

# First archaeobotanical plant macro-remain analysis from the Middle Bronze Age wetland settlement of Viverone (Viverone "Emissario" Project: campaign Viv16)

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**Zusammenfassung** – Erste archäobotanische Untersuchungen in der mittelbronzezeitlichen Seeufersiedlung von Viverone belegen das enorme Potenzial dieses Fundplatzes für entsprechende Analysen. Aufgrund der gut erhaltenen Schichten sind hier zahlreiche Pflanzenreste und eine große Artenvielfalt vorhanden. Der Nachweis von Emmer, Dinkel, tetraploidem Nacktweizen, Spelzgerste, Erbse und Ackerbohne entspricht dem Kulturpflanzenspektrum der mittleren Bronzezeit. Die Wildpflanzen stammen von verschiedenen Standorten in unmittelbarer Nähe und ermöglichen einen Einblick in die damalige Landschaft. Zahlreiche Wildpflanzen wurden von den Siedlern absichtlich genutzt. Zu den gesammelten Früchten zählen Kornelkirschen, Haselnüsse, Holzapfel und verschiedene Beeren.

Darüber hinaus unterstützen die archäobotanischen Analysen die schon während der Ausgrabung gemachten Beobachtungen, dass es innerhalb der Siedlung mindestens zwei funktional unterschiedliche Bereiche gab. Während sich in Abschnitt 50/51 vor allem Reste der täglichen Lebensmittelzubereitung fanden, ist für das Fundspektrum aus Abschnitt 7 ein Zusammenhang mit Tierfutter anzunehmen.

**Schlüsselwörter** – Feuchtbodensiedlung, pflanzliche Großreste, Mittelbronzezeit, Kulturpflanzen, Vorratsschädlinge

**Abstract** – The first archaeobotanical studies of the Middle Bronze Age lakeshore settlement demonstrate the enormous potential of this site for appropriate analyses. On the basis of the well-preserved layers a multitude of plant remains and wide diversity of species are present at this site. Evidence of emmer, spelt, tetraploid naked wheat, hulled barley, peas and broad beans conforms to the basic cultural crop spectrum of the Middle Bronze Age. The wild plants originate from various locations in the direct vicinity and allow an insight into the landscape at that time. Numerous wild plants were intentionally used by the settlers. Fruits gathered include cornelian cherries, hazelnuts, crab apples and a diversity of berries.

Furthermore, archaeobotanical analyses support observations already made on site that within the settlement there are at least two functionally different areas. While in section 50/51 the layers contain the remains of daily food preparation, section 7 indicates a link to animal fodder.

**Keywords** – Wetland settlement, plant macro-remains, Middle Bronze Age, crops, insect pests

## Introduction

The pile-dwelling site Viverone "Emissario" <sup>351</sup> is located adjacent to a small inlet on Lake Viverone, Province of Biella, within sight of the Alpine foothills (fig. 1–2). The site has been intermittently investigated since the 1970s, with systematic planning of the settlement pile field conducted in the 1990s (FOZZATI 1998; BERTONE/FOZZATI 2004). Investigation of the ceramic and bronze artefacts from the site confirmed an occupation phase during the Middle Bronze Age (16<sup>th</sup>–15<sup>th</sup> centuries BC), with a possible occupation also occurring during the Late Bronze Age (11<sup>th</sup>–10<sup>th</sup> centuries BC) (RUBAT BOREL 2006; idem 2009; idem 2011). Excavations between 2010 and 2014 (funded by the Swiss National Science Foundation) and 2015–2016 (funded by the National Geographic Society) (fig. 3) focussed on identifying whether the settlement stood above water or dry (partially wet) land, understanding the natural environment and setting of the site, and defining the chronological situation of the settlement through dendrochronological and radiocarbon dating.

Rapid survey of the site with a Remote Operated Vehicle facilitated the identification of key areas for excavation, and also permitted the recognition of areas of recent erosion and deposition of sediment within the settlement area. The excavations identified a single phase of occupation on the site, relating to the Middle Bronze Age occupation, with no evident layer – within the zones excavated – relating to the possible Late Bronze Age phase. Sediment cores collected during the excavation within the settlement, and from the surrounding dryland environment, suggest that the settlement was constructed on a sand bar adjacent to the lake inlet, surrounded by water, but it remains unclear if the structures were permanently above water – more likely they were elevated to account for seasonal variation in the lake depth (JENNINGS et al. in prep.) (as seen at other sites in the Alpine region; e. g. JACOMET et al. 2004; MENOTTI 2004; idem 2015).

