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NOTES

LAND USE FROM SEASONAL ARCHAEOLOGICAL SITES: THE ARCHAEOBOTANICAL EVIDENCE OF SMALL ROMAN FARMHOUSES IN CINIGIANO, SOUTH-EASTERN TUSCANY - CENTRAL ITALY

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Abstract – This paper focuses on the archaeobotanical study of two Roman small farmhouses, San Martino and Poggio dell'Amore, located near Cinigiano, in the province of Grosseto-Tuscany. The sites were probably occupied during seasonal agricultural works, a peculiar typology of site that has not been usually identified in Roman sites of central Italy. The integrated analyses of pollen, non pollen palynomorphs, charcoal particles and seeds/fruits help to obtain interesting details on the site function, land use and palaeoenvironment of these archaeological contexts. The archaeobotanical reconstruction shows that the landscape was fairly treeless. Pastures surrounded the small buildings while cereal fields were probably less extended or further away than legume fields cultivated to forage. Shrubs and some fruit trees might mark boundaries of fields, while the woods, including oak woods, were distributed far from the sites. Anthropogenic pollen indicators, spores of coprophilous fungi and parasite eggs point to the presence of excrements in the sites suggesting that the small buildings were used as small barns for domestic animals, or a temporary shed.

Keywords: Palynology, NPPs, Archaeological sites, Roman peasants, Tuscany

Introduction

Archaeobotanical research helps to understand the cultural transformations of lands affected by human presence going back to pre-historical and historical periods (Faegri & Iversen, 1989; Behre & Jacomet, 1991). Plant exploitation and land use are especially evident from visible and invisible plant remains brought to light from archaeological sites (Pearsall, 2000; Mariotti Lippi et al., 2009; Sadori et al., 2010; Mercuri et al., 2013). Seeds and fruits, woods/charcoals and pollen are the most important palaeoethnobiological-economical bio-indicators while the non-pollen palynomorphs (NPPs), including fungi and algae, and charcoal particles may greatly improve the fire and palaeoenvironmental reconstructions (van Geel, 1986; Carrión, 2002; van Geel et al., 2003; Riera et al., 2006; Bal et al., 2010; Miras et al., 2010; Buonincontri & Di Pasquale, 2013).

This paper focuses on how the integrated analyses of botanical records - pollen, NPPs, charcoal particles and seeds and fruits - may help to obtain new information on the site function, land use and palaeoenvironment of archaeological contexts. The case study deals with two small archaeological sites, San Martino and Poggio dell'Amore, that did not show impressive structures during the excavations. They were probably only occupied during seasonal agricultural works, a peculiar typology of site that has not been identified in Roman sites of central Italy until now (Ghisleni et al., 2011). Their study was part of a systematic multidisciplinary project on Roman rural non-elites in south-eastern Tuscany between the 2nd century BC and the 6th century AD (Bowes et al., 2011; Ghisleni et al., 2011). The investigation aims at

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producing a consistent knowledge of the Roman peasantry and their socio-economic conditions, for example by collecting data on the exploitation of local resources and on agriculture practices. The project excavates small sites, where materials are spatially and functionally different from Roman villas, and likewise analyses the surrounding landscape to understand the relationship between these small farmers and their environment.

Materials and methods

The sites

San Martino and Poggio dell'Amore are located in the commune of Cinigiano (Grosseto; Fig. 1). Cinigiano (Lat. 42° 53' 00" N; Long. 11° 24' E; 324 m a.s.l.) lies on the valley of the Ombrone river. The two archaeological sites are close, at about a 700 m from each other. As they were discovered inside modern fields, they were found to be somewhat plough-damaged, with some contexts heavily abraded. Nevertheless, a large part of the sites was intact. San Martino dated from the late 2^{nd} century BC to the late 1^{st} century BC, while Poggio dell'Amore was confined to the first half of the 1^{st} century AD. The general absence of faunal remains and the few archaeological materials

