17
cNN1	spikelet fork	1.00	1.38	2.75	0.75	50.00
cNN1	spikelet fork	0.63	1.25	2.06	0.88	60.61
cRR15	spikelet fork	0.69	0.69	1.75	0.25	39.29
cRR15	spikelet fork	1.00	1.13	2.50	0.63	45.00
cRR15	spikelet fork	0.63	0.69	1.75	0.50	39.29
cRR15	spikelet fork	0.88	0.94	2.06	0.50	45.45
cRR15	spikelet fork	0.94	0.94	2.13	0.31	44.12
cRR15	spikelet fork	0.94	1.00	1.88	0.69	53.33
c169	spikelet fork	0.94	0.94	2.44	0.69	38.46
c169	spikelet fork	0.81	0.88	2.00	0.63	43.75
c169	spikelet fork	0.94	0.94	2.06	0.81	45.45
c169	spikelet fork	1.00	1.00	2.19	0.81	45.71
c169	spikelet fork	0.94	0.94	2.38	0.50	39.47
c169	spikelet fork	0.81	1.25	1.75	0.63	71.43
cRR140	spikelet fork	0.94	1.13	2.00	0.88	56.25

Lavagnone – MBA samples						
samples	**type of remains**	**a**	**b**	**c**	**d**	**b:c x 100**
c4034 0.35 mm	spikelet fork	0,69	0,56	1,56	0,38	36,00
c4034 0.35 mm	spikelet fork	1,06	1,00	1,88	0,63	53,33
c4034 0.35 mm	spikelet fork	0,88	0,88	1,81	0,50	48,28
c4034 0.35 mm	spikelet fork	0,88	0,88	1,75	0,44	50,00
c4034 0.35 mm	spikelet fork	0,94	1,00	2,38	0,63	42,11
c4034 0.35 mm	spikelet fork	0,75	0,63	1,69	0,25	37,04
c4034 0.35 mm	spikelet fork	0,94	1,06	2,31	0,63	45,95
c4034 0.35 mm	spikelet fork	0,88	0,69	2,00	0,50	34,38
c4034 0.35 mm	spikelet fork	0,88	0,94	2,31	0,50	40,54

c4034 0.35 mm	spikelet fork	0,75	0,75	1,88	0,44	40,00
c4034 0.35 mm	spikelet fork	0,88	0,69	2,31	0,50	29,73
c4034 0.35 mm	spikelet fork	0,88	0,88	1,88	0,63	46,67
c4034 0.35 mm	spikelet fork	0,88	0,75	2,13	0,50	35,29
c4034 0.35 mm	spikelet fork	0,88	0,63	1,81	0,44	34,48
c4034 0.35 mm	spikelet fork	1,00	0,94	1,94	0,56	48,39
c4034 0.35 mm	spikelet fork	0,81	0,69	1,75	0,50	39,29
c4034 0.35 mm	spikelet fork	1,06	0,56	1,63	0,50	34,62
c4034 0.35 mm	spikelet fork	1,00	0,81	2,50		32,50
c4025 0.35 mm	spikelet fork	0,75	0,88	2,06	0,38	42,42
c4025 0.35 mm	spikelet fork	0,81	0,63	1,75	0,31	35,71
c4025 0.35 mm	spikelet fork	0,69	0,50	1,63	0,31	30,77
c4025 0.35 mm	spikelet fork	0,88	0,81	2,13	0,50	38,24
c4025 0.35 mm	spikelet fork	0,75	0,69	1,81	0,50	37,93
c4025 0.35 mm	spikelet fork	0,94	0,88	2,06	0,50	42,42
c4025 0.35 mm	spikelet fork	0,75	0,63	1,63	0,44	38,46
c4025 0.35 mm	spikelet fork	0,94	1,06	2,00	0,50	53,13
c4025 0.35 mm	spikelet fork	0,75	0,69	1,88	0,38	36,67
c4025 0.35 mm	spikelet fork	0,75	0,50	1,56	0,38	32,00
c4025 0.35 mm	spikelet fork	0,75	0,69	1,81	0,50	37,93
c4025 0.35 mm	spikelet fork	1,00	0,94	2,19	0,50	42,86
c4025 0.35 mm	spikelet fork	0,81	0,88	1,75	0,50	50,00

Lucone D – EBA samples						
samples	**type of remains**	**a**	**b**	**c**	**d**	**b:c x 100**
c1	spikelet fork	1.13	1.38	2.38	0.75	57.89
c1	spikelet fork	0.94	1.13	2.00	0.69	56.25
c1	spikelet fork	0.94	0.69	2.00	0.44	34.38
c1	spikelet fork	1.13	1.25	2.31	0.75	54.05
c1	spikelet fork	0.94	1.00	2.06	0.69	48.48
c1	spikelet fork	1.06	1.25	2.44	0.88	51.28
c1	spikelet fork	1.13	1.25	2.50	1.00	50.00
c1	spikelet fork	0.88	1.13	2.38	0.88	47.37
c1	spikelet fork	0.63	1.13	2.13	1.13	52.94
c1	spikelet fork	1.06	1.13	2.13	0.88	52.94
c1	spikelet fork	1.13	0.81	2.31	0.75	35.14
c1	spikelet fork	1.13	1.13	2.50	0.75	45.00
c1	spikelet fork	1.25	1.38	2.81	0.69	48.89
c1	spikelet fork	0.81	1.00	2.06	0.63	48.48
c1	spikelet fork	1.06	1.00	2.13	0.56	47.06
c1	spikelet fork	0.94	1.13	2.06	0.81	54.55
c1	spikelet fork	0.00	0.81	2.00	0.50	40.63
c1	spikelet fork	1.06	1.06	2.00	0.75	53.13
c1	spikelet fork	1.13	1.13	1.94	0.63	58.06

c1	spikelet fork	1.06	1.06	2.13	0.81	50.00
c1	spikelet fork	1.13	1.13	2.25	0.88	50.00
c1	spikelet fork	0.88	0.94	2.25	0.63	41.67
c1	spikelet fork	0.94	0.88	1.88	0.69	46.67
c1	spikelet fork	1.06	1.13	2.44	0.75	46.15
c1	spikelet fork	1.25	0.94	2.38	0.81	39.47
c1	spikelet fork	1.13	1.06	2.06	0.56	51.52
c1	spikelet fork	0.88	0.88	2.06	0.63	42.42
c1	spikelet fork	1.06	1.44	2.50	0.94	57.50
c1	spikelet fork	1.06	0.94	1.94	0.50	48.39
c1	spikelet fork	1.13	1.13	2.13	0.75	52.94
c1	spikelet fork	1.00	1.13	2.00	0.69	56.25
c1	spikelet fork	1.13	1.38	2.38	0.75	57.89
c1	spikelet fork	0.94	1.13	2.00	0.69	56.25
c1	spikelet fork	0.94	0.69	2.00	0.44	34.38
c1	spikelet fork	1.13	1.25	2.31	0.75	54.05
c1	spikelet fork	0.94	1.00	2.06	0.69	48.48
c1	spikelet fork	1.06	1.25	2.44	0.88	51.28
c1	spikelet fork	1.13	1.25	2.50	1.00	50.00
c1	spikelet fork	0.88	1.13	2.38	0.88	47.37
c1	spikelet fork	0.63	1.13	2.13	1.13	52.94
c1	spikelet fork	1.06	1.13	2.13	0.88	52.94
c1	spikelet fork	1.13	0.81	2.31	0.75	35.14
c1	spikelet fork	1.13	1.13	2.50	0.75	45.00
c1	spikelet fork	1.25	1.38	2.81	0.69	48.89
c1	spikelet fork	0.81	1.00	2.06	0.63	48.48
c1	spikelet fork	1.06	1.00	2.13	0.56	47.06
c1	spikelet fork	0.94	1.13	2.06	0.81	54.55
c1	spikelet fork	0.00	0.81	2.00	0.50	40.63
c1	spikelet fork	1.06	1.06	2.00	0.75	53.13
c1	spikelet fork	1.13	1.13	1.94	0.63	58.06
c1	spikelet fork	1.06	1.06	2.13	0.81	50.00
c1	spikelet fork	1.13	1.13	2.25	0.88	50.00
c1	spikelet fork	0.88	0.94	2.25	0.63	41.67
c1	spikelet fork	0.94	0.88	1.88	0.69	46.67
c1	spikelet fork	1.06	1.13	2.44	0.75	46.15
c1	spikelet fork	1.25	0.94	2.38	0.81	39.47
c1	spikelet fork	1.13	1.06	2.06	0.56	51.52

Triticum spelta L. and *Triticum* cf. *spelta* and cf. *Triticum spelta* spelt
Preservation: waterlogged (glume base), charred
Type of remains: spikelet fork, glume base, ear base, ear uppermost part, grain
Life form: T scap
Ecology: group 1.1 (C).
Ubiquity: **LAV:** EBA (unc 4.2%, c 66.6%), MBA (c 61.5%). **LUC:** 1st ph (c 46.1%), 2nd ph (unc 4%, c 56%).
Photo: Plate 8

Description: robust and massive spikelet forks and glume bases, internodes rather broad. Glume bases are wide but thinner than in emmer and with well obvious nerves on sides. Grains elongated with a flat ventral side and a dorsal side slightly and symmetrically convex on the whole grain length (highest point in the middle). Parallel sides in dorsal view.
Bibliography: Jacomet 2006

Triticum sp. wheat
Preservation: waterlogged, charred
Type of remains: spikelet fork, glume base, rachis, ear base, ear uppermost part, glume frag, testa fragm, grain
Life form: T scap
Ecology: group 1.1 (C).
Ubiquity: **LAV:** EBA (unc 71%, c 62.5%), MBA (unc 54%, c 100%), section 98 (unc 66.6%, c 77.7%), lav37 (c, unc: EBA I A-B-C, EBA II, MBA). **LUC:** 1st ph (unc 23%, c 92.3%), 2nd ph (unc 24%, c 84%).
Photo: Plate 7
Description: wheat remains not identifiable to species level because of bad preservation, high fragmentation or absence of diagnostic features.
Bibliography: Jacomet 2006