Dendrochronological sampling between 2011 and 2016 has been used to refine the wiggle-matched floating sequence for the Viverone site (RUBAT BOREL et al. 2016), and indicates that the site was likely built and occupied during the

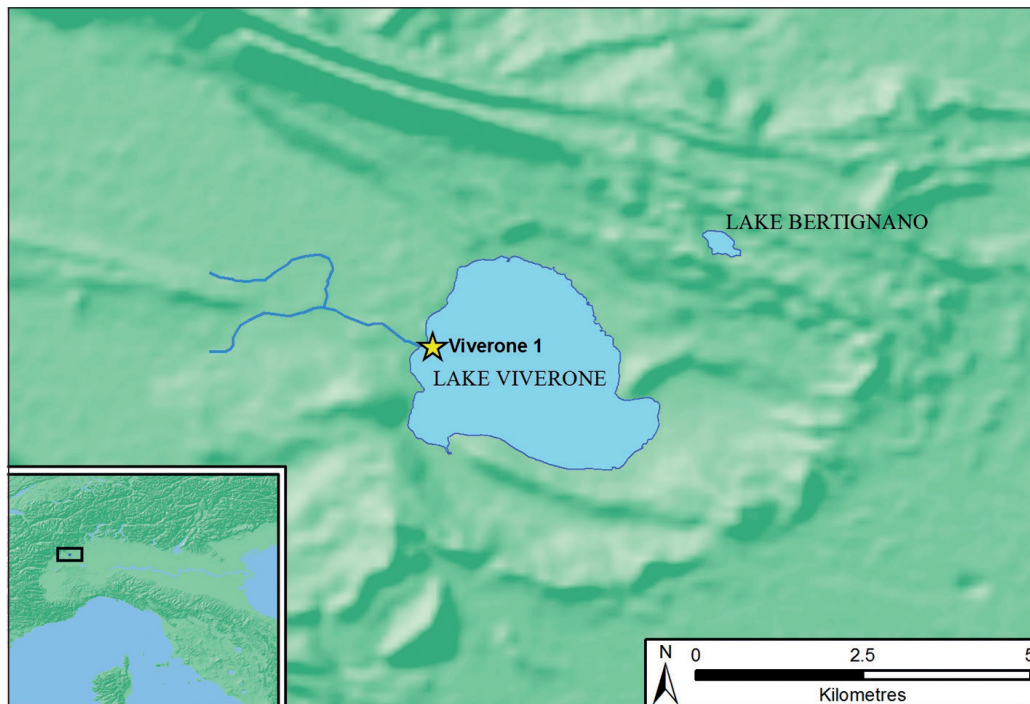


Fig. 1 The location of Viverone "Emissario" 35.



Fig. 2 Impressions on Lake Viverone. Bronze Age piles are visible under the water surface.