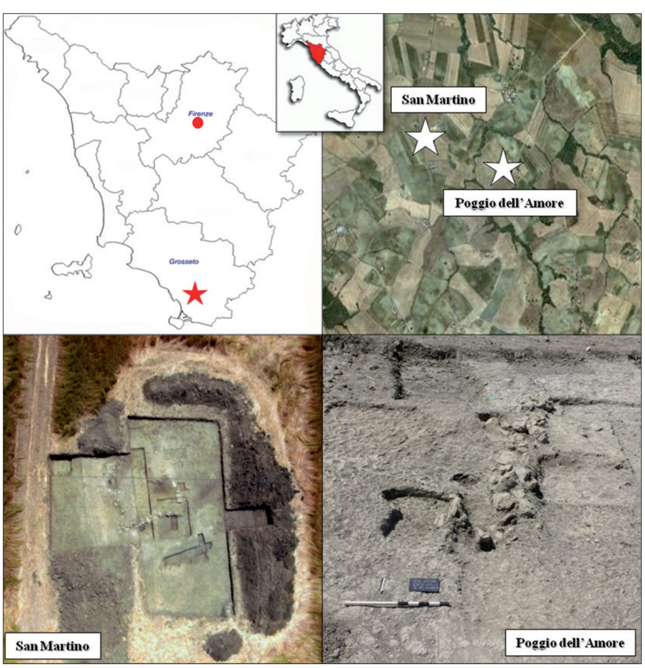


Fig. 1. Map of Tuscany, in central Italy, and location of San Martino and Poggio dell'Amore in the province of Grosseto (stars). At the bottom, the excavations of the two sites.

suggested that these sites were used as seasonally occupied work buildings.

San Martino lies upon a gentle slope of a valley that currently serves as prime agricultural land. The site is near the Fosso Vallanzo, a minor branch of the Orcia river which is a tributary of the Ombrone river, and faces the prevailing northern winds. The excavation revealed a building c. 7x6 m, with stone socle, pisé walls, beaten earth floor and and a single-pitch thatched roof.

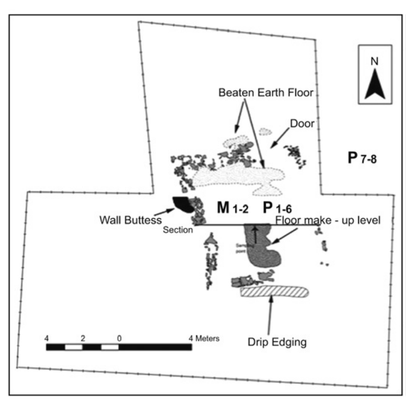
Poggio dell'Amore is located immediately below a hillside with a slope degrading to the west, at about 20 m far from a large spring ('fontone'). A north-south oriented wall, 60 cm large x 4.6 m length, many broken tiles and other evidences suggested that the original building was small (2.8 x 4.6 m). Unlike San Martino, this site yeilded glass fragments, roof tiles and a somewhat richer, if still very sparse material culture.

Archaeobotanical sampling

Twenty samples were collected from layers excavated in 2010 and 2011.

In San Martino (Sm), eight pollen samples were taken from inside the building, from Sm-P1 to Sm-P6, and two from out of the building (Fig. 2), Sm-P7 and Sm-P8. Two soil sediments (Sm-M1, Sm-M2; total 11 litres) for macroremain analyses were collected inside the building.

In Poggio dell'Amore (Pa), five pollen samples were taken from inside the building, from Pa-P1 to Pa-P4, and one from outside the building, Pa-P5 (Fig. 3). Five soil sediments (from Sm-M1 to Sm-M5; total 85 litres) for macroremain analyses were collected inside the building.

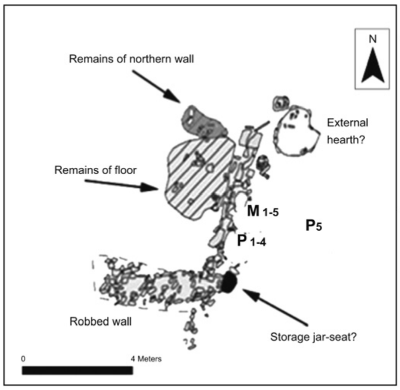


	Sample	Layer and Context	
Pollen	Sm - P1	L4033	Inside the building
	Sm - P2		
	Sm - P3		
	Sm - P4		
	Sm - P5	L4006	
	Sm - P6		
	Sm - P7	-	Out of the building
	Sm - P8	-	
Macro-remains	Sm - M1	L4005	Inside the building
	Sm - M2	L4033	

Fig. 2. Sampling and description of the samples of San Martino.

