

The “Vasca Inferiore di Noceto”: palynological data for the reconstruction of the Po Plain landscape in the Bronze Age

Eleonora Clò
*Laboratorio di Palinologia e
Paleobotanica*
*Dip. di Scienze della Vita,
Università di Modena e
Reggio Emilia*
Modena, Italy
178051@studenti.unimore.it

Marta Mazzanti
*Laboratorio di Palinologia e
Paleobotanica*
*Dip. di Scienze della Vita,
Università di Modena e
Reggio Emilia*
Modena, Italy
marta.mazzanti@unimore.it

Paola Torri
*Laboratorio di Palinologia e
Paleobotanica*
*Dip. di Scienze della Vita,
Università di Modena e
Reggio Emilia*
Modena, Italy
paola.torri@unimore.it

Rossella Rinaldi
*Laboratorio di Palinologia e
Paleobotanica*
*Dip. di Scienze della Vita,
Università di Modena e
Reggio Emilia*
Modena, Italy
rossella.rinaldi@unimore.it

Maria Chiara Montecchi
*Laboratorio di Palinologia e
Paleobotanica*
*Dip. di Scienze della Vita,
Università di Modena e
Reggio Emilia*
Modena, Italy
mariachiara.montecchi@
unimore.it

Anna Maria Mercuri
*Laboratorio di Palinologia e
Paleobotanica*
*Dip. di Scienze della Vita,
Università di Modena e
Reggio Emilia*
Modena, Italy
annamaria.mercuri@
unimore.it

Mauro Cremaschi
*Dip. di Scienze della Terra
“A. Desio”*
Università Statale di Milano
Milano, Italy
mauro.cremaschi@unimi.it

Abstract—The aim of this work is to describe the paleoenvironment and cultural landscape near the archaeological site of “Vasca Inferiore di Noceto” (an artificial basin) in about one century during the Bronze Age (1420-1320 BC). The study of the ecological-floristic characters revealed by pollen analysis (pollen, spore of Monilophytes s.l. and Briophytes s.l. and non-pollen palynomorphs–NPPs) allowed to distinguish the past biodiversity and ecological successions that are typical of natural or human-induced wet environments. This research provides new biological information to an archaeological context, discovered in 2004, through a detailed analysis of plant cover near the site. The low forest cover and signs of human activity (with evidence from *Corylus*, cereals and synanthropic plants) are at the base of pollen spectra. Data permit to investigate the complex relationships between this basin and human activity, and the human impact on landscape.

Keywords—pollen, NPPs, landscape reconstruction, archaeobotany, Po Plain, Bronze Age

I. INTRODUCTION

Palynological analysis of the site “Vasca Inferiore” is included in the framework of the national-funded interdisciplinary project SUCCESSO-TERRA (PRIN-20158KBLNB). It is a geoarchaeological and archaeobotanical investigation (pollen and macroremains), with the aim to reconstruct the land transformations and the relationship between humans, climate and the environment that occurred at the onset, duration, and end of the Terramare culture in the southern-central Po Plain (Emilia Romagna region, Italy). The Terramare are a unique cultural phenomenon: banked and moated villages that were located in the alluvial plain of the Po River, dated to Middle/Recent Bronze ages (1550-1170 years BC): a complex society based on intensive agriculture (cereals / legumes), pastoralism and trade [1] – [3].

In the spring of 2004, an artificial basin of the Middle Bronze Age was found in Noceto, in the province of Parma

(Fig. 1). The structure of this basin represents a unique finding built entirely with oak wood of standardized dimensions assembled with very few adaptations, and perfectly preserved until its discovery. The intervention by the Soprintendenza per i Beni Archeologici dell’Emilia Romagna was immediate because this site immediately presented an unusual and extraordinary character [4]. The excavation campaigns that followed, thanks to the cooperation between the Università di Milano and Comune di Noceto, brought to light well-preserved bio-archaeological materials. The extraordinary state of preservation of the findings is due to the anoxic conditions of deposit of saturated clay, where they remained always submerged until their recovery [5]. Another structure emerged during excavations in 2015: this one, collapsed before the built of the first discovered “Vasca Superiore” (top basin), is called “Vasca Inferiore” (bottom basin) for its position. According to the geoarchaeological hypothesis, the two structures were utilized for votive practices for about one hundred years (1420 - 1320 BC, according to the first results obtained from lamination of sediments, archaeological evidences and radiocarbon and dendrochronological analysis) [6].