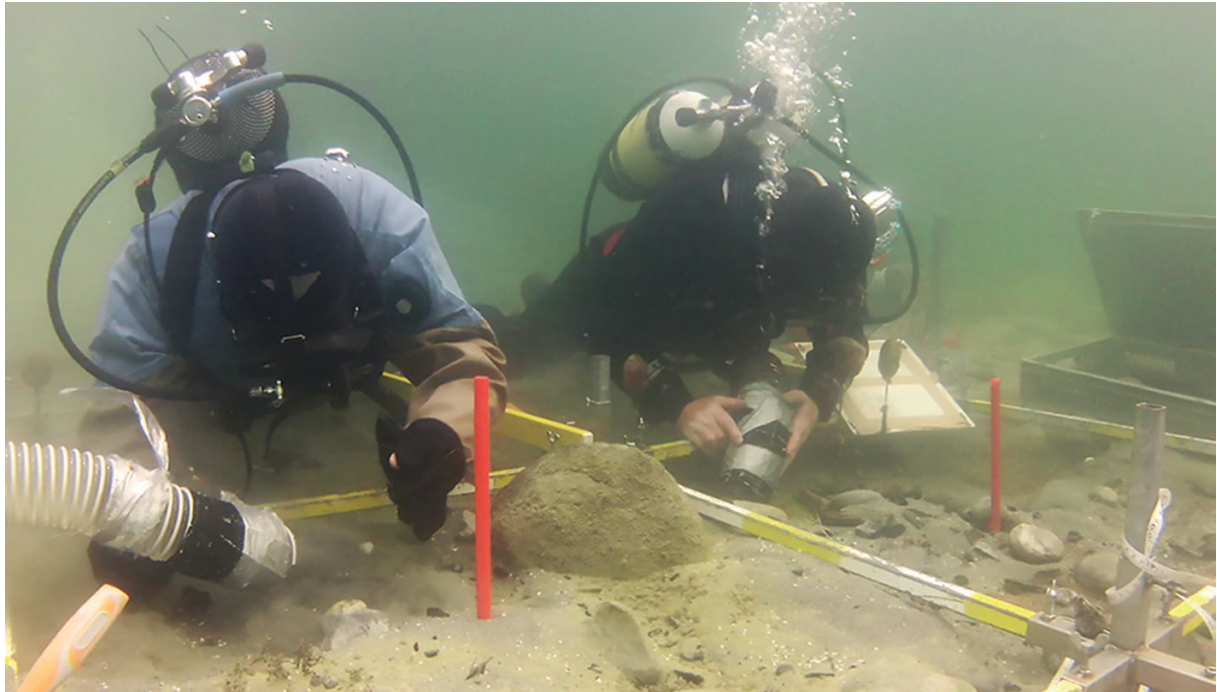


Fig. 3 Working under water. The sandy nature of the lake bed material is evident, with some larger stones and materials present.

1<sup>st</sup> half of the 14<sup>th</sup> century and the last quarter of the 13<sup>th</sup> century BC. Identification of construction units suggests that some of the structures may have been up to 17 m in length, and approaching 7 m in width, constructed parallel to the main settlement walkway (JENNINGS et al. in prep.). Ongoing dendrochronological research will help to further refine the potential for providing confirmed calendrical dating of the site.

During the excavation campaign in November 2016, 35 samples for an archaeobotanical macro-remain analysis were taken from cultural layers found in sections 50/51 and 7 of the Middle Bronze Age settlement of Viverone “Emissario” 35 (fig. 4). In the course of this first preliminary analysis, 19 sediment samples were processed. This report is supplemented by a further sample taken in a vessel from the 2015 campaign (Viv15, sample Number 15-01). Furthermore, a series of individual finds from the 2016 campaign are presented in this report.

## Method

The 20 soil samples with a total volume of 10.75 liters were wet washed through a sieve column with four mesh sizes (2; 1; 0.5; and 0.25 mm). All

identifiable residues were selected using a stereo microscope with a magnification of 6.3x–40x and soft tweezers and these were identified with the assistance of the reference collection of the archaeobotanical laboratory of the Institute of Archaeological Science of the Goethe-Universität Frankfurt am Main and relevant classification literature (e. g. CAPPERS et al. 2006). The selected subfossil material was finally preserved in distilled water in crimp-seal vials and test tubes, charred residues were dried and stored in small plastic containers. The recording of the various classes of materials (wood, charcoal, moss, insects) took place in the form of a three-tier scale: + few finds, ++ medium amount of finds, +++ many finds/dominance in sample. Finally, the data was entered into the Archaeobotanical Data Bank system ArboDat (KREUZ/SCHÄFER 2002). The Oberdorfer based nomenclature (OBERDORFER 2001) and ecological categorization of the species is modified in ArboDat.