Extraction and analyses of microremains

Pollen samples, about 4-9 g each, were treated with the method described by Florenzano et al. (2012a), which



	Sample	Layer and Context	
Pollen	Pa - P1	L6004	Inside the building
	Pa - P2		
	Pa - P3	L6011	
	Pa - P4		
	Pa - P5	-	Out of the building
Macroremains	Pa - M1	L6002	Inside the building
	Pa - M2	L6004	
	Pa - M3	L6005	
	Pa - M4	L6011	
	Pa - M5	L6012	

Fig. 3. Sampling and description of the samples of Poggio dell'Amore.

includes heavy liquid separation (Na-metatungstate hydrate). Permanent slides were mounted on glycerol jelly. *Lycopodium* spores were added to calculate concentrations expressed as pollen or NPPs or charcoal particles per gram (p/g, npps/g, ch/g). A mean of about 500 pollen grains per sample were counted. Pollen identification was made at light microscope 1000x magnification, with the help of speciality literature and the reference pollen collection. Non Pollen Palynomorphs (NPPs) were counted in the same slides, and identified according to van Geel (1986). Charcoal particles > 125 µm, that are indicative of local fires, were also counted while the particles < 90 µm in size are not measured because they can be fragments of greater charchoals (Carcaillet, 2007).

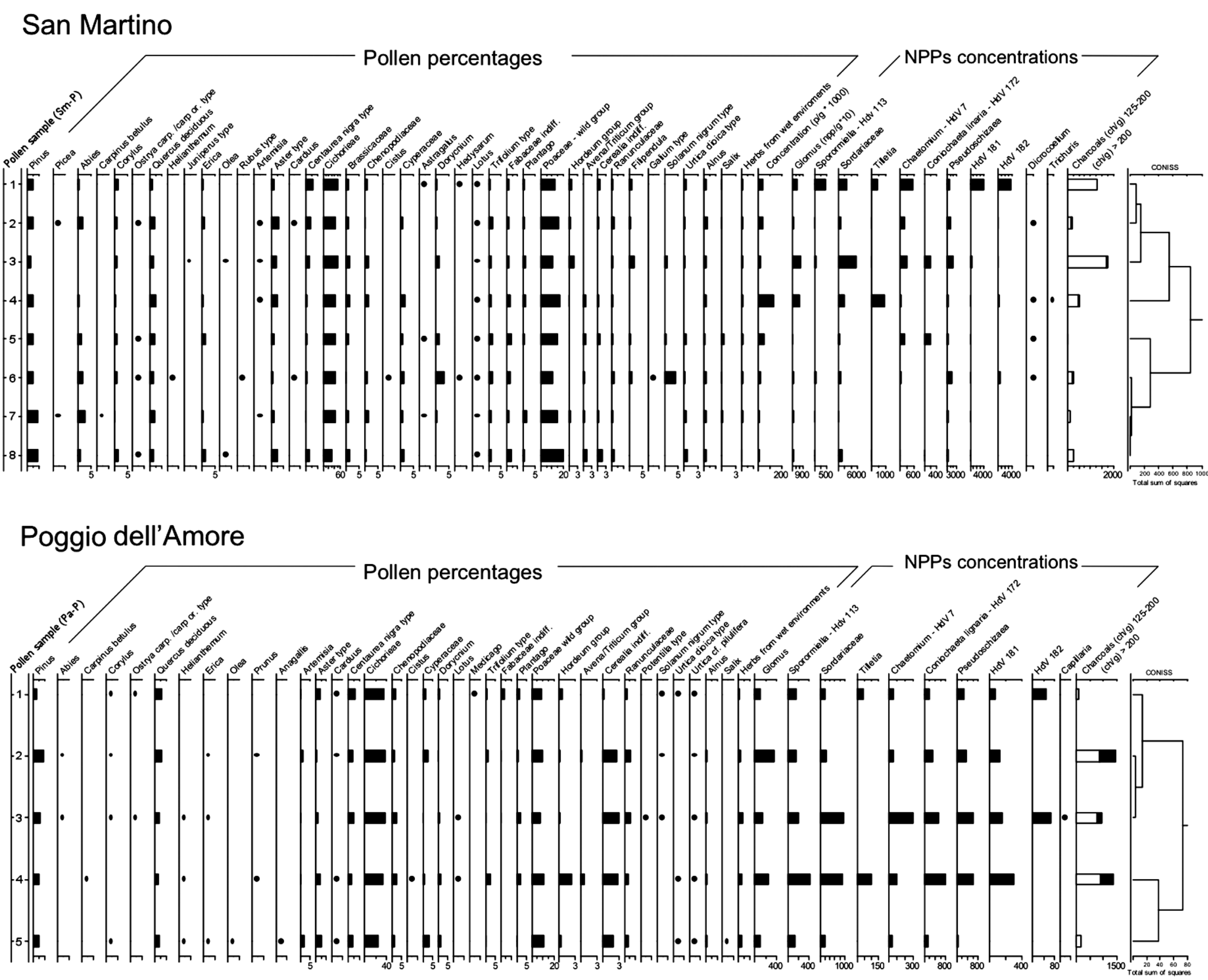


Fig. 4. Diagrams of percentage pollen, NPPs concentrations and charcoal particles of the two sites (selected taxa).
Pollen sum includes all pollen grains counted.