Typhaceae (reedmace family)
Typha latifolia L. / *T. angustifolia* L. bulrush/lesser bulrush
Preservation: waterlogged
Type of remains: fruits, seeds
Life form: G rhiz
Ecology: group 6.3 (LS). The species grows on watersides, lakes, ditches and canals. *T. latifolia* grows on more organic soils than *T. angustifolia*.
Ubiquity: **LAV:** EBA (unc 25%), MBA (unc 15.3%), section 98 (unc 66.6%), lav37 (unc Chal, EBA IA IB IC, EBA II, MBA). **LUC:** 1st ph (unc 7.7%), 2nd ph (unc 8%).
Measurements (10 selected seeds): L: 1.16 mm; W: 0.28 mm

	L (mm)	W (mm)
LAV c NN1	1.0	0.3
LAV c NN1	1.1	0.3
LAV c NN1	1.2	0.3
LUC c 397	1.0	0.3
LUC c 397	1.1	0.3
LUC c 397	1.1	0.3
LUC c 397	1.3	0.3
LUC c 397	1.4	0.3
LUC c 397	1.2	0.3
LUC c 397	1.3	0.3

Photo: Plate 7
Description: seeds tiny, spindle-shaped, pointed at one end and with a short central stem at the opposite end. Surface is characterized by elongated cells. A differentiation between *T. latifolia* and *T. angustifolia* seeds is hard to achieve because based only on small differences in seed length.
Bibliography: Jacquat 1988, Schoch *et al.* 1988.

Cyperaceae (sedge family)
Carex flacca Schreber glaucous sedge
Preservation: waterlogged
Type of remains: nutlet
Life form: G rhiz
Ecology: group 6.1 (LS). It grows in wet or dry grasslands on limestones or base-rich clay. In the Garda area, it is common also in Turkey oak woods, especially in clearings, e.g. Le Crosere spot in the municipality of Lonato (pers. observ.)
Ubiquity: **LAV:** EBA (unc 4%), MBA (unc 15.3%).
Measurements (3 nutlets): average L: 1.99 mm; average W: 1.47 mm

	L (mm)	W (mm)
LAV c NN1	2.0	1.5
LAV c 4075	1.8	1.1
LAV c 4076	2.3	1.8

Photo: Plate 7
Description: nutlets three-sided, rounded, wider in the upper half and with a very short beak. Surface finely pitted.
Bibliography: Schoch *et al.* 1988, Bojňanský & Fargašová 2007, Stace 2010.

Carex hirta L. and *Carex* cf *hirta* L. hairy sedge
Preservation: waterlogged and charred
Type of remains: nutlet
Life form: G rhiz
Ecology: group 2.4 (RU). It is common in damp grassy places in many habitats.
Ubiquity: **LAV:** EBA (unc 8.3%), MBA (unc 15.4%), lav37 (unc EBA IC, EBA II, MBA). **LUC:** 1st ph (unc 30.7%, c 15.4%), 2nd ph (unc 7.7%).
Measurements (8 nutlets): average L: 2.22 mm; average W: 1.32 mm

	L (mm)	W (mm)
LAV c 169	2.7	1.5
LAV c NN1	2.6	1.4
LAV c 4073	2.2	1.2
LAV c 4064	2.1	1.4
LUC c 46	2.1	1.3
LUC c 51	1.9	1.3
LUC c 113	2.0	1.1
LUC c 1	2.3	1.4

Photo: Plate 7
Description: nutlets elongated, triangular in cross section, wider in the upper half, slightly tapering on the base and narrowed in a beak on the top. Surface finely pitted.
Bibliography: Jacquat 1988, Bojňanský & Fargašová 2007, Stace 2010.

Cyperus flavescens L. yellow flatsedge
Preservation: waterlogged
Type of remains: nutlet
Life form: T caesp
Ecology: group 6.2 (LS). It grows on waterside and wet open ground, also along wet roadsides.
Ubiquity: **LAV:** EBA (unc 41.7%), MBA (unc 84.6%), lav37 (unc Neol, Chal, EBA IA IB IC, EBA II, MBA). **LUC:** 1st ph (unc 7.7%).
Measurements (10 selected nutlets): average L: 0.84 mm; average W: 0.61 mm

	L (mm)	W (mm)
LAV NN1	0.9	0.7
LAV NN1	0.9	0.7
LAV NN1	0.8	0.6
LAV NN1	0.9	0.6
LAV NN1	0.8	0.5
LAV NN1	0.8	0.6
LAV NN1	1.0	0.7
LAV NN1	0.8	0.6
LAV NN1	0.8	0.6
LAV NN1	0.9	0.6

Photo: Plate 7

Description: achenes biconvex, slightly domed, almost rounded in outline, with apex narrowed into a beak (short style residue). *C. fuscus* is very similar but it has a trigonous cross-section.
Bibliography: Jacquat 1988, Bojňanský & Fargašová 2007.

Cyperus glomeratus L. and *Cyperus* cf *glomeratus* L. galingale
Preservation: waterlogged
Type of remains: nutlet
Life form: He (T scap)
Ecology: group 6.3 (LS). It grows in wet habitat, in ditches, muddy riverbanks, sea-shores.
Ubiquity: **LAV:** EBA (unc 29%), MBA (unc 30.8%), section 98 (unc 66.6%), lav37 (unc Neol, Chal, EBA IA IB IC, EBA II, MBA).
Measurements (10 selected nutlets): average L: 1.16 mm; average W: 0.32 mm

	L (mm)	W (mm)
LAV c NN1	1.2	0.4
LAV c NN1	1.3	0.3
LAV c 135	1.2	0.3
LAV c 135	1.3	0.3
LAV c 169	1.1	0.4
LAV37 c 120.5cm	1.1	0.3
LAV37 c 120.5cm	1.1	0.4
LAV37 c 100.5cm	1.2	0.3
LAV c 4025	1.1	0.3
LAV c RP02	1.1	0.3

Photo: Plate 7
Description: achenes small, trigonous and elongated, with a short beak on the top (style residue). Surface densely reticulate-foveate.
Bibliography: Bojňanský & Fargašová 2007.

Schoenoplectus cf. *mucronatus* (L.) Palla bog bulrush
Preservation: waterlogged
Type of remains: nutlet
Life form: He (T scap)
Ecology: group 6.3 (LS). It grows in swamps, ponds banks, and reeds.
Ubiquity: **LAV:** EBA (unc 12.5%), MBA (unc 30.7%), lav37 (unc EBA IC, MBA).
Measurements (4 nutlets): average L: 1.11 mm; average W: 0.86 mm

	L (mm)	W (mm)
LAV c 4061	1.1	0.9
LAV c 76	1.3	1.0
LAV c RR115	1.0	0.8
LAV c 136	1.0	0.8

Photo: Plate 7
Description: nutlets obovoid, trigonous, apex with beak. Surface with transversal wavy wrinkles.
Bibliography: Bojňanský & Fargašová 2007.

Scirpus radicans Schkuhr club-rush
Preservation: waterlogged
Type of remains:
Life form: G rhiz
Ecology: group 6.2 (LS). It grows along waterside, in the changing water levels belt, ditches and ponds, on denuded bottoms of ponds.
Ubiquity: **LAV:** EBA (unc 54%), MBA (unc 92.3%), section 98 (unc 66.6%), lav37 (unc Neol, Chal, EBA IA IB IC, EBA II, MBA). **LUC:** 1st ph (unc 7.7%).

Measurements (10 selected nutlets): average L: 0.87 mm; average W: 0.49 mm

	L (mm)	W (mm)
LAV c WES04	1.0	0.5
LAV c WES04	0.9	0.5
LAV c WES04	0.8	0.5
LAV c WES04	0.9	0.5
LAV c WES04	0.9	0.5
LAV c WES04	0.8	0.5
LAV c WES04	0.9	0.5
LAV c WES04	0.9	0.5
LAV c WES04	0.8	0.4
LAV c WES04	0.8	0.5

Photo: Plate 7
Description: nutlets small, obovate, slightly three-sided (ventral side flattish, dorsal side roof-like with a longitudinal rib). Apex with a beak.
Bibliography: Bojňanský & Fargašová 2007.