## Results

The samples contained a total of 7 385 plant residues (fig. 14, Appendix). Up to now 112 plant species have been identified. A number of still

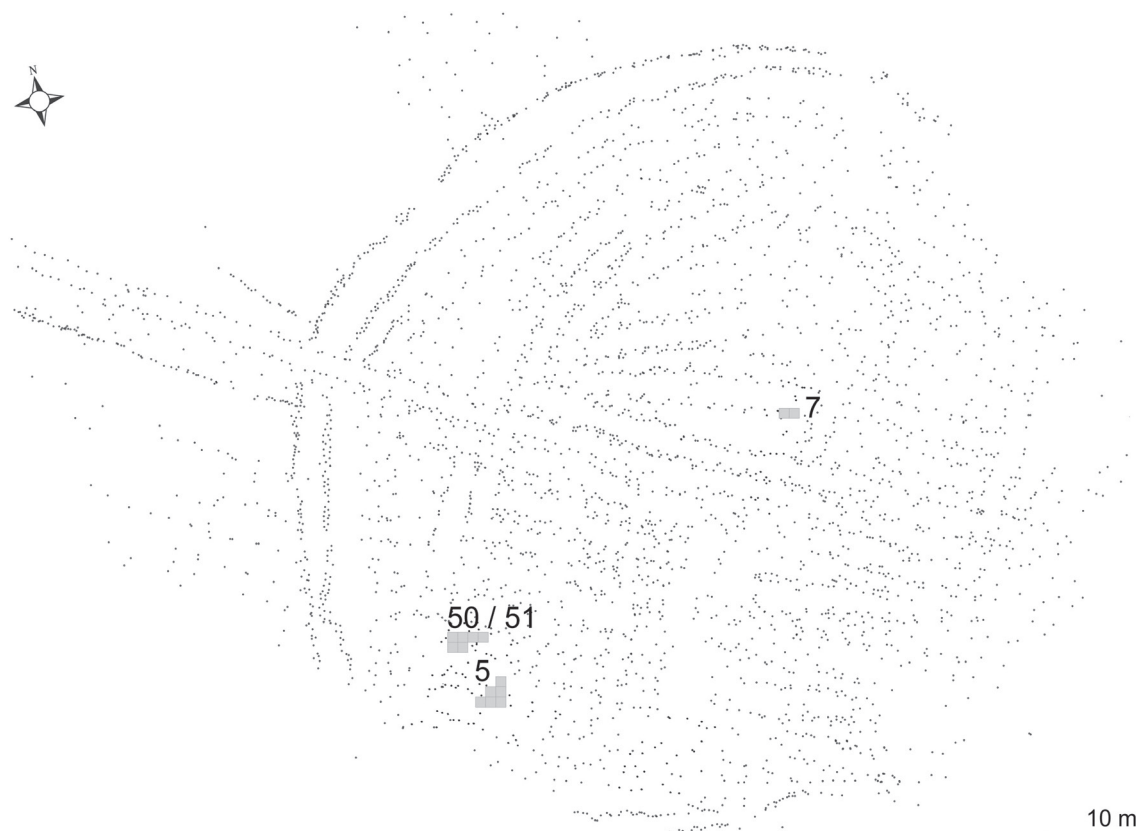


Fig. 4 Site plan with piles and sections 7 and 50/51 where samples were taken.

unidentified objects await further investigation. Needles of silver fir (*Abies alba*) from section 7 were the most frequently occurring remains found in Viv16 and represent 34 % of the spectrum.

The impressive variety of distinctive cultural layers in both settlement areas already observed during the excavation, are supported by the archaeobotanical investigations. Section 50/51 and section 7 display significant differences in composition (fig. 5) and indicate two functionally different areas of this site.