The palynological study of the laminated deposits from the “Vasca Inferiore” allows to obtain useful information on the paleoenvironment and cultural landscape near the site and possibly shed light on the ‘offerings’ and rituals around the basin [7].

II. MATERIALS AND METHODS

In 2015, 22 pollen samples were collected from two vertical trenches, in close series, excavated in the northeast corner of the “Vasca Inferiore”. The pollen extraction method aims at the elimination of most organic and mineral parts of the sediment, and includes sieving and heavy liquid floatation to concentrate pollen and non-pollen palynomorphs.



The state of preservation of pollen grains was observed, and some photos were taken to the better preserved pollen grains.

Plant cover (AP/NAP) and anthropogenic indicators (API, strongly correlated to archaeological sites) were assessed. In addition, the presence of entomophilous pollen types, which have a limited diffusion, was observed. The local recovery of showy and pleasant flowers could support the geoarchaeological hypothesis about the use of this structure for votive practices.

All 22 samples were analysed for pollen and NPPs; the 6 samples resulted sterile are not discussed in the results section (Fig. 2).

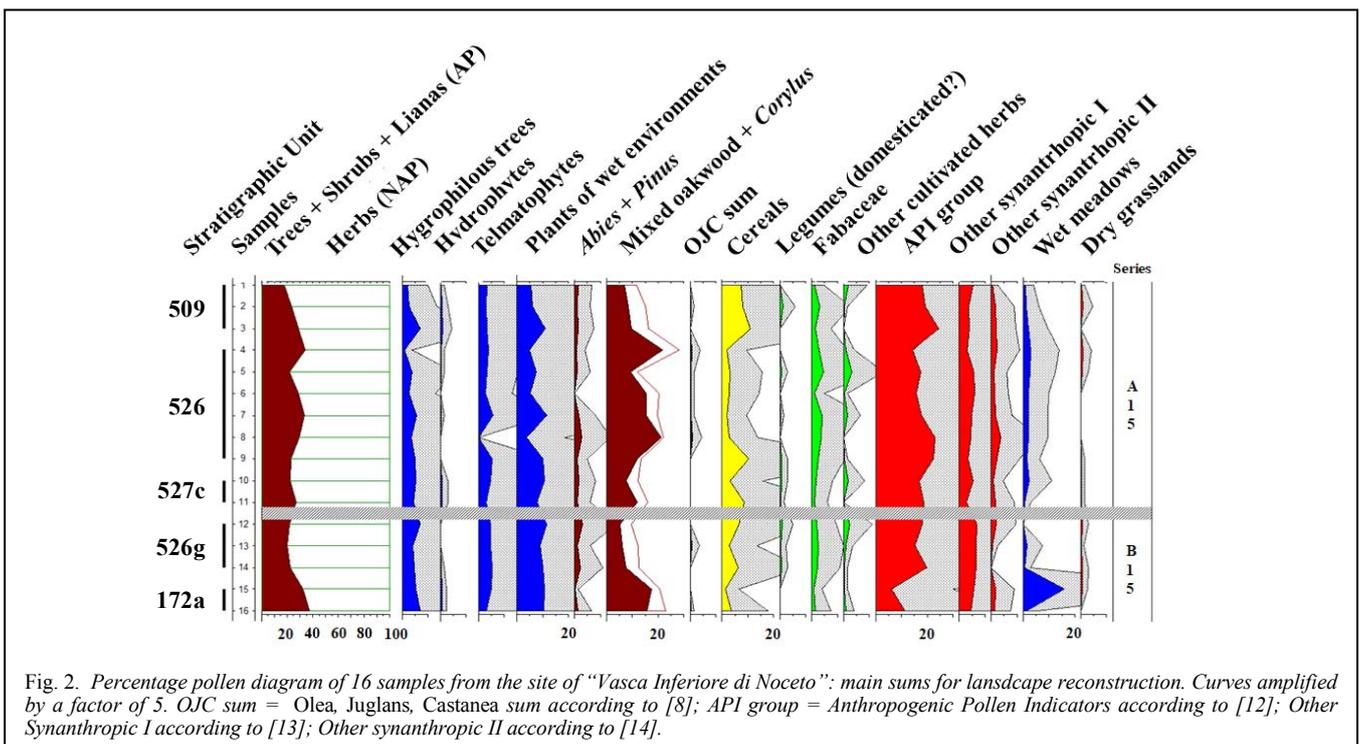
III. RESULTS AND DISCUSSION

The pollen concentration is quite high (22900 pollen/gram on average) and pollen is usually well preserved: these feature allowed identification of a floristic list composed of 204 taxa.

A low forest cover (26.5% on average), probably with scattered shrubs and a mixed oakwood (deciduous *Quercus*, *Carpinus betulus*, *Ostrya/Carpinus orientalis*, *Tilia*, *Fraxinus excelsior* type, *Acer campestre* type, *Ulmus*) on background, characterized the environment around the basin. Trees indicating human-induced environments (OJC sum [8]) were also recovered. The recovery of *Corylus* pollen in all samples suggests that these shrubs were grown near the basin (perhaps subsequently implemented in number around the "Vasca Superiore" [9]). Moreover, it is possible that also *Vitis*, almost ubiquitous, was grown/cared for not far from the basin.

