

PALEOENVIRONMENTAL FEATURES OF A PERI-EUGANEAN (PADUA, NORTHERN ITALY) DEPRESSION DURING THE LATE QUATERNARY: FIRST RESULTS

G. Calderoni⁽¹⁾ - G.B. Castiglioni⁽²⁾ - D. Foddai⁽³⁾ - S. Gallio⁽³⁾ - M. Lombardo⁽⁴⁾ - A. Miola⁽³⁾ - P. Zangheri⁽²⁾

⁽¹⁾Dip. to di Scienze della Terra, Università "La Sapienza" di Roma, Roma

⁽²⁾Dip. to di Geografia, Università di Padova, Padova

⁽³⁾Dip.to di Biologia, Università di Padova, Padova (E-mail: miola@civ.bio.unipd.it)

⁽⁴⁾Viale Appio Claudio 233, 00174 Roma

RIASSUNTO - *Aspetti paleoambientali di una "depressione peri-euganea" alla fine del Quaternario: primi risultati* - Il Quaternario Italian Journal of Quaternary Sciences, 9(2), 1996, 667-670 - Nel settembre 1995 è stata campionata una carota di 50 m di lunghezza al centro di una zona pianiziale depressa situata nella parte centro-orientale dei Colli Euganei (Padova). Sono state condotte analisi preliminari da ricercatori di discipline diverse allo scopo di collocare nel tempo la sequenza (radiodattazioni ¹⁴C), di indicarne il tipo di sedimenti, di verificare la presenza di polline fossile e di resti di entomofauna. I primi risultati fanno pensare che il bacino di sedimentazione campionato abbia una storia che inizia prima di 43.000 anni fa, presumibilmente con l'inizio della glaciazione würmiana e che termina con la fine del Pleistocene. I sedimenti, costituiti da torbe, argille, limi e sabbie fini sembra si siano depositi con continuità; contengono una ricca flora pollinica ben conservata e le torbe più superficiali presentano resti di coleotteri. I risultati finora conseguiti fanno ritenere che studi ulteriori potranno dare esiti interessanti al fine di contribuire alla ricostruzione paleoambientale della zona, in particolare per il periodo würmiano, per aspetti riguardanti sia la biologia che le scienze della terra.

ABSTRACT - *Paleoenvironmental features of a peri-euganean (Padua, Northern Italy) depression during the Late Quaternary: first results* - Il Quaternario Italian Journal of Quaternary Sciences, 9(2), 1996, 667-670 - We report the first results of a multidisciplinary research addressed to reconstruct the paleoenvironmental evolution of a sedimentary basin, from the SE sector of the Colli Euganei area (Padua, Northern Italy). It is likely that the sedimentation in the basin was active at least over the time span from the Würmian glaciation up to the end of Pleistocene. The site is interesting because it was scarcely subjected to flooding by the nearby Adige and Brenta rivers. As a result the basin was almost continuously subjected to low energy conditions consistent with significantly long lasting episodes of peat accumulation. A 50 m long continuous core drilled at nearly the center of the basin provided a sediment record consisting of clay, silt and sands layers along with recurrently interbedded peaty levels of variable thickness. Radiocarbon dating of peat from 3.3, 18.6 and 33.0 m deep in core yielded the ages of 19,000, 25,900 and >43,000 yr BP, respectively, thus providing evidence that if the topmost portion of the sequence did not undergo natural erosion or exploitation of peaty levels, the basin ceased to be active far before Holocene. Results of the pollen analysis so far performed, relative to the 2.4 and 3.3 m deep levels, agree in ruling out the occurrence of the *Quercetum-Carpinetum boreoitalicum* forest. In particular, at 2.4 m deep the identified NAP taxa, almost equally the AP, suggest the occurrence of dry steppe climate. By reverse downcore, at 3.4 m deep it has been found that NAP greatly prevails over AP and, further, the higr/hydrophyllous plants became dominant, thus likely reflecting a phase of climatic deterioration. The sediment suite also provided some remnants of *Coleoptera*: their identification, however is still in progress.

Key-words: Upper Pleistocene, stratigraphy, radiocarbon dating, palynology, paleoentomology, Venetian Plain, NE Italy

Parole chiave: Pleistocene superiore, stratigrafia, radiodattazioni, palinologia, paleoentomologia, pianura padano-veneta, Italia nord-orientale

1. INTRODUCTION

A 50 m-long continuous core has been drilled in one of the plain embayments at the eastern border of the Euganean Hills (NE Italy). The bedrock has not been reached during the drilling. Although the studied site shows some peculiar geomorphologic and geologic features, so far little attention has been paid to its investigation, whereas numerous geologic accounts exist for the surrounding hills (Piccoli *et al.*, 1981; Schlarb, 1961).