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PLATE 1

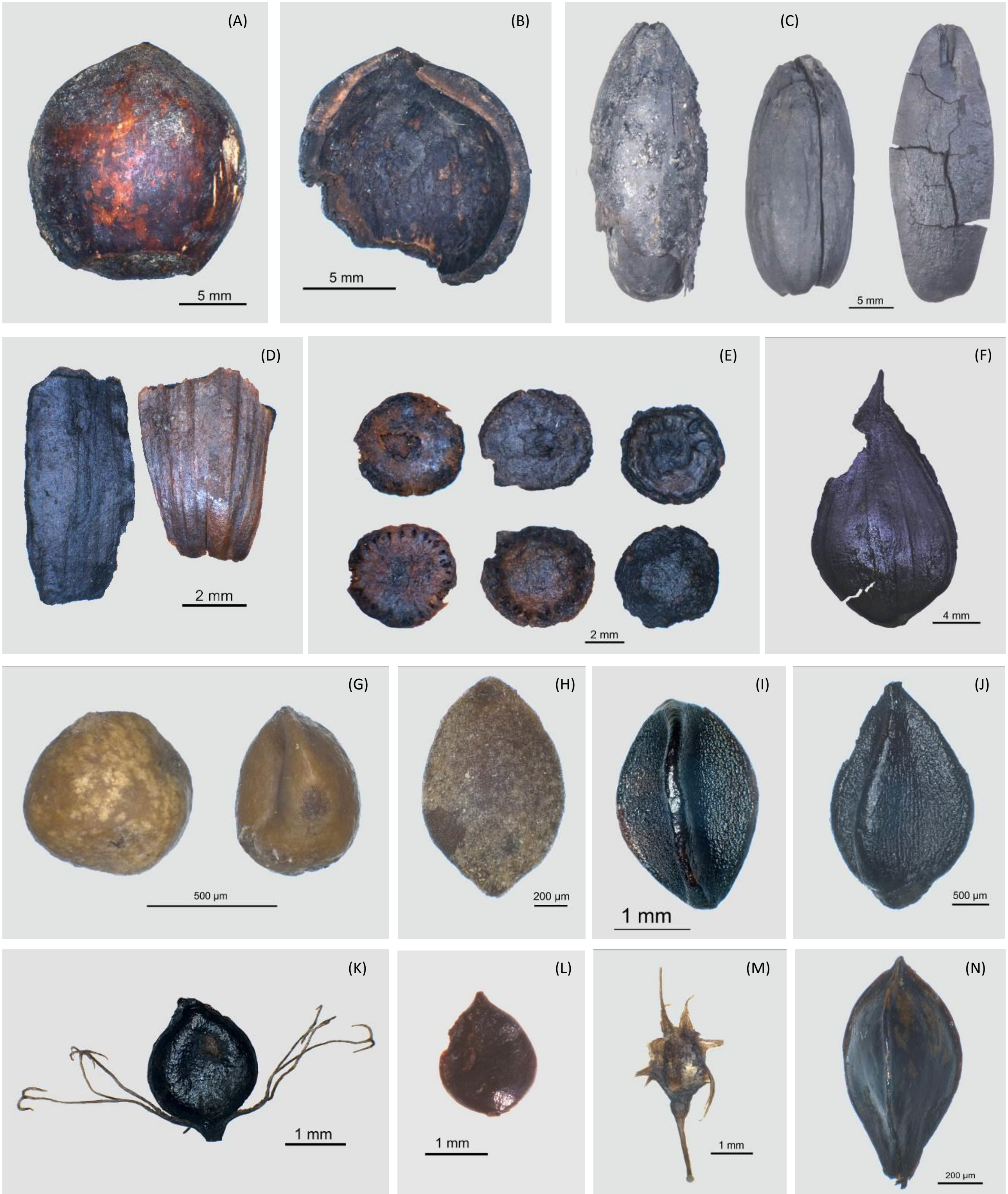

Plate 1 – Corylaceae: (A-B) *Corylus avellana*; Fagaceae: (C-E) *Quercus* sp. (C) charred acorns, (D) pericarp fragments, (E) receptacle circular (hypothecium); (F) *Fagus sylvatica*; Moraceae: (G) *Ficus carica*; Urticaceae: (H) *Urtica dioica*; Polygonaceae: (I) *Fallopia convolvulus,* (J) *Polygonum aviculare,* (K) *Polygonum lapathifolium*, (L) *Polygonum persicaria*, (M) *Rumex maritimus* perianthium, (N) *Rumex maritimus* seed.

PLATE 2

Plate 2 – Chenopodiaceae: (A) *Chenopodium album,* (B) *Polycnemum arvensis / P. major* ; Portulacaceae: (C) *Portulaca oleracea*; Caryophyllaceae: (D) *Arenaria serpyllifolia*; Papaveraceae: (E) *Papaver argemone*, (F) *P. dubium*, (G) *P. rhoeas*; Oxalidaceae: (H) *Oxalis corniculata*; Violaceae: (I) *Viola riviniana / V. reichenbachiana;* Ranunculaceae: (J) *Ranunculus sardous*, (K) *R. sceleratus;* Brassicaceae: (L) *Camelina sativa* – capsule; Rosaceae: (M) *Agrimonia eupatoria,* (N) *Fragaria vesca*, (O) *Potentilla reptans*, (P) Maloideae pericarp fragment (© photos C, D, E, F, G, H, I by G. Haldiman).

PLATE 3

Plate 3 – Rosaceae: *Pyrus pyraster* (A) complete internal part (D) pip, *Pyrus* sp. (B) calyx remnants (C) stone cells; (E) *Rubus* gr *fruticosus*, (F, G) *Prunus spinosa*; Linaceae: *Linum usitatissimum* (H) waterlogged seeds, (I) charred seeds, (J) charred capsule, (K) fibres, (L) capsule fragments; Fabaceae: (M) *Vicia faba* var. *minor* (© photos D H, I, J by G. Haldiman).

PLATE 4

Plate 4 – *Staphylea pinnata* perforated seeds and reconstruction of the necklace from Lucone (Stratigraphic Units SU5, first settlement phase). Each seed is represented in lateral, adaxial and abaxial views (© photo necklace Museo Val Sabbia, reproduced with permission).

PLATE 5

Plate 5 – Cornaceae: (A) *Cornus mas*; Vitaceae: (B, C) *Vitis vinifera* L. subsp. *sylvestris*; Verbenaceae: (D) *Verbena officinalis*; Apiaceae: (E) *Orlaya grandiflora*; Plantaginaceae: (F) *Plantago major*; Lamiaceae: (G) *Mentha aquatica / M. arvensis,* (H) *Lycopus europaeus*, (I) *Ajuga reptans;* Solanaceae: (J, K) *Physalis alkekengi* (© photos F, G, I by G. Haldiman).

PLATE 6

Plate 6 – Valerianaceae: (A) *Valerianella dentata*; Dipsacaceae: (B) *Dipsacus fullonum*, (C) *Knautia arvensis*; Campanulaceae: (D) *Legousia hybrida / L. speculum veneris*; Alismataceae: (E) *Caldesia parnassifolia*; Asteraceae: (F) *Anthemis tinctoria,* (G) *Cirsium arvense,* (H) *Onopordum acanthium,* (I) *Carthamus tinctorius*, (J-L) *Lapsana communis,* (M) *Carthamus cf lanatus* (© photos B, C, D, E, F, G, I by G. Haldiman).

PLATE 7

Plate 7 – Typhaceae: (A, B) *Typha latifolia* / *T. angustifolia*; Cyperaceae: (C) *Carex flacca*, (D) *Carex hirta*, (E) *Cyperus glomeratus*, (F) *Schoenoplectus* cf *mucronatus*, (G) *Cyperus flavescens*, (H, I) *Scirpus radicans;* Poaceae: (J) cf *Eragrostis minor,* (K, L) *Triticum* sp. waterlogged spikelet, (M) *Panicum miliaceum* (© photos A, C, D, E, F by G. Haldiman).

PLATE 8

Plate 8 – Cereals: (A) *Triticum monococcum*; (B) *Triticum dicoccum*; (C) *Triticum spelta*; (D, E) *Triticum* nn (NGW); (F) *Triticum aestivum*; (G) *Triticum durum/turgidum*; (H) *Hordeum vulgare* (© all photos by G. Haldiman).

PLATE 9

Plate 9 – Cereals: (A, B) *Triticum dicoccum*;
(C, D, E) *Triticum* nn (NGW);
(F) *Triticum durum/turgidum*; (G) *Hordeum vulgare*
(© all photos by G. Haldiman).

APPENDIX 8

Research papers:

Perego R., Badino F., Deaddis M., Ravazzi C., Vallè F. and Zanon M. (2011) – L'origine del paesaggio agro-pastorale in nord Italia: espansione di *Orlaya grandiflora* (L.) Hoffm. nella civiltà palafitticola dell'età del Bronzo della regione del Garda. NAB Notizie Archeologiche Bergomensi, 19: 161-173. ISSN: 1127-2155. Link: http://geomatic.disat.unimib.it/home/palinologia/download/Perego%20et%20al%20Orlaya%20NAB%202011.pdf
Reproduced with permission of the Journal Editor in Chief (Direttore Responsabile).

Heiss A. G., Filipovič D, Nedelcheva A., Ruß-Popa G., Wanninger K., Schramayr G., **Perego** R., Jacomet S. (2014) - A fistful of bladdernuts: the shifting uses of *Staphylea pinnata* L. as documented by archaeology, history, and ethnology. Folk life: journal of ethnological studies, vol. 52, n. 2: 95-136. DOI 10.1179/0430877814Z.00000000031 Online ISSN: 1759-670X.
Link: http://dx.doi.org/10.1179/0430877814Z.00000000031

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L'origine del paesaggio agro-pastorale in nord Italia: espansione di *Orlaya grandiflora* (L.) Hoffm. nella civiltà palafitticola dell'età del Bronzo della regione del Garda

Renata Perego-Federica Badino-Massimiliano Deaddis-Cesare Ravazzi-Francesca Vallè-Marco Zanon

Introduzione

I dati archeobotanici forniscono le basi per la ricostruzione degli ambienti del passato e dell'economia dei popoli preistorici. I ritrovamenti fossili di piante coltivate e di specie selvatiche – in particolare specie infestanti delle colture (flora segetale), specie ruderali e specie di ambienti naturali e seminaturali (boschi, aree umide, prati, pascoli, ecc.) – documentano attività pastorali, tecniche agricole ed aspetti economici che non sarebbero altrimenti decifrabili. La prassi delle indagini archeologiche più recenti comprende studi paleobotanici; il più delle volte però questi si riducono a liste floristiche commentate, prive della documentazione sistematica dei reperti significativi. Inoltre, sono rarissimi i casi di studio in cui si sia realizzata un'integrazione stratigrafica tra le principali fonti di informazione archeobotanica – polline, semi e frutti, carboni, legni e loro anelli. Le analisi sono spesso incomplete, i campionamenti incoerenti, sicché le sintesi ottenute a posteriori sono mere operazioni di somma.

I recenti programmi di scavo nelle palafitte gardesane, promossi da Raffaele C. de Marinis e ultimamente corroborati dall'impegno dei suoi numerosi allievi, hanno fornito una nuova opportunità per sperimentare le potenzialità della ricerca paleobotanica a diversa scala: dai coproliti ai cumuli di scarico, fino alla successione millenaria dei depositi associati a taluni abitati palafitticoli. Identificazioni dettagliate di polline e macroresti vegetali vengono messi a confronto tra loro e con la rispettiva stratigrafia archeologica, nonché con la funzione delle strutture che li contengono.