The wet environment (8.5% on average) suggested by the archaeological evidence (an artificial basin) is confirmed by the palynological data, although pollen spectra always show low values of hydro-hygrophilous plants. The palynological image of wet environments was overall significant, considering both the anthropic nature of the site (characterized by a continuous and accurate cleaning of the margins and the inside of the basin) and the biology of some plants (like hydrophytes, which are known to be low pollen producers).

Wet environments are testified by hygrophilous trees (e.g., *Salix*), hygro-hydrophilous herbs and algae *sensu lato* (non-pollen palynomorphs). There was a great dominance of the limno-telmatophytes (like Cyperaceae undiff. and



Phragmites) on the hydrophytes (like *Hydrocharis morsus-ranae*, *Nuphar* and *Potamogeton*). The presence of *Lemna* (highly resistant to eutrophic conditions [10]) and, in particular, of *Rivularia* type cyanobacteria [11] suggests an eutrophic state of water caused by the degradation of organic matter.

Wet meadows (e.g., *Lotus* type, *Trifolium repens*, *Filipendula ulmaria* and *Solanum dulcamara*) dominated in the site surroundings, but also habitats characterized by aridity (e.g., *Cirsium* and *Hypericum*) are documented by the spectra.

The Anthropogenic Pollen Indicators-API group [12] together with other synanthropic plants ([3], [13], [14], and see [15] for Cichorieae) attests a continuative human pressure (Fig. 2). In the Noceto's spectra, API plants (17.4% on average) were dominated by nitrophilous species, ruderals and several weeds of cereal crops. Together with spores of coprophilous fungi and, in some samples, eggs of intestinal parasites (e.g., *Trichuris*), they are indicator of presence of both humans and animals in the site (Fig. 3).