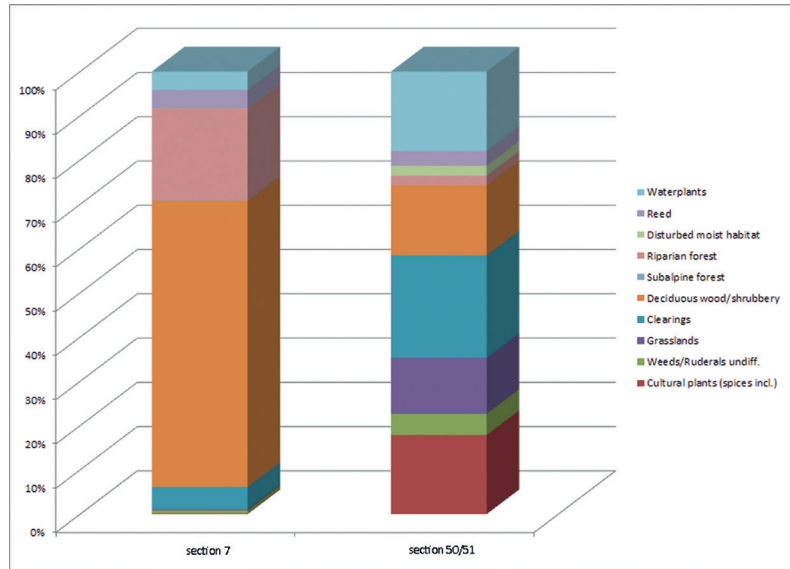
#### Section 50/51

The cultural layer encountered in section 50/51 is 2-4 cm thick. The organic detritus is embedded in a sandy matrix. The high proportion of water plant diaspores (fig. 14, Appendix), the modest state of conservation of the subfossil plant remains (often mushy) and the smoothed surface of (maybe eroded?) charcoal (and wood)

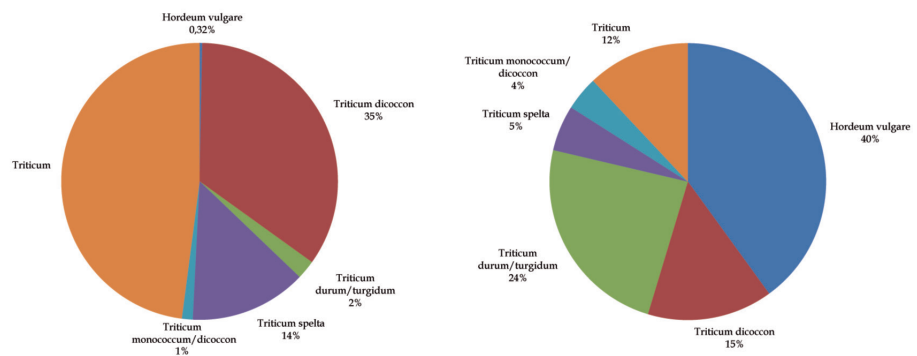
speak for lacustrine influences in this part of the settlement. Additionally, in some places, the large number of fine rhizomes indicates recent root penetration of the cultural layer. The rhizomes/shoot fragments of reeds (*Phragmites australis*) also point to disturbance.

3 061 plant remains from the samples from section 50/51, however, is a considerable quantity of finds. The plant spectrum is dominated, above all, by cultural plants and species that flourish in locations influenced by human activities: weeds and ruderals, grassland species, clearings/shrubbery or ruderals which prefer moist to wet eutroph conditions (shore/settlement). The high proportion of the group "deciduous wood/shrubbery" can be traced back to a large amount of oak fragments (*Quercus*) found in the samples.

Almost all cultural plant remains, mostly cereals, come from section 50/51<sup>2</sup>. Amongst the subfossil remains, emmer wheat (*Triticum dicoccon*) is dominant over spelt (*Triticum spelta*), tetraploid *durum/turgidum* wheat (*Triticum*



**Fig. 5** Composition of the ecological spectrum in section 7 (n = 4 130) and section 50/51 (n = 2 861).



**Fig. 6** Absolute cereal proportions. Left: uncharred, subfossil material (n = 315). Right: charred material (n = 75).

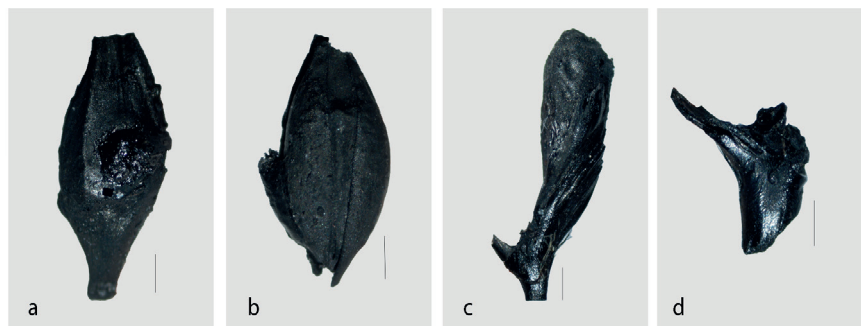
*durum/turgidum*), and hulled barley (*Hordeum vulgare*)<sup>3</sup> (fig. 6). However, on account of the poor state of preservation almost 50 % of the cereal remains could only be identified as genus (*Triticum*). Fragments of seed coats (*testae*) that were present in almost all samples from section 50/51 have been classified generally as Cerealia indet. (Cereals).