Il presente contributo è rivolto alla storia di una specie indicatrice di ecosistemi di pascolo secco strettamente legati all'origine del paesaggio agrario padano. È con l'inizio dell'età del Bronzo (ca. 2100 a.C.) che in alcune aree dell'Italia Settentrionale inizia a delinearsi un paesaggio agrario, dopo millenni di interventi più o meno devastanti sulla vegetazione naturale, ma non decisivi per lo sviluppo di un paesaggio agro-pastorale vero e proprio, che richiede insediamenti stabili. Disponiamo ora di successioni polliniche, ottenute da depositi costantemente alloggiati in acqua, relative a due palafitte dell'anfiteatro gardesano[1]; dal Lavagnone è disponibile anche una stratigrafia di semi e frutti[2]. Queste successioni polliniche abbracciano l'intero sviluppo del Bronzo Antico e del Bronzo Medio, e offrono indicatori della fisionomia del paesaggio a una scala di alcuni chilometri intorno ai siti. Per il Lavagnone è stata elaborata una cronologia archeologica dettagliata, che è alla base della periodizzazione del Bronzo Antico in Italia Settentrionale[3]. Essa sarà impiegata anche nella presente indagine.

In questo lavoro ci occuperemo di un particolare fenomeno emerso durante le indagini archeobotaniche: l'espansione improvvisa e coeva – a scala secolare in entrambi i siti studiati – di una pianta erbacea (*Orlaya grandiflora*, famiglia delle ombrellifere) caratteristica del paesaggio agro-pastorale tradizionale della regione balcanico-pannonica e, in parte, di quella mediterranea. Si

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1) Lavagnone: ARPENTI et Al. 2002; DE MARINIS et Al. 2005; RAVAZZI et Al. c.s.; Lucone di Polpenazze: BADINO et Al. 2011 e in prep.

2) PEREGO et Al. in prep.

3) DE MARINIS 1999.

Fig. 1: Infiorescenza di *Orlaya grandiflora*, esemplare fotografato sul Monte Nuvolo presso Le Crosere di Lonato, BS (foto C. Ravazzi).

discute quindi del significato di questo fenomeno, come indicatore delle modificazioni nelle attività agro-pastorali e degli scambi tra le popolazioni dell'età del Bronzo, che hanno promosso la diffusione e la migrazione di specie vegetali e sono da ultimo responsabili della strutturazione della biodiversità della vegetazione attuale. Entità vegetali estranee alla flora pleistocenica del Bacino Padano furono importate accidentalmente, in quanto infestanti delle colture, e trovarono quindi diffusione negli ambienti seminaturali, sino a divenire elementi caratterizzanti di alcuni habitat e di vegetazioni particolari. Dimostriamo nel presente lavoro che *Orlaya grandiflora* (L.) Hoffm. è uno dei protagonisti di queste vicende.

Orlaya grandiflora oggi: habitat, fitosociologia e distribuzione

Orlaya grandiflora (L.) Hoffmann, denominata in italiano "lappola bianca", è una specie erbacea annuale (terofita scaposa) appartenente alla famiglia delle ombrellifere. Il fusto si accresce sino a raggiungere un'altezza di 20-70 cm; la fioritura si svolge da maggio a luglio. Le ombrelle sono composte da 5-8 (12) raggi lunghi 10-30 mm, e portano numerosi fiori con petali di color bianco crema. I petali esterni dei fiori periferici dell'ombrella sono vessillari, di dimensioni molto maggiori (lunghi 10-15 mm) e profondamente bifidi (fig. 1)[4]. Polline e frutti sono particolarmente rilevanti ai fini della presente indagine e quindi saranno esaminati in dettaglio nel capitolo successivo.

O. grandiflora è comune soprattutto nei prati aridi (specie xerotermofila) dalla regione pontica e pannonica ai settori più caldi del Centroeuropa e marginalmente fino alle aree mediterranee, preferibilmente su substrati pietrosi basici calcarei, ma anche su marne e suoli argillosi. È diffusa stabilmente anche in pascoli cespugliati a forte impietramento, in boschi luminosi, negli zerbi non più arati e in stato di abbandono; più rara nei settori marginali delle colture di cereali, nonché in orti e vigneti, come infestante[5] (fig. 2).

L'areale si estende nell'Europa meridionale dalla Spagna alla Grecia, nell'Europa centrale (bacino pannonico), verso nord fino al Belgio e alla Germania centrale; verso est fino al Mar Nero (Crimea)[6]. In Europa centrale risulta più comune nelle aree con copertura di *loess*.

***O. grandiflora* nella vegetazione segetale e sinantropica.** In Europa centrale e nella regione pannonica è specie caratteristica dell'Associazione *Caucalido-Adonidetum* (Tx. 50 ex Oberd. 57), vegetazione infestante delle colture di cereali e leguminose di clima caldo nelle aree temperate e submediterranee della regione Euro-Siberiana[7]. Inoltre è presente nell'Alleanza *Alysso-Sedion*, che comprende un complesso di habitat di pratelli xerotermofili, erboso-rupestri, colonizzati da terofite pioniere, su substrati generalmente calcarei. Nel Carso forma un'associazione specifica, e quivi raggiunge elevate coperture[8]. Nella regione strettamente mediterranea la specie occupa soprattutto habitat sinantropici.

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4) PIGNATTI 1982.

5) HEGI 1954; OBERDORFER 1993.

6) HEGI 1954; SEBALD-PHILIPPI 1992.

7) OBERDORFER 1993; CHYTRY 2009.

8) POLDINI 1998.

***O. grandiflora* nei prati aridi.** Nelle Alpi Retiche compare nei prati xerofili continentali dell'ordine *Festucetalia valesiacae*[9]. Si tratta di una vegetazione erbacea prativa di chiara impronta steppica, limitata a zone ristrette dell'arco alpino a bassa quota, con maggior diffusione in Valtellina tra Sondrio e Tirano, nel Sudtirolo tra Bolzano e Merano. Prati aridi con basse coperture di *O. grandiflora* si presentano comunemente anche nell'area dei laghi Maggiore e di Como, nonché nella regione gardesana (alleanza *Diplachnion*, classe *Festuco-Brometea*[10]). Sempre nell'habitat dei prati aridi (classe *Festuco-Brometea*), la specie si presenta a est delle Alpi, dalla regione pannonica[11] fino alle montagne balcanico-orientali[12].

***O. grandiflora* nella regione gardesana oggi.** Secondo Zersi (1871), Zanotti (1991), Guarino e Sgorbati (2004) e nostre osservazioni, *O. grandiflora* è diffusa in pascoli arbustati xerofili delle colline moreniche dell'anfiteatro e delle scarpate aride della pianura bresciana, a discreto impietramento, spesso frequentati da greggi soprattutto durante il periodo della transumanza. È presente anche in pratelli xerofili a copertura discontinua, in ambienti pietrosi su substrato lapideo, lungo le coste rocciose nel basso Garda e nelle adiacenti Prealpi Venete (Rocca di Manerba, Rocca di Rivoli, bassa Valle dell'Adige). Nell'Alto Garda è localizzata in aree agricole tra 70 e 300 m s.l.m. (vigneti, frutteti, oliveti), mentre non partecipa alla vegetazione xerotermofila petrofila delle falesie e dei prati rupestri[13].

Fig. 2: Esempio di prato arido con *Orlaya grandiflora*, uno degli habitat tipici per questa specie nell'area gardesana, Le Crosere di Lonato (BS) (foto C. Ravazzi).

Non è documentata come infestante delle colture oggi diffuse nella regione in esame. Le tecniche agricole moderne e la tipologia della coltura (mais e orzo quasi esclusivi), non sono favorevoli alla conservazione/diffusione della maggior parte delle infestanti delle colture tradizionali (tra cui *Orlaya*). Principali ostacoli sono l'intensa irrigazione richiesta dal mais, il suo spiccato accrescimento in altezza e, non ultimi, gli effetti delle operazioni di diserbo.

Diagnosi di polline e frutti allo stato fresco e fossile

La prima segnalazione di resti fossili di *Orlaya* si deve ad Ammermann et Al. (1976), lavoro in cui vengono descritti polline e frutti fossili di *Orlaya* trovati in abbondanza nel sito di Monte

9) BRAUN-BLANQUET 1949.

10) Si veda MEYER 1976.

11) KROPAC 2006; DAVID-ZACHENSKA 2010.

12) TODOROVA-TZONEV 2010.

13) MAFFEI et Al. 1998; GUARINO-SGORBATI 2004 e nostre osservazioni.

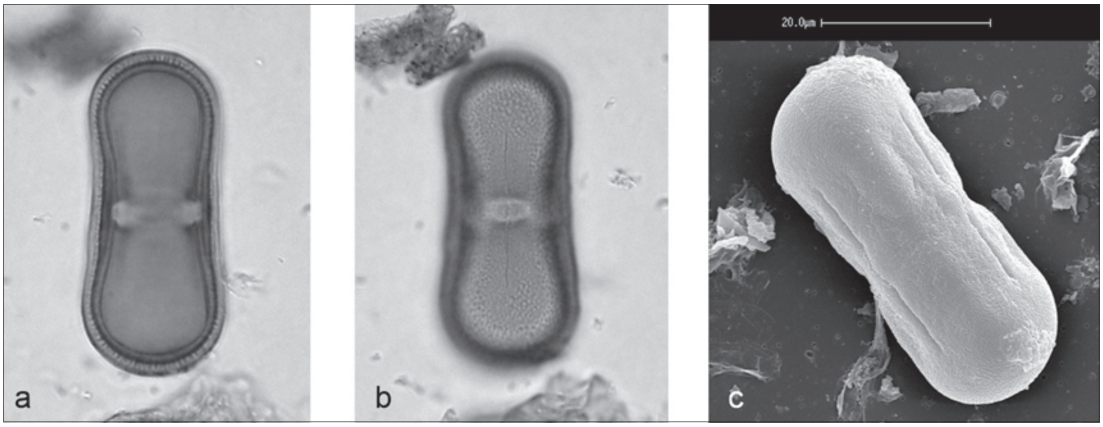

Fig. 3: Granuli pollinici di *Orlaya grandiflora* in visione equatoriale. a) e b) due diversi piani focali del granulo pollinico al microscopio ottico (foto E. Arpenti); c) visione del granulo al SEM, *Scanning Electron Microscope* (foto A. Rizzi, CNR IDPA Milano).