This paper is aimed at reporting the first data obtained by taking into consideration the most appropriate geologic and biologic proxy-indicators, for reconstructing the evolution of the local environment during the whole time span that brackets the accumulation of the cored sediments. In our opinion, at the end of this research, the information gained will contribute to improve the knowledge of the evolution of the peri-Euganean depressions.

2. MAIN GEOMORPHOLOGIC OUTLINES OF THE STUDIED AREA

The studied site is located in an embayment of the alluvial plain extending deeply into the Euganean Hills. The location of the depression (Fig. 1) highlights that the interest of such embayment is due to its special position related both to the surrounding hills and the alluvial plain.

The Euganean Hills consist of a variety of igneous rocks of Paleogene age and marly limestones of Cretaceous to Paleogene age (Bellati *et al.*, 1980). Commonly, the hills show steep slopes, the sharp foot angle on the plain margin being just interrupted by the occurrence of few and small alluvial fans deposited by streams that drain the hilly area. In the outer portion of the eastern sector, where the alluvial aggradation by Brenta and Adige rivers (*Carta Geomorfologica della Pianura Padana*, 1996) lasted up to protohistoric/historic

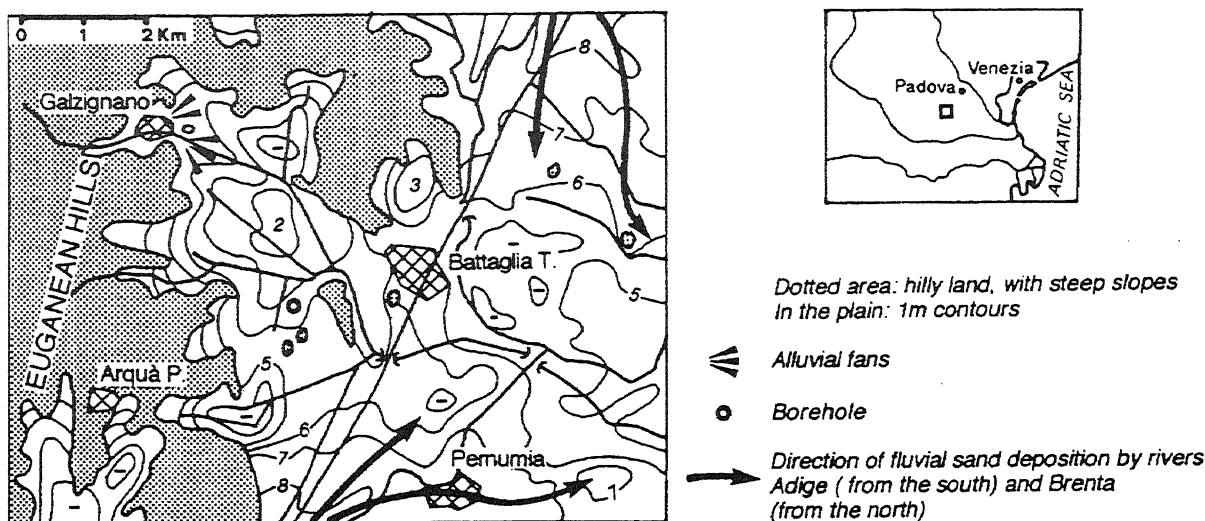


Fig. 1 - The site of the borehole in the depression "Le Valli", Galzignano.
Localizzazione del sondaggio nella depressione "Le Valli", presso Galzignano.

times, the plain is infilled by sandy-silty sediments. By contrast, fluvial deposition in the plain embayment was scarce. Therefore, swamp and/or lacustrine/pond environments could develop in the lowest parts of the plain depressions, where peaty sediments widely occur at the surface. The contour map shows that the inner-central parts of some depressions lie at less than 3 m a.s.l., while the alluvial eastward plain is 5-7 m a. s. l. This is due partly to the different rates of accumulation processes and partly to the loss of volume through sediment compaction generating subsidence.

The studied embayment was also selected because it lies few km far from the lake of Arquà Petrarca, and the village of Montegrotto, two sites for which comprehensive pollen records are available. In particular pollen data for the latter site allowed to reconstruct the vegetation (thus, the climate) evolution from the end of Würm to the post-Glacial Age (Lona, 1957), and the record from the former site spans from the beginning of the Glacial Age to Riss (Bertolani Marchetti, 1962). Thus, the ultimate goal of our pollen analysis is to bridge the gap between these two pollen records.