Seeds and fruits

Macroremain samples were floated and water-sieved through a three sieve bank of 10, 0.5 and 0.2 mm. Sediments were put into water for about 20 days, and then sieved with abundant water, aided by manual kneading to dissolve the ‘pasty’ clay. The residues were sorted under a stereomicroscope. The identification of seeds and fruits was made at 6x to 80x magnification with the help of speciality literature and the reference pollen collection of seeds and fruits.

Results

The main results are reported in Fig.4. Below, the mean data of the all samples of each site are reported.

San Martino

A total of 4345 pollen grains, 7285 NPPs, 1188 charcoal particles, and 51 seeds/fruits were counted.

Sm pollen concentrations range from 128 x 10^3 p/g in P4 (L4033), to 14 x 10^3 p/g in P3 (L4033) and P6 (L4006), and to 7 x 10^3 p/g in P7 and P8. In these latter samples, collected out of the building, pollen was less preserved than in those taken into the building, suggesting that the internal layers were richer of organic matter than the external ones. Accordingly, very well preserved, not pressed nor folded, pollen grains of *Dorycnium*, *Filipendula*, *Hedysarum*, *Knautia*, *Linaria* type, *Solanum nigrum* type, *Juniperus* type and *Cistus* were found in P1-P6. Their recovery together with folded pollen grains in the same samples is evidence that pollen grains from diverse origins were incorporated into the sediments. As they give a coherent vegetational frame with the other taxa in the spectra, they were interpreted as evidence of plants not subjected to trampling.

Some pollen clusters (10-15 pollen grains) of Poaceae and Cichorieae were observed.

In the spectra, pollen taxa are 84, from 37 (P4) to 51 (P6) per sample. Woody plants are somewhat more represented outside (20%) than inside (15%) the building. These low values confirm that the landscape was definitively open around the site.

The most represented trees are *Pinus* (6%), deciduous *Quercus* (4%), and *Alnus* (2%). Interestingly, *Pinus* is twice outside (9%) than inside (4.5%) the building as this over-represented airborne pollen is more easily found floating out of buildings than inside a house. *Helianthemum* (0.01%) and *Erica* (0.8%) are very low. The only tree of economic interest is *Olea* (found in P3 and P8, with 0.2% each). The spectra included herb taxa of economic importance such as cereals (1.4%) and Cichorieae. This latter (35%) and *Aster* type (3.5%) are prevalent and indicative of dry pastures. Poaceae-wild group (15%) includes wild grasses growing in grasslands. They may be cultivated for fodder together with Fabaceae (6%, mainly *Dorycnium*, with *Astragalus*, *Trifolium* type, *T.* cf. *pratense*, *Lotus, Hedysarum*).

Among NPPs, fungi (22 types) and algae (6 types) are fairly common. Fungi are about 6500 npp/g on average in P1-P6, and six times lower in P7 and P8, out of the building (ca.1200 npp/g). The coprophilous Sordariaceae, including *Sporormiella*, are prevalent in all samples, followed by *Glomus* that is indicative of soil erosion. Of interest are *Tilletia*, a pathogenic fungus, and *Chaetomium* as fire index (Vànky, 1994). Also algae are decidedly higher in P1-P6 (2900 npp/g on average) than in P7-P8 (380 npp/g). HdV181 and HdV182, living at the surface of water bodies, and *Pseudoschizaea*, an anthropogenic indicator of soil erosion living in moist environments (Grenfell, 1995), are ubiquitous. Parasite eggs of *Trichuris* (in P4) and *Dicrocoelium* (in P2, P4, P5, P6) were found. Charcoal particles > 125 µm are in all samples, with concentration in P1-P6 (640 ch/g) three times higher than in P7 and P8 (190 ch/g). A few charcoals of very large size (> 300 µm) were observed in P6 (fireplaces?).