Taking into account the proportion of charred cereal remains, the find spectrum shifts towards

hulled barley (fig. 7a,b) which now dominates with 40 %, followed by naked *durum/turgidum* wheat (24 %) (fig. 7c,d), emmer wheat (15 %) and spelt (5 %). However, in order to make further representative propositions regarding the cereal spectrum more investigations are necessary.

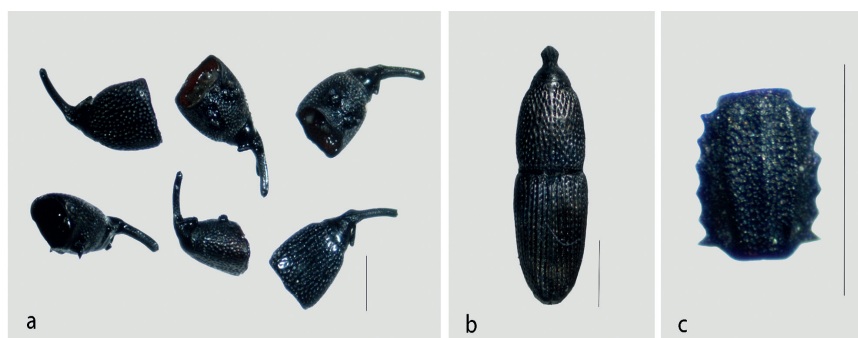
The identified pod fruits/legumes in Viv16 are broad beans (*Vicia faba*) (fig. 8d) and peas (*Pisum sativum*). Additionally, in the samples

**Fig. 7** Cereal remains: a,b caryopses *Hordeum vulgare*, c caryopses in internod *Triticum durum/turgidum*, d internod *Triticum durum/turgidum*. Scale 1 mm.





**Fig. 8** Fruits and seeds: **a** *Anthemis tinctoria*, **b** *Anethum graveolens*, **c** *Apium graveolens*, **d** *Vicia faba*, **e** *Juniperus*, **f** *Valeriana officinalis*, **g** *Vitis vinifera* ssp. *sylvestris*. Scale 1 mm.



**Fig. 9** Remains of storage pests: **a** wheat weevil, subfossil (*Sitophilus granarius*); **b** almost complete wheat weevil, charred; **c** pronotum (dorsal) of sawtoothed grain beetle (*Oryzaephilus surinamensis*). Scale 1 mm.

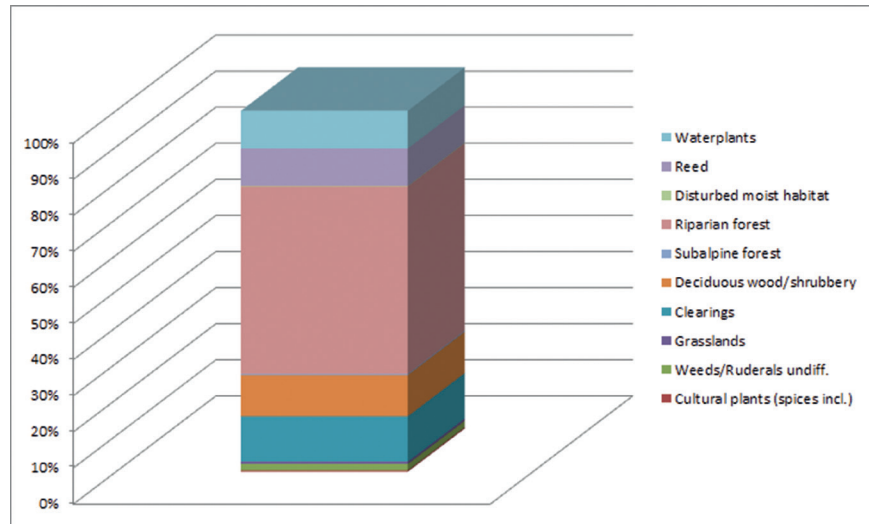
from sections 50/51, there are large numbers of pod fragments, in all likelihood, from lentils (cf. *Lens culinaris*). Generally, pod fruits are under-represented in wetland contexts because their seeds swell and rupture in water and in a highly fragmented state are no longer to be found.