Leoni (provincia di Parma). Dopo questa prima segnalazione sono apparsi altri lavori che documentano ritrovamenti fossili*,* soprattutto in siti dell'Europa centrale. Nonostante la diagnosi del tipo pollinico comparisse già nella chiave per l'identificazione del polline delle ombrellifere di Cerceau-Larrival (1959), è solo negli ultimi anni che questa distinzione è entrata negli studi pollinici di siti archeologici. Alcuni autori hanno esaminato i caratteri diagnostici e le possibili confusioni sia per granuli pollinici che i frutti di *Orlaya*[14]. Ci sembra opportuno ribadirli di seguito.

Polline. *Orlaya grandiflora type* è un tipo pollinico monospecifico[15] (fig. 3) distinguibile per i granuli tricolporati a superficie psilata e in base ai seguenti caratteri: 1) asse polare compreso tra 52-63 µm, asse equatoriale tra 24-29 µm; 2) colpi stretti e corti (lunghi circa la metà dell'asse polare); 3) endoapertura (un colpo) grande, a margini distinti e di forma ellittica, orientato in senso trasversale rispetto all'asse del granulo; 4) tetto liscio, non o poco ondulato, notevolmente ispessito nella zona equatoriale.

Possibili confusioni nell'identificazione riguardano *O. kochii*, che tuttavia presenta colpi più corti, e *Caucalis platycarpos*. Il polline di quest'ultimo *taxon* è facilmente distinguibile per la forma con strozzatura equatoriale molto più pronunciata, per il tetto distintamente ondulato e meno ispessito nella zona equatoriale[16].

Frutti. I frutti di *Orlaya grandiflora* sono composti da due mericarpi compressi dorso-ventralmente, di forma ovale, lunghi circa 6-8 mm x 4-6 mm di larghezza. Le coste dorsali primarie sono strette e provviste di brevi setole. Diversamente, le coste secondarie sono percorse da spine uni- o biseriate, fortemente prominenti, sottili e rigide (lunghe circa 3-5 mm), a volte terminanti in un piccolo uncino, scarsamente compresse e non confluenti alla base[17] (fig. 4).

La maturazione dei frutti avviene a partire dalla fine di luglio. Essi presentano dispersione prevalentemente ectozoocora[18], cioè da parte di animali senza ingestione, ma per trasporto esterno. Ciò avviene ad esempio quando piccoli invertebrati accumulano semi e frutti per le riserve alimentari, oppure nel caso di ancoraggio casuale sul vello o sulla pelliccia di vertebrati, grazie alla presenza delle spine sporgenti dai mericarpi.

Il pericarpo presenta un certo grado di lignificazione che favorisce la conservazione e la fossilizzazione del frutto, ma frequentemente vengono perse le spine e la consistenza dei tessuti si riduce, limitando le possibilità di identificazione.

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14) KÖRBER-GROHNE 1999; PALS-VOORRISP 1978; ARPENTI et Al. 2002; BEUG 2004.

15) PUNT 1994; ARPENTI et Al. 2002; RAVAZZI et Al. 2004.

16) TROOSTHEIDE in PALS et Al. 1992; KÖBER-GROHNE 1999.

17) PIGNATTI 1982; NIETO FELINER et Al. 2003; STRID 1986; TUTIN et Al. 1968.

18) FENNER 1985.

La storia archeobotanica di *Orlaya grandiflora*. Reperti paleobotanici in Italia e in Europa

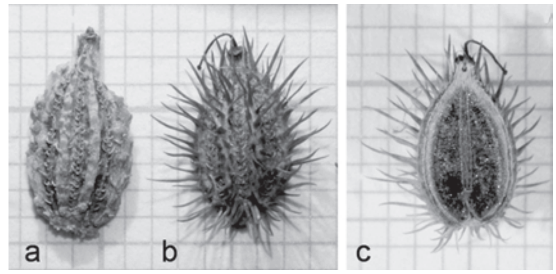

Fig. 4: Acheni freschi di *Orlaya grandiflora*: a) mericarpo in visione dorsale privato delle spine presenti sulle coste secondarie; b) lato dorsale, c) lato ventrale (foto C. Ravazzi).

Sporadici granuli pollinici fossili di *Orlaya grandiflora* sono documentati in Italia a partire dal Neolitico[19] e poi frequentemente a partire dall'età del Bronzo, mentre non risultano reperti più antichi nel Tardoglaciale-Olocene medio. Ciò suggerisce che la specie non sia autoctona in Nord Italia e nelle Alpi, ma sia stata introdotta con l'espansione delle colture cerealicole e delle greggi, in un momento non ben definito dello sviluppo neolitico.

È tuttavia da siti dell'età del Bronzo che provengono indicazioni di una diffusione ampia di *Orlaya* in diversi habitat della vegetazione sinantropica. Gli importanti lavori archeobiologici interdisciplinari svolti a Monte Leoni, in provincia di Parma[20] rappresentano il punto di partenza per comprendere il valore ecologico di alcune specie indicatrici di attività agro-pastorali nella preistoria. A Monte Leoni, granuli pollinici e frutti di *Orlaya* sono stati trovati in discrete quantità. Da allora si sono susseguiti ritrovamenti in Nord Italia datati al Bronzo Antico, soprattutto alla sua parte finale (BA II) e al Bronzo Medio (fig. 5). In base a questi dati, *Orlaya grandiflora* sembra diffondersi bruscamente a partire dal Bronzo Antico II, tanto che, nel Bronzo Medio, la sua rappresentazione pollinica si mantiene intorno a valori del 5%.

Anche nelle regioni a nord delle Alpi sono noti ritrovamenti di *Orlaya*, ma solo a partire dall'età romana e in territori inclusi nelle province romane[21]. Alcuni autori hanno perciò ipotizzato che la specie sia stata introdotta a nord delle Alpi dai Romani con i traffici commerciali di cereali o con il trasporto di vettovaglie per l'esercito romano stanziato in quei territori[22].

Ritrovamenti in località ancora più a nord[23] sono chiaramente imputabili al trasporto di cereali per scambi commerciali.

Il *record* fossile nei siti dell'età del Bronzo delle palafitte gardesane

Il Laboratorio di Palinologia del CNR-IDPA svolge da diversi anni indagini paleobotaniche e paleoambientali nell'anfiteatro morenico del Garda. Oggetto di studio sono i bacini inframorenici che caratterizzano questa regione e che rappresentano una delle principali fonti di informazioni per le ricostruzioni dei paleoambienti e della storia della vegetazione nel Nord Italia. Numerosi bacini hanno ospitato villaggi palafitticoli durante l'età del Bronzo, in particolare durante le fasi del Bronzo Antico e del Bronzo Medio (2200-1300 a.C.). Le testimonianze si sono conservate nei depositi palustri-lacustri che hanno colmato nel corso del tempo queste depressioni. La sommersione sotto falda di questi sedimenti ha consentito un'ottima conservazione anche dei resti vegetali – non solo polline ma anche macroresti – offrendo elevate potenzialità per gli studi archeobotanici.

Nel presente lavoro vengono presi in considerazione due siti dell'età del Bronzo nel settore occidentale dell'anfiteatro morenico del Garda (provincia di Brescia) in cui sono in corso indagini archeobotaniche: Lavagnone di Desenzano del Garda e Lucone D di Polpenazze. Queste due località distano tra loro circa 13 km (siti 1 e 2 in fig. 5). L'avvio delle indagini è frutto della collaborazione con il Dipartimento di Scienze dell'Antichità, cattedra di Preistoria e Protostoria dell'Università di Milano e il Museo Civico Archeologico G. Rambotti di Desenzano del Garda (BS) per il sito del Lavagnone; con il Museo Archeologico della Val Sabbia per il sito del Lucone di Polpenazze.

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19) BANINO 2005.

20) AMMERMANN et Al. 1978; PALS-VOORRIPS 1979.

21) KRÖBER-GROHNE 1999.

22) KOOISTRA 1991; PALS-TROOSTHEIDE 1992; KRÖBER-GROHNE 1999; PONEL et Al. 2000.

23) Paesi Bassi: PALS-HAKBIJL 1992.

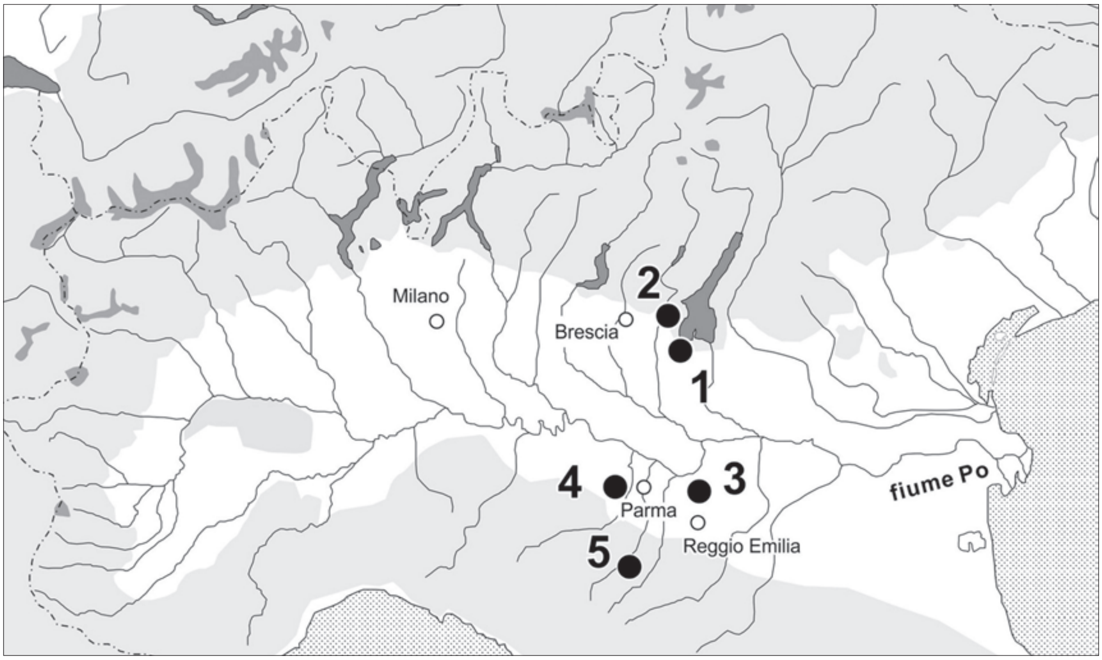

Fig. 5: Localizzazione dei siti dell'Italia Settentrionale dai quali provengono reperti di *Orlaya grandiflora*. 1) Lavagnone (ARPENTI et Al. 2002 e questo lavoro); 2) Lucone di Polpenazze (questo lavoro e BADINO et Al. 2011 e in prep.); 3) S. Rosa di Poviglio (RAVAZZI et Al. 2004); 4) Noceto (ACETI et Al. 2009); 5) Monte Leoni (AMMERMANN et Al. 1976).