All seeds and fruits were mineralized and badly preserved. The concentration of remains was very low (5 sf/l). One fruit plant (*Ficus carica*) and two vegetables were found (*Atriplex hortensis*, *Portulaca oleracea*). Ruderals and weeds are prevalent (*Ajuga chamaepitys*, *A.* sp., *Atriplex* sp., *Chenopodium* sp., *Euphorbia cyparissias*, *Galium* sp., *Helminthotheca echioides*, *Papaver somniferum*, *Sambucus* sp., *Verbena officinalis*).

The herbs probably cultivated for fodder include *Hedysarum coronarium*, *Medicago* sp., *Melilotus officinalis* type, *Trifolium* cf. *repens*. Moreover, Poaceae, *Ranunculus* sp. and Brassicaceae were found. Cereals are absent. Therefore, there is no evidence of plant accumulation or processing inside the structure.

Poggio dell’Amore

A total of 2329 pollen grains, 427 NPPs, 170 charcoal particles, and 446 seeds/fruits were counted.

Pa pollen concentrations range from 27 x 10^3 p/g in P4 (L6011), to 12 x 10^3 p/g in P1 (L6004) and P5, and to 6 x 10^3

p/g in P2 and P3 (L6004, L6011). Though pollen was present in a poor state of preservation, sometimes with thinned or rearranged exines, good pollen spectra were obtained. Some small pollen clusters (5-6 pollen grains) of *Quercus* and Cichorieae were observed.

The total number of taxa is 63, from 35 (P1) to 44 (P5) per sample. As at San Martino, woody plant percentage was very low (13% on average), and shows that trees and shrubs were not so numerous in the area to be evident in the local pollen rain.

The most represented trees are *Pinus* (6%) and deciduous *Quercus* (4%). The trees of economic interest or with edible fruits are *Olea*, found only in P5 (i.e. out of the building, with 0.3%), and *Corylus* that was common though in low quantities (0.4%). The traces of *Prunus* (in P2 and P4, 0.1%) may belong to fruit plants. The spectra are characterised by Cichorieae (34%) that point to dry pastures together with *Centaurea nigra* type and Ranunculaceae (4% each), and *Aster* type (3%) Poaceae-wild group (10%) and Cyperaceae (2%) are indicative of relatively more wet pastures/grasslands or habitats. Fabaceae (e.g., *Medicago*, *Trifolium*) and cereals (*Hordeum* group, and *Avena/Triticum* group) are about 3% each. They are, therefore, significant evidence of legume-fodder and cereal fields.

As for NPPs, fungi (17 types) and algae (6 types) are significant but less than in San Martino. Fungi are about 1685 nnp/g on average. They include Ascospores, and especially Sordariaceae with *Sporormiella*. The latter genus has species of obligate coprophilous fungi occurring on domestic or wild herbivores dung. *Coniochaeta linaria* is a decomposer mushroom. The recovery of *Chaetonium*, a fire index found also in Sm, is in agreement with the charcoal particles.

The concentration of algae is low (599 npp/g on average). HdV181and *Pseudoschizaea* are ubiquitous as in the other site while other types are scattered. One egg of the parasite *Capillaria* was found. Charcoal particles > 125 µm, and also the very large > 400 µm, were found in all samples (1710 ch/g on average) sustaining evidence of fire presence at the site.

Seeds and fruits were mainly mineralised, and partly charred, and bad preserved. As in San Martino, the total number of remains was low (5 sf/l), cereals were absent, and ruderal and weeds prevailed. Therefore, even in this site there is no evidence of plant accumulation or processing in place. It is noteworthy that three fragments of pips were found in two layers (L6002, L6005). The macroremain record includes *Anagallis arvensis, Helminthotheca echioides*, *Geranium dissectum*, *Malva* sp., *Polygonum aviculare* group, *Thymelaea passerina*, *Verbena officinalis*; and also *Melilotus* sp., *Petrorhagia prolifera*, *Trifolium dubium/campestre*, *T. repens*, *T.* cf. *striatum*, *T.* cf. *subterraneum*, *T.* sp. Moreover, Poaceae and Brassicaceae were found.

Discussion

The woods and wet habitats

The archaeobotanical analyses show that these small sites were settled in an open landscape.