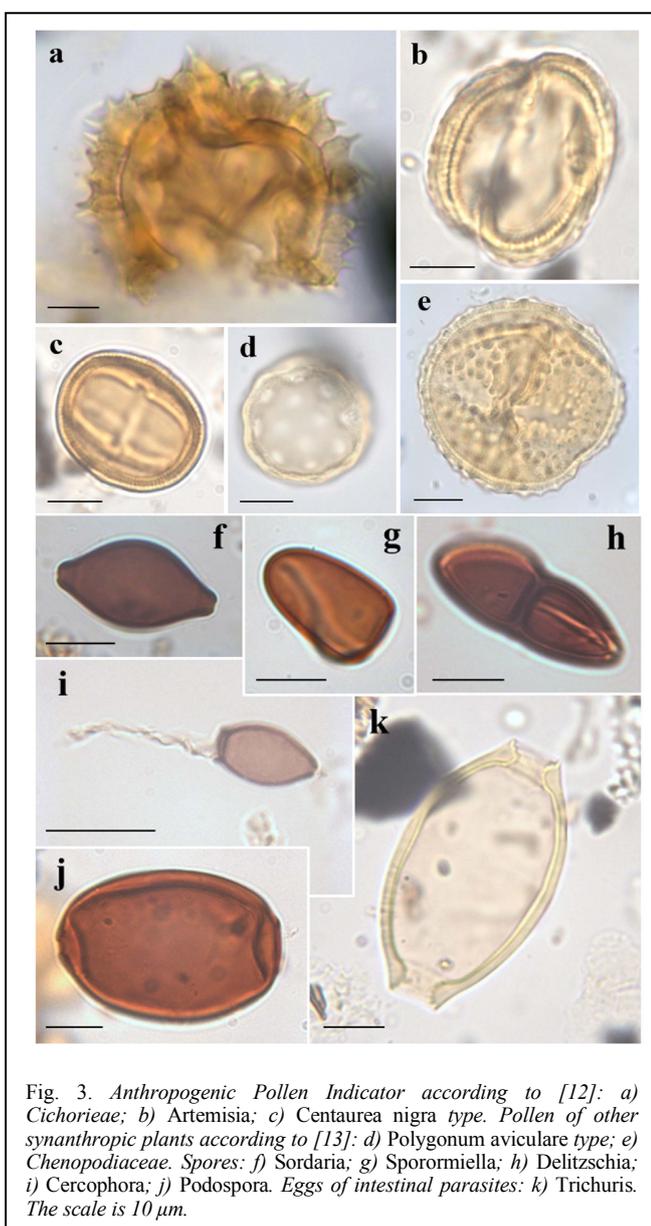


Fig. 3. Anthropogenic Pollen Indicator according to [12]: a) Cichorieae; b) Artemisia; c) Centaurea nigra type. Pollen of other synanthropic plants according to [13]: d) Polygonum aviculare type; e) Chenopodiaceae. Spores: f) Sordaria; g) Sporormiella; h) Delitzschia; i) Cercophora; j) Podospora. Eggs of intestinal parasites: k) Trichuris. The scale is 10 μ m.

Cereal fields were present in the area (5.1% on average) as testified by pollen of *Hordeum* group and *Avena/Triticum* group (including also some pollen of *Triticum aestivum/spelta*, according to [16]), *Secale* and *Panicum*. Part of cereal pollen could be related to the deposition in the basin of whole spikes: this hypothesis is supported both by the recovery of one *Hordeum* pollen cluster in these samples, and by the carpological findings analysed from the “Vasca Superiore” [17].

The most peculiar character of “Vasca Inferiore” is the presence in the whole diagram of pollen of many entomophilous species (e.g., *Tilia* and *Sambucus nigra* type among trees, and *Convallaria* type and *Melilotus* among herbs) (Fig. 4).

Abundance and diversity of these pollen types, combined with the good state of preservation and the presence of some pollen clusters (*Filipendula* besides cereals), suggest that flowers or inflorescences were deposited in the water as offerings, confirming the geoarchaeological hypothesis about the use of this artificial basin for votive practices.

IV. CONCLUSION

Palynological analysis of the site “Vasca Inferiore di Noceto” allowed to obtain detailed information on the past plant cover near the site and revealed the clear presence of human activity as a cause of change of the natural landscape.

The potential of this palynological research has been and will be useful in the future to outline and try to clarify various aspects of the environment, human behaviour, land-use, plant exploitation and the particular use of this structure. In fact, the optimal preservation conditions of organic material make it a very rich archive of naturalistic and archaeological elements.

Furthermore, this work may be a contribution to conservation studies and sustainable management plans of environments in the Po Plain, through new information useful for a better understanding of human impact on small mires that limits the development of biotic communities and the formation of true ecological successions.

V. ACKNOWLEDGMENTS (FOUNDERS)

This research was carried out in the framework of the project 'SUCCESSO-TERRA – Società Umane, Cambiamenti Climatico-ambientali e Sfruttamento/Sostenibilità delle risorse durante l'Olocene medio in Pianura Padana. Il caso delle Terramare' funded by MIUR (Project PRIN 20158KBLNB; PI: Mauro Cremaschi).