On to the oil and fibre plants: the role of the opium poppy (*Papaver somniferum*) in Viverone remains open as only one uncertain poppy seed has been identified up to now. Confirmed species found in contemporary settlements, such as einkorn wheat (*Triticum monococcum*), broom-corn millet (*Panicum miliaceum*) and foxtail millet (*Setaria italica*) and, above all, flax (*Linum usitatissimum*), which is a cultivated plant that is generally found in all wetland settlements, have not been found in Viv16 to date. In Viv16, the spices dill (*Anethum graveolens*) (**fig. 8b**)

and celery (*Apium graveolens*) (**fig. 8c**) were identified.

The wild plants: there were also the remains of various weeds in the deposits with the cultural plants. Detailed assessment regarding the methods of planting and harvesting, the conditions of the fields, the cultivated crops and the weeds, should be part of further investigations in Viverone, particularly on the basis of a broader data pool. The same applies to the ruderals and grassland species, whereas the complex discussion on the development of grasslands is still ongoing and these species are more likely to be seen as part of a Bronze Age field-grass economy (e. g. SCHIBLER et al. 1997, 363; RÖSCH 2011).

Additionally, in section 50/51 the remains of various forest communities (mesophilic deciduous woodlands and riparian forest) as well



**Fig. 10** Composition of the ecological spectrum in section 7 without fir remains (n = 1 646).

plants growing at the shore (reed vegetation) and aquatic plant communities have been found (**fig. 14, Appendix**). Classical gathered plants were hazel (*Corylus avellana*), blackberry (*Rubus fruticosus*), raspberry (*Rubus idaeus*), wild strawberry (*Fragaria vesca*) and crab apple (*Malus sylvestris*).

Not forgetting to mention the 615 bracken leaf fragments (*Pteridium aquilinum*) in section 50/51. This fern is an indicator of increased human impact and expanding habitat intrusions. It grows in woodlands, and at the edges of pastures, where it is poisonous to grazing stock. Its competitive strength benefits considerably from any kind of forest clearing and in particular from the use of fire, which strongly promotes the growth of its rhizomes. Moreover its cuttings were used for bedding in stables (RUSSELS 1908; ELLENBERG 1996; BIRCH et al. 2000).

The constant and massive occurrence of the remains of wheat weevils (*Sitophilus granarius*) in all samples from section 50/51 was striking (**fig. 9a,b**). The remains were particularly numerous in samples 3 and 6 from Q511B. Based on the elytra a minimum number of individuals could be calculated for both samples: sample 6 = 60 weevils, sample 3 = 120 weevils. These are extremely high figures considering the relatively small volumes of both samples (sample 3 = 750 ml, sample 6 = 250 ml). Additionally, there were individual finds of sawtoothed grain beetles (*Oryzaephilus surinamensis*) (**fig. 9c**) in the samples. Both kinds of beetles are stock pests and in all probability must

have given the settlers at Viverone "Emissario" serious concerns about the secure storage of their harvested reserves.

#### Section 7

In section 7 most of the remains discovered represent various woodland locations and, of course, some disturbed areas in the direct vicinity of the settlement (**fig. 5** and **fig. 14, Appendix**). The silver fir (*Abies alba*) is the dominant type. If we exclude the remains of the silver fir in the depiction of the ecological spectrum, species of the riparian forest dominate (**fig. 10**). Present, and also well represented, in the samples are plants which grow directly at the shore – reed vegetation. Species of aquatic plant communi-



**Fig. 11** Cone cf. *Larix decidua*. Scale 1 cm.



Fig. 12 Fruitstones *Cornus mas*. Scale 1 cm.

ties are rarer in section 7 than in section 50/51. Cultural plants and synanthropic species are almost completely absent in the range of species from section 7.