Woodlands (Sm=15%, Pa=13%, on average) consist of mixed conifer - broadleaf woods, oakwoods (deciduous *Quercus*, *Carpinus betulus*, *Corylus* and *Ostrya carpinifolia/Carpinus orientalis*), Mediterranean evergreen woods, hygrophilous woods. The traces of *Abies, Picea* and *Fagus* represent trees living at higher belts. Plants producing fruits may have grown wild in the oakwoods (*Corylus*, *Prunus*, *Rubus* type), while *Olea* may have been the wild or cultivated olive. Besides *Olea*, the shrubby Mediterranean vegetation, only represented by traces of *Erica* and *Helianthemum*, was probably distributed in the better sun-exposed slopes.

Contrarily, the hygrophilous woods (Sm=2%, Pa=0.6%), with alder (*Alnus*) and some willows (*Salix*) living along streams, grew nearer than other woods, and were more plentiful at San Martino. In wet habitats, there were helophytes growing at the edges of ponds and along the riverbanks of slow-flooding river, or edges of channels used to irrigate the fields (Cyperaceae, *Typha*/*Sparganium*, *Typha latifolia* type, *Phragmites australis* cf.; Sm=1%, Pa=2%). Only *Schoenoplectus tabernaemontani* (1 records in Sm, L4005) and *Leersia oryzoides* (16 records in Pa, L6002, and L6011) were found in the macroremain record. The latter species was therefore present in the region at that time, as already found in Roman contexts of Emilia Romagna, an adjacent region of northern Italy (Rinaldi, 2010). Accordingly, both sites exist today next to modern bodies of water.

The water-floating plants needing permanent water (*Lemna, Potamogeton, Nuphar, Nymphaea* cf. *alba, Sagittaria, Myriophyllum*; Sm=0.3%, Pa=1%) and the algae of different types are further evidence of the presence of fresh-water habitats as small ponds or (seasonal) rivers. These wet environments are more evident in the Pa-samples, mirroring a relatively highest local availability of water. This evidence is true in the Roman times, and it is fairly similar to the present condition. Today, the spring-pool near Poggio dell'Amore represents a standing water compared with the river, i.e. the running water that is present near San Martino . However, it must be noted that the algae and pollen were probably also incorporated in sediments by the transport of water (or urine) and not solely by the local presence of water bodies.

The cereal fields

Pollen of cereals are low but significant in the spectra, and support the hypothesis that cereal fields were grown in the area. Probably, they were further from San Martino (1.4%) than from Poggio dell'Amore (3%). Wheat fields, with *Avena-Triticum* group, prevail in Sm, while *Hordeum* group, which can however include wild grasses besides the cultivated barley, prevails in Pa. The local presence of fields is also supported by *Tilletia*, which includes some pathogens of cereals (*T. tritici* and *T. secalis*). Interestingly, the cereal pollen percentage is a bit higher outside (1.9%) that inside (1.3%) the building of San Martino, suggesting that crops were not accumulated into the building. In the two sites, pollen percentages are too low to infer that these small houses were used for storage (see, for example, the 20-40% of cereal pollen found in houses of the Terramara di Montale; Mercuri et al., 2006), which had been an early hypothesis of the excavators. Accordingly, cereal caryopses were not found: although it cannot be excluded that the macroremains were not preserved, if a great quantity of plant accumulation was done this is expected to leave some traces. Therefore, the use of these small buildings as storage rooms for cereals (Booth & Richards, 1978; Rempel, 1997) may be excluded.

Pastures and areas cultivated to animal fodder

Animal breeding, pastoral activities or practices of animal foraging are evident from the Local Pastoral Pollen Indicators (Mazier 2007), which are helpful to investigate the response of plants to browsing (LPPI in Sm = 43%, or 8% without Cichorieae; in Pa = 47%, or 13%). They include Asteroideae (*Artemisia, Aster* type, *Carduus*, *Centaurea nigra* type), *Ranunculus* type, Ranunculaceae indiff., *Galium* type and *Potentilla* type. Cichorieae are prevalent, and may be overrepresented because their very resistant exine is easily recognisable even in poor pollen preservation conditions causing selective corrosion and low concentrations (Bottema, 1975). However, Cichorieae pollen is a good index that a great part of the land was devoted to pastures because probably grasses were browsed before blooming and resulted under-represented in spectra (Behre, 1986; Groenman-Waateringe, 1993; Hjelle, 1999). Data from other archaeological sites of this (Vaccaro et al., accepted) and other Italian regions (Mercuri et al., 2010, 2012; Florenzano et al., 2012b, 2013) support this interpretation.