Entrambi i siti registrano la presenza di polline di *Orlaya grandiflora*, mentre resti carpologici sono stati finora ritrovati solo nei sedimenti del Lavagnone. La cronologia si basa sul modello età-profondità delle sequenze archeobotaniche, ottenuto con Oxcal 4.0[24], e basato su tre ordini di dati cronologici: dendrocronologia, datazioni radiocarboniche AMS (accuratezza ±35-40, 2σ) e periodizzazione archeologica[25]. Nel testo sono pertanto riportate le datazioni ottenute dal modello, espresse in anni a.C., accompagnate dall'accuratezza modellata (2σ).

Distribuzione stratigrafica del polline di *Orlaya* nella successione del Lavagnone. Nella sequenza pollinica del settore D del deposito del Lavagnone (carota analizzata: LAV1[26]), granuli pollinici di *Orlaya* compaiono sporadicamente in livelli precedenti all'insediamento. Con le fasi iniziali del Bronzo Antico la presenza diventa continua, mentre a partire dal 1870±70 a.C. circa le percentuali polliniche raggiungono valori elevati, intorno al 5%; valori di poco inferiori persistono tra il 1600 e il 1400 a.C. durante il Bronzo Medio (fig. 6).

Le massule fossili di *Orlaya*+Fabacee e il prosciugamento del Lavagnone (1450-1370 a.C.). Nella porzione superficiale della sequenza investigata, riferibile al Bronzo Medio (carota LAV1, livelli a partire dalla profondità di 92 cm, 1460±45 a.C., fig. 6) sono stati rinvenuti anche granuli pollinici di *Orlaya* organizzati in massule plurispecifiche (fig. 7) formate da *Orlaya* e da un tipo pollinico di Fabaceae. Queste massule sono il risultato dell'attività delle api fossorie, che visitano un numero limitato di specie fiorite, e poi rilasciano le masse agglutinate plurispecifiche di granuli pollinici all'interno di fori nel terreno asciutto che loro stesse scavano (quali ad esempio api del genere *Lasioglossum,* comuni in ambiente mediterraneo)[27]. Nella successione stratigrafica del settore

24) BRONK RAMSEY 2009.

25) Dettagli in ARPENTI et Al. 2002; DE MARINIS et Al. 2005; BADINO et Al. 2011 e in prep.; PEREGO et Al. in prep.

26) Vedi ARPENTI et Al. 2002.

27) MICHENER 1974.

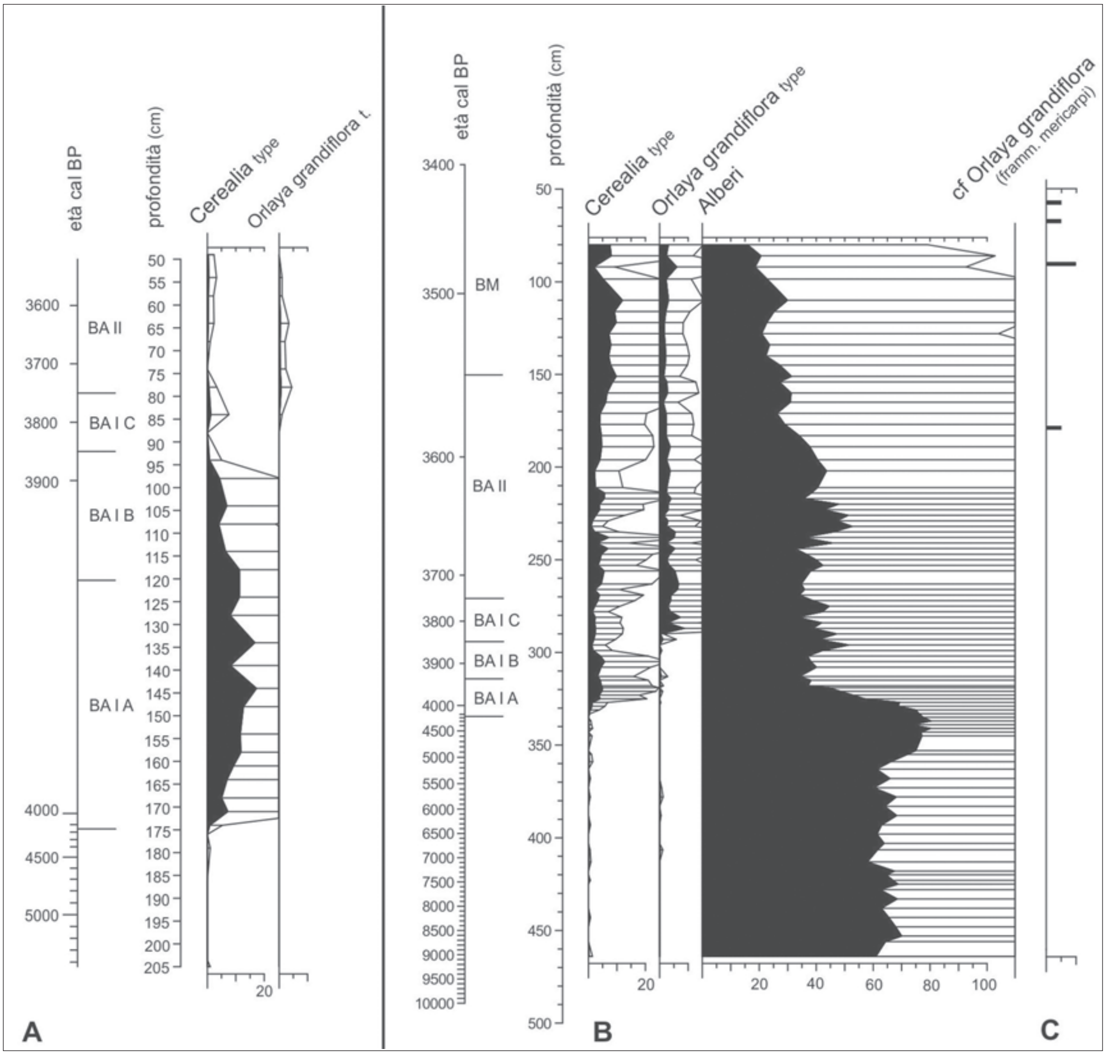

Fig. 6: *Record* fossile di *Orlaya grandiflora* nei siti del Lucone e del Lavagnone, secondo la cronologia ottenuta tramite il modello età-profondità Oxcal 4.0. A) curve polliniche di *Orlaya grandiflora type* e Cerealia *type* per il sito del Lucone D (Trincea 2; analisi F. Badino); B) curve polliniche di *Orlaya grandiflora* type, Cerealia *type* e Alberi per il sito del Lavagnone (carota LAV1; analisi: E. Arpenti, M. Deaddis, R. Banino, M. Zanon, F. Vallè); C) istogramma che illustra la posizione stratigrafica dei frutti fossili di cfr. *Orlaya grandiflora* rinvenuti nel deposito del Lavagnone (LAV37, identificazione R. Perego).

D del Lavagnone, la comparsa delle massule di *Orlaya*+Fabaceae si accompagna a un radicale mutamento dell'ambiente di sedimentazione nel settore centrale del Lavagnone, segnato da un aumento della frazione minerale (sabbia extrabacinale) e dalla cessazione della sedimentazione di fanghi organici in ambiente acquatico (*gyttja*), che aveva caratterizzato le fasi del Bronzo Antico (2077-1600 a.C.) e la parte inferiore del Bronzo Medio (1600-1450 a.C.). Probabilmente ciò è avvenuto in relazione a interventi di bonifica e/o a un abbassamento della falda ed espulsione delle acque imbibenti il sedimento. Questi eventi hanno favorito la terrestrializzazione e la messa a coltura del fondo del lago. Ciò spiegherebbe anche la comparsa di nuovi legumi coltivati (Fabaceae), e la diffusione delle rispettive infestanti (tra cui *Orlaya*). Gli insetti fossori sarebbero intervenuti nel periodo incolto tra fasi di coltura, infestando il terreno per la costruzione di tane e provocando così la contaminazione dei sedimenti con i *taxa* visitati nel corso dell'attività di bottinatura. Dato che la costruzione delle tane richiede terreno asciutto, la presenza di massule di *Orlaya* dimostra che la vegetazione termoxerofila si era spinta fin sul fondo del Lavagnone, evidentemente durante una fase di persistente aridità e contrazione degli specchi

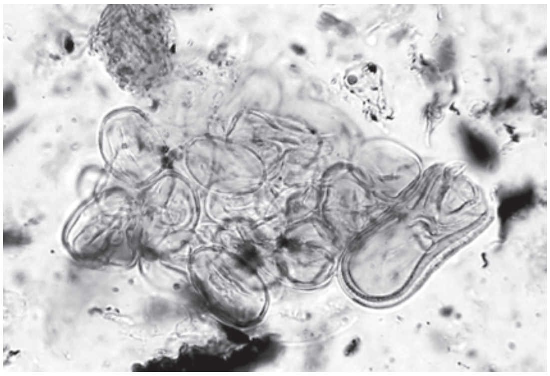

Fig. 7: Esempio di massula plurispecifica formata da granuli pollinici di *Orlaya grandiflora* e da un tipo pollinico di Fabaceae. Queste massule sono state rinvenute nei campioni a partire dalla profondità di 92 cm nella carota LAV1 del Lavagnone (foto F. Vallè).

lacustri gardesani. La profondità raggiunta dalle tane delle api può complicare l'interpretazione stratigrafica per via della contaminazione di sedimenti più profondi[28]. Tuttavia la comparsa delle massule approssima la profondità del cambiamento di *facies* deposizionale che contiene ceramica del BM II (rapporto di scavo anno 2007, ined.) ed è terminata da una data ^{14}C calibrata 1370±60 a.C.[29]. Pertanto l'inizio della fase di prosciugamento del fondo del lago è databile tra il 1460 e il 1370 (±60) a.C. L'evento si collocherebbe all'inizio di una fase di aridità in pianura Padana[30] e di ritiro dei ghiacciai alpini, indicato come *optimum* climatico tra il 1350 e il 1250 a.C.[31].