The compact detritus layer in section 7 has hardly been affected by the lake, or at least less than the cultural layer from section 50/51 which seems to have been, more or less, completely mixed up.

If anything the cultural layer in section 7 has a completely different character to that of section 50/51. Section 7 consists of a 2–20 cm

thick coarse detritus layer. It contains mainly wood remains (splinters and chips, remains of twigs and bark) and leaf fragments, with buds being also quite common. Accordingly, there doesn't appear to be a link to human diets or the processing of cultural plants (only sparsely). The absence of dung fragments in the samples speaks against a direct link to animal excrement. It is possible that here we are concerned, at least partially, with the remains of animal fodder. The large amounts of fir needles would support this as fir brushwood is excellent animal fodder. Fir wood fragments as well as fir needles were identified in dung fragments from the Horgen settlement Arbon-Bleiche 3 (ZIBULSKI 2004, 321). For further evaluation of the cultural layer of section 7, however, wood analysis is necessary.

#### Individual Finds

During the excavation campaign some 50 botanical individual finds were recovered. The material consists of conifer cones (probably European larch cf. *Larix decidua*) (fig. 11), pits of the European cornelian cherry (*Cornus mas*) (fig. 12), which has also been a very popular gathering plant (HOSCH/JACOMET 2004, 155 f.), common hazelnut shells (*Corylus avellana*), acorn remains, common dogwood (*Cornus sanguinea*), cocklebur

square	sample	cow/goat/sheep	goat/sheep	rodents
506D	Fnr. 8			+ sf/vk
506C	Fnr. 1000			+ vk
75B	Fnr. 9			+
511B	Fnr. 10			+ sf
75A	Fnr. 19			+ sf
74B	Fnr. 3			+ sf
505A	Fnr. 17			+ sf
74A	Fnr. 1			+ sf
74D	Fnr. 7			+
511B	Fnr. 4	+ sf		+ sf
502C	Fnr. 11	+ sf		+ sf
75B	Fnr. 10	+ sf		+ sf
502B	Fnr. 2	+ sf		+ sf
511	Fnr. 3	+ sf		+ sf/vk
74C	Fnr. 8	+ sf		+ sf
511B	Fnr. 6	+ sf	+ sf	+ sf

Fig. 13 Excrement remains in the analyzed samples. + present, sf subfossil, vk charred.



(*Xanthium*), charred caryopsis of emmer, spelt and the remains of tree fungi.

#### Excrement/Dung

The remains of animal coprolites were found in several samples. The dung remains were very fragmented which is why, with one exception, they could only be categorized together as originating from cattle/sheep/goat (**fig. 13**). There were rodent droppings in almost all samples. Pollen analysis and parasitological evaluation of the cultural layer material and of the dung remains for future investigations.

#### Comparison to contemporary sites

The Middle Bronze Age material from the cultural layer at Viverone is unique in north western Italy. Even in the Lake Garda region, which is rich in finds, reliably dated bioarchaeological analysis of Middle Bronze Age cultural layers are extremely rare. Comparison of the botanical spectrum from Viverone with contemporary sites in northern Italy is difficult as comprehensive publications of contemporary lakeshore sites like Lavagnone, Lucane and Fiavé have yet to be published. However, the cultivated crops: emmer, spelt, hulled barley, *Triticum durum/turgidum*, broad beans, peas, (lentils) and opium poppy found at Viverone represent quite a number of the contemporary Middle Bronze Age species of northern Italy (MERCURI et al. 2006; STIKA/HEISS 2013a, 193; idem 2013b, 351 f.).

#### Notes

<sup>1</sup> Thanks to the former project manager: Prof Dr Francesco Menotti, the leader of the excavation: Dr Joachim Köninger as well to Jamie MacIntosh for the translation.

<sup>2</sup> Only three cereal remains come from section 7.

<sup>3</sup> Barley is underrepresented as threshed barley, in an uncharred state, does not preserve as well as threshed wheat species (SCHIBLER et al. 1997, 227).

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**Fig. 1–4** terramare/J. Köninger.

**Fig. 5–14** Ch. Herbig.

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