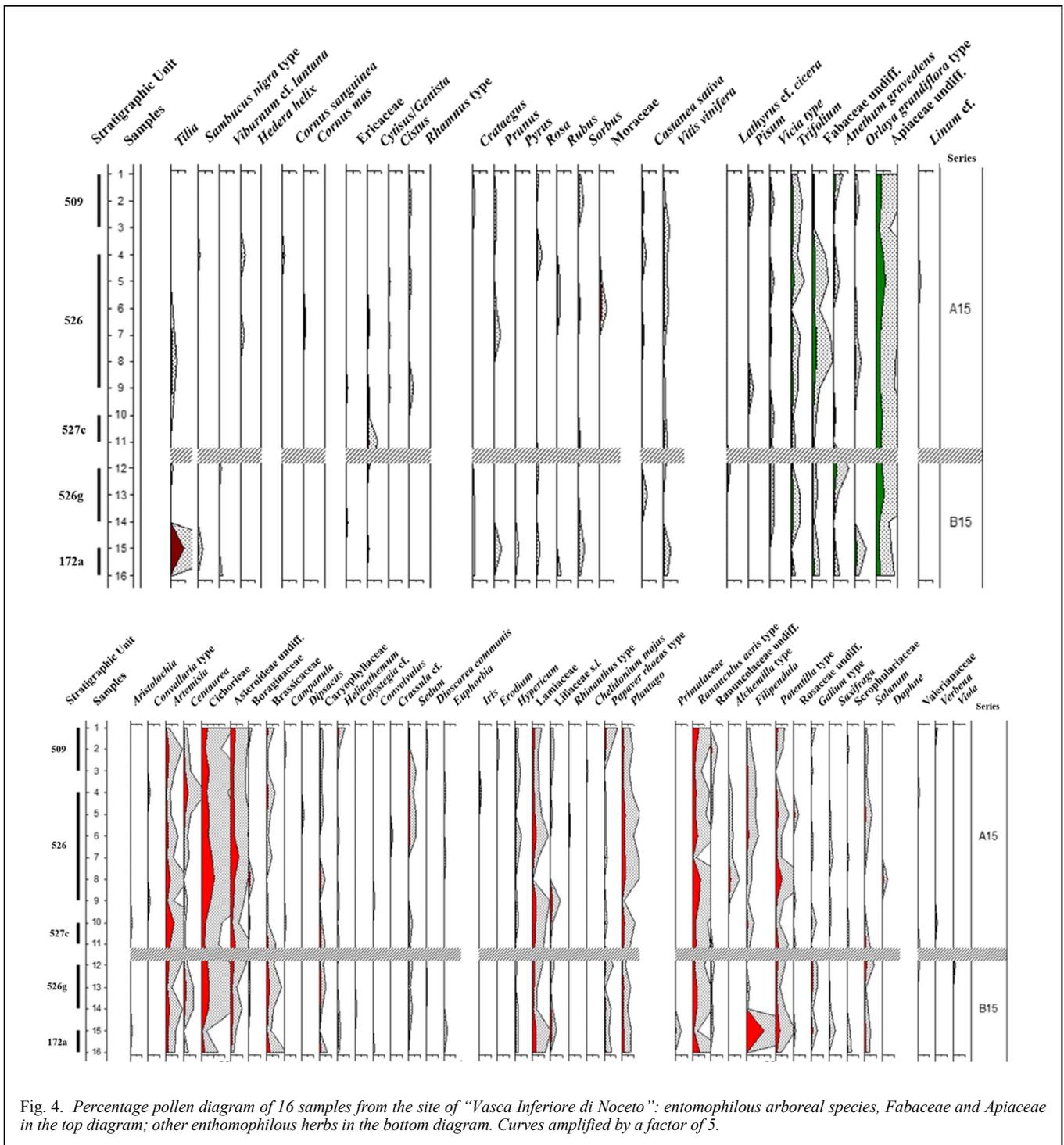


Fig. 4. Percentage pollen diagram of 16 samples from the site of "Vasca Inferiore di Noceto": entomophilous arboreal species, Fabaceae and Apiaceae in the top diagram; other entomophilous herbs in the bottom diagram. Curves amplified by a factor of 5.

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