I reperti fossili di acheni del Lavagnone e il confronto con i dati pollinici. L'analisi carpologica della successione stratigrafica del settore D è stata svolta sulla carota LAV37, prelevata a una distanza di circa 2 m dalla carota studiata per il contenuto pollinico (LAV1). Le due carote sono perfettamente correlabili. Questa indagine ha evidenziato resti carpologici di *Orlaya* in 4 campioni corrispondenti a 4 distinti livelli del Bronzo Medio (profondità nella carota LAV37: 57,5; 67,5; 90,5 cm, fig. 6) e del Bronzo Antico II (LAV37 178,5 cm). Si tratta di 5 frammenti di mericarpi (2 nel campione alla profondità di 90,5 cm) che, in base alla morfologia, sono stati identificati come cfr. *Orlaya grandiflora* (fig. 8). L'incompletezza dei reperti non ha consentito un'identificazione certa. L'analisi carpologica di livelli del Bronzo Antico I dall'area dello scavo archeologico "settore A" non ha restituito alcun reperto di *Orlaya.* Questi dati confermano l'espansione di *Orlaya* nel Bronzo Antico II e Bronzo Medio, già evidenziata dalla distribuzione stratigrafica del polline nella carota LAV1 (fig. 6).

Distribuzione stratigrafica di *Orlaya* nelle successioni del lago Lucone. Nella sequenza *off-site* del sito Lucone D (fig. 6), la comparsa del polline di *Orlaya* è databile al 1800±50 a.C., sincrona, o appena più recente, dell'espansione osservata al Lavagnone. La comparsa di *Orlaya* non è in relazione con lo sviluppo dell'abitato Lucone D, che era già stato abbandonato, come testimoniato dal forte calo dei cereali e dalla contemporanea riforestazione nel 1850±50 a.C.[32]. Lungo le sponde del Lago Lucone erano però stati impiantati altri insediamenti. Infatti, uno studio pollinico *off-site* alla palafitta Lucone A ha rinvenuto polline sporadico di *Orlaya* a partire dall'inizio dell'insediamento intorno al 1950 a.C. e una sua espansione intorno al 1750 a.C.[33].

Discussione

Fin dalla prima diffusione dei paesaggi rurali all'inizio dell'età del Bronzo, nell'area gardesana erano presenti paesaggi rurali aridi con habitat litofitici, nonché di pascoli arbustati a *Prunus spinosa*, *P. mahaleb*, *Cornus mas*, *Crataegus* sp., in cui potevano diffondersi anche alberi da frutta come *Malus* sp. e *Pyrus* sp.[34]. Fin dal BA I (2100-1800 a.C.) i prati steppici, espressione delle attività pastorali in contesto climatico asciutto, occupavano vaste estensioni e ospitavano un'alta biodiversità floristica[35].

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28) BOTTEMA 1975.

29) RAVAZZI et Al., in prep.

30) CREMASCHI et Al. 1996; RAVAZZI-PEREGO c.s.

31) HOLZHAUSER 1984; HOLZHAUSER et Al. 2005.

32) BADINO et Al. 2011 e in prep.

33) VALSECCHI et Al. 2006.

34) ARPENTI et Al. 2002; DE MARINIS et Al. 2005.

35) Si vedano gli abbondanti reperti di *Helianthemum* e *Sanguisorba minor* in ARPENTI et Al. 2002.

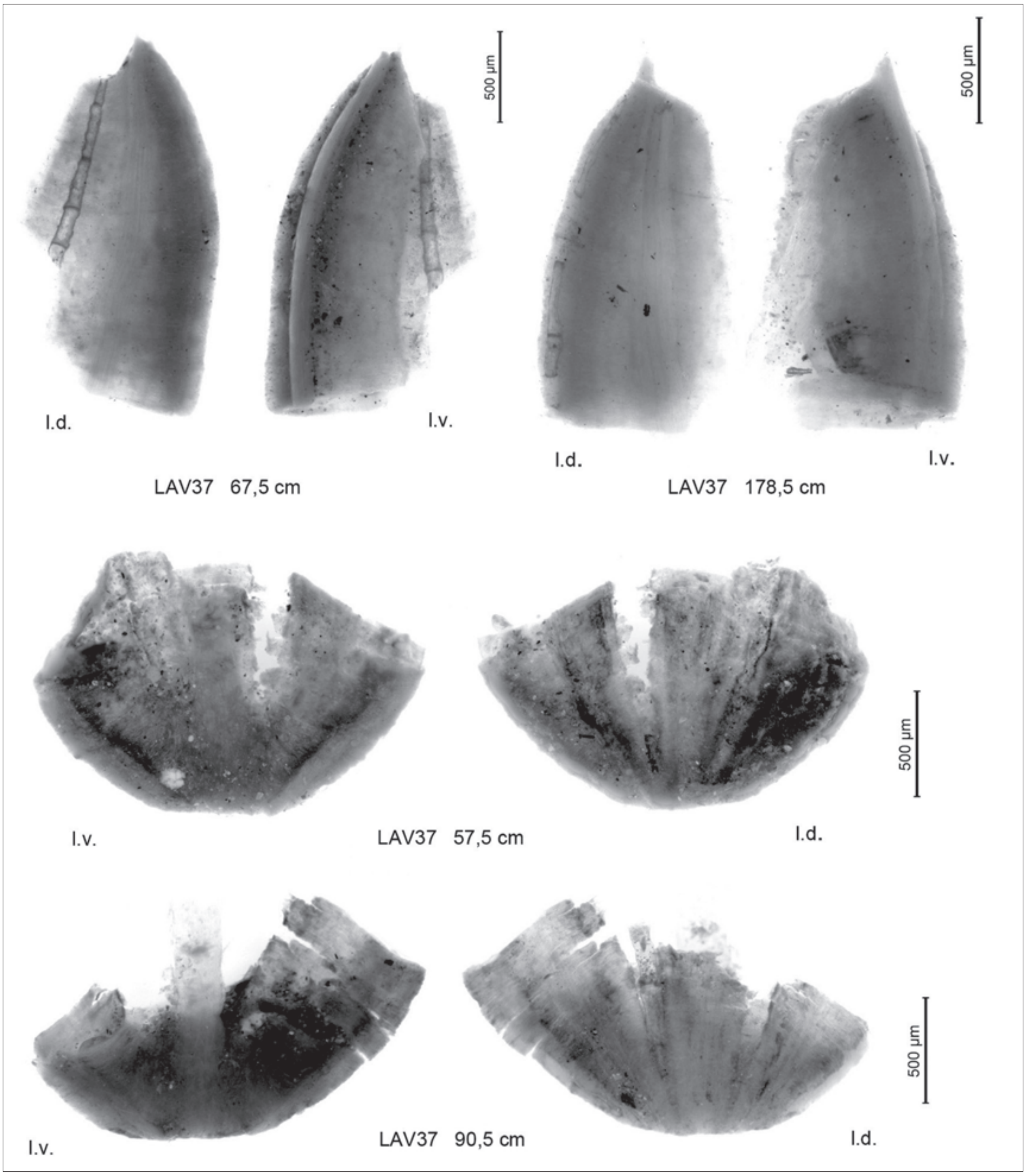

Fig. 8: Mericarpi fossili di cfr. *Orlaya grandiflora* rinvenuti nel deposito del Lavagnone (LAV37), lato dorsale (l.d.) e lato ventrale (l.v.) (identificazione e foto R. Perego).

Questo paesaggio sembra potenzialmente favorevole alla diffusione di *Orlaya grandiflora*. In realtà i dati paleobotanici stabiliscono che, nella successione delle due palafitte indagate, *Orlaya grandiflora* appare marginalmente nelle vegetazioni sinantropiche delle prime fasi di occupazione nel Bronzo Antico (BA I), e che si espande solo 2-3 secoli più tardi, intorno al 1900-1800 a.C. Probabili processi di intensa erosione del suolo, innescati dalla deforestazione, dalla pratica dell'incendio e dal pascolo di ovicaprini e maiali nel bosco (fig. 9) potrebbero aver determinato il denudamento dei versanti e l'accentuarsi dell'aridità delle aree più acclive e su substrati a granulometria grossolana, favorendo la diffusione di specie xerofile come *Orlaya*. Intorno al 1450 a.C. (Bronzo Medio) è documentato un ulteriore episodio di espansione di *Orlaya* sul fondo del lago Lavagnone, prosciugato a seguito di una bonifica e probabilmente anche di condizioni climatiche asciutte. Si può ritenere che, in questa fase, *Orlaya* abbia occupato sia colture di leguminose o cereali (prevalentemente farro, *Triticum sp.*- "nuovo frumento vestito", orzo e farro piccolo), sia recinti di stabulazione, sia aree abbandonate dopo intenso sfruttamento agricolo, versanti ciottolosi dei rilievi morenici, praterie steppiche, aree di radure e ambienti litofitici, dove ancora oggi *Orlaya* si accompagna a specie come *Odontites*, *Helianthemum* spp., *Verbascum* spp. e *Fumana*.