Legumes such as *Trifolium* type, *Medicago* and *Dorycnium*, *Lotus*, Fabaceae indiff., and also partly Poaceae-wild group, include species that may be cultivated for fodder. Other herbs are common in pastures or in abandoned fields (Apiaceae indiff., *Brassica* type and Brassicaceae indiff., Caryophyllaceae and *Chenopodium*).

Also the coprophilous fungi such as *Sporormiella* that were found in the two sites are strongly indicative of dung and therefore of pastures. They grow on excrements of both domestic and wild herbivores where also some parasite eggs may be found (*Capillaria*, *Dicrocoelium*, *Trichuris*).

Conclusive remarks

The archaeobotanical data from San Martino and Poggio dell'Amore provided consistent information on local palaeoenvironmental conditions in these low hills of Tuscany at Roman times.

The treeless landscape was covered with pastures and crop fields next to the sites. Cereal and forage (legume-grasses) field boundaries, distant from the sites, were probably marked with shrubs and some fruit trees. Oak woods and other woods were distributed on the hills and far from the sites. Rivers and water bodies surrounded by hygrophilous woods were available in the area.

Although 'off-site' (lake) long sequences reporting pollen data for the Roman period in this area are rare, some evidence from the 'Ombrone Borehole', drilled at the plain level (2 m asl) of the Ombrone valley may give some regional data on the plant landscape (Biserni & van Geel, 2005, p. 21). In this diagram, although the resolution of the Roman phase is low, at the bottom of lpaz-3, pollen of *Quercus* shows a decreasing trend that began in pre-Roman, probably Etruscan times. The Etruscan impact on vegetation was demonstrated also at sites from the Gulf of Follonica area (southern Tuscany) where human modifications of vegetation cover were attested from about 1200 BC to 700 BC. The agriculture, wood cutting for fuel for the iron reduction, and the prevalent use of deciduous *Quercus* to build houses showed that Etruscan activities heavily altered the natural state of the pre-existing woodlands in this region (e.g., at Pian d'Alma; Mariotti Lippi et al., 2000, 2003; Sadori et al., 2010). Cutting activities during the Etruscan period were also evident from pollen analyses at Lago dell'Accesa, after ca. 2800 cal BP (Drescher-Schneider et al. 2007).

In the study area of Cinigiano, however, no Etruscan sites were found (Ghisleni, 2010). Therefore the data of an open Roman landscape are similar but may have had a different origin. Possibly, the area of San Martino and Poggio dell'Amore, due to its peculiar lithostratigraphical context (Vaccaro et al., accepted), never supported heavy forests and it was not deforested.

In the 'Ombrone Borehole' sequence, besides oaks, the only other significant woody plants are *Alnus*, *Corylus* and

Ericales, while Poaceae including cereals, and *Artemisia* show significant peaks in the Roman phase. Cichorieae and Chenopodiaceae start to increase, while local water environments reduced and became brackish. *Olea* is absent from this diagram, while traces of *Vitis* are found just before the Roman phase. The spread of these important economic trees in pre-Roman times are however well attested at Lago dell'Accesa (Drescher-Schneider et al., 2007), and Lago di Mezzano (Sadori et al., 2004).

In San Martino and Poggio dell'Amore, there is no evidence of local cultivations of woody plants. The traces of *Olea* pollen only inform that some isolated olive tree lived far, in the area, while those of *Vitis* pips are informative of the presence of some grape fruits in one of the sites. Though wheat and barley were grown in the area, giving possibility to host pathogen fungi, these cereals or other crops were not stored or processed in site.

The diversity of pasture-grazing pollen indicators, the high values of Cichorieae pollen, the presence of coprophilous fungi and parasite eggs are evidences that pastures constituted an important part of the lands in the vicinity of the site.

In accordance with archaeological evidence, a fairly similar function of these small sites may be hypothesised. In San Martino, the good pollen preservation and high concentrations suggest that some transport of plants to the house occurred. The presence of fodder species suggests that this was an accumulation of forage, maybe in the manger of a stable, not subjected to trampling. Accordingly, many evidences point to the presence of excrements in the sites suggesting that the small buildings were used as small barns for domestic animals, or a temporary shed. Taken together with the animal bone record from the site of Pievina, located in the same area (Ghisleni et al., 2011), it would look that pasture animals, i.e. sheep and goats, dominated this peasant environment of Roman Tuscany.

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