Gli eventi di comparsa della specie all'inizio del Bronzo Antico, e la sua diffusione intorno al 1800 e al 1450 a.C. appaiono solo in parte connessi con la fondazione degli abitati esaminati e la dinamica interna delle attività agro-pastorali. In realtà l'espansione del 1900-1800 a.C. appare sincrona, alla scala secolare, in diversi abitati palafitticoli (Lavagnone, Lucone D e Lucone A), distanti fra loro 13 km e caratterizzati da una sequenza culturale differente. Riteniamo pertanto che si tratti di un fenomeno non più limitato alle pertinenze di un singolo villaggio, ma che richiede una continuità regionale nel paesaggio agro-pastorale gardesano. In proposito si possono indicare due diverse cause concomitanti:

- la strategia di dispersione ectozoocora della specie suggerisce che fasi di espansione siano in relazione a un'intensificazione del pascolo e delle greggi transumanti con il BA II;
- l'espansione della specie potrebbe essere promossa da fasi di pronunciata aridità, come suggerito dalla diffusione di *Orlaya* sul fondo lacustre prosciugato del Lavagnone dopo il 1450 a.C. In questa prospettiva, l'abbondanza di *Orlaya* osservata a partire dal BM II e nel Bronzo Recente nell'area terramaricola e nell'Appennino settentrionale[36] può essere imputata alla diffusione di attività di pascolo intensivo, all'influenza climatica mediterranea nelle regioni in destra idrografica del Po, nonché a fasi di aridità che caratterizzano la variabilità del clima in questo periodo, con particolare riguardo al Bronzo Recente.

Conclusioni

Lo studio archeobotanico di una specie indicatrice di ecosistemi di pascolo secco nei depositi di due palafitte gardesane ha documentato tre momenti salienti dello sviluppo del paesaggio agro-pastorale nell'età del Bronzo. L'impianto degli abitati nel XXI sec. a.C. si accompagna alla deforestazione, messa a coltura e pascolo di porzioni delimitate del territorio, in un raggio di 1-5 km intorno ai villaggi. In una fase avanzata del Bronzo Antico, databile tra il 1900 e il 1800 a.C., l'espansione sincrona di *Orlaya grandiflora* in villaggi palafitticoli distanti tra loro 13 km evidenzia la continuità strutturale del pascolo, cioè l'intreccio tra aree rurali pertinenti a ciascuno dei singoli villaggi, e lo sviluppo di un sistema regionale nella circolazione delle greggi di ovicaprini. Anche la concomitanza di fasi climatiche di aridità a scala secolare può avere controllato la dinamica del paesaggio rurale. L'evento documentato dal prosciugamento del Lavagnone intorno al 1450-1370 a.C. potrebbe rappresentare l'inizio di un importante periodo secco che si estenderebbe durante il successivo Bronzo Recente, come suggerito dai dati glaciologici e dalle evidenze geoarcheologiche emerse in area terramaricola, dove *Orlaya* raggiunge la sua massima diffusione in età preistorica.

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36) AMMERMANN et Al. 1976; RAVAZZI et Al. 2004; ACETI et Al. 2009.

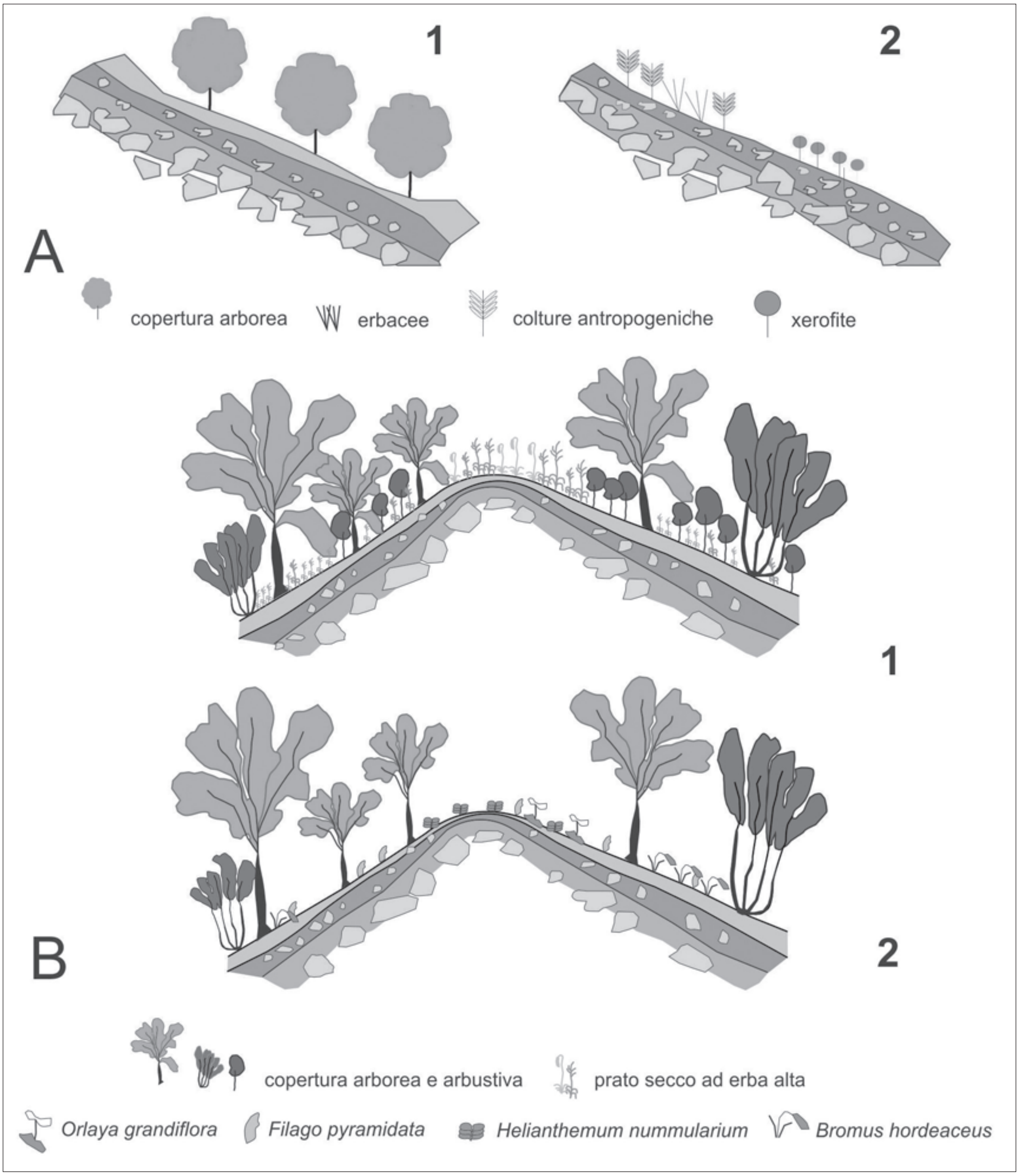

Fig. 9: Due esempi della dinamica della vegetazione che porta alla formazione di habitat a substrato subaffiorante, favorevoli all'insediamento di *Orlaya grandiflora* e di altre entità floristiche xerofitiche quali *Helianthemum spp.,* abbondante nelle indagini polliniche delle fasi di abitato del Lavagnone, *Cytisus spp., Verbascum sp.*
A) schemi 1 e 2, deforestazione del versante di una morena e impianto di colture, erosione della parte superiore del profilo del suolo, diffusione di xerofite nei settori marginali delle colture e durante le fasi di riposo (*fallow land*).
B) schemi 1 e 2, effetto del pascolo intensivo di ovicaprini e cavalli osservato sul Monte Nuvolo, presso il Lago di Polecra (comune di Lonato del Garda) tra gli anni 2007 e 2011. Lo schema 1 illustra la vegetazione rilevata nel 2007 (boscaglie dense, mantello forestale e prati aridi cespitosi densi). Lo schema 2 mostra le variazioni intervenute nel 2011 a seguito della formazione di un recinto per il pascolo e la stabulazione di capriovini e cavalli. Il recinto ha interessato sia i lembi di prato secco presso la cresta che le boscaglie circostanti. La vegetazione arbustiva ha subito una forte riduzione. Il prato secco ad erba alta (*Chrysopogon grillus-Bromus erectus*) è stato distrutto e sostituito da vegetazione erbacea terofitica (*Filago pyramidata, Bromus hordeaceus, Medicago minima*) e camefitica (*Helianthemum nummularium*). Tra le emicriptofite persistono alcune specie non appetite, che si adattano al pascolo intensivo divenendo rosulate, tra cui *Orlaya grandiflora* e *Carduus nutans*.

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Summary

The origin of the rural landscape in Northern Italy. Expansion of *Orlaya grandiflora* (L.) Hoffm. in the Bronze Age pile dwelling culture of the Garda region. We examine the Bronze Age history of a weed plant growing on dry pastures and steppes (*Orlaya grandiflora*) in N-Italy on the base of the pollen and fruit record from two pile dwellings close to the Garda Lake. The modern habitat of the species is also examined in order to support the indicator value of this species in past environments, while precisions on the diagnosis of pollen and fruits and fruit dispersal strategy help improving the fossil documentation. *Orlaya grandiflora* pollen sporadically appears in the northern Italian Neolithic records, and shows only little increase after deforesting and mowing at the pile dwelling foundation beginning at the Early Bronze Age in N-Italy. A significant expansion occurred synchronously at different pile dwelling sites during the 19th century BC, suggesting that landscape connection between villages had became established as a consequence of the increasing pasture extent, and of the intervening dry climate phases. Further evidence of *Orlaya*-Fabaceae massules, provided by borrowing bees, were discovered in sediments dated to 15th to 14th centuries BC at the bottom of the former lake Lavagnone. At that time the lake had became to a complete desiccation, after a pronounced phase of dryness, allowing xerophytic weeds to invade the floor of the desiccated lake. This event may actually represent the onset of a secular phase of warm and dry conditions – sometimes called "Bronze optimum" – that characterized the *Orlaya* acme during the development of the Terramare culture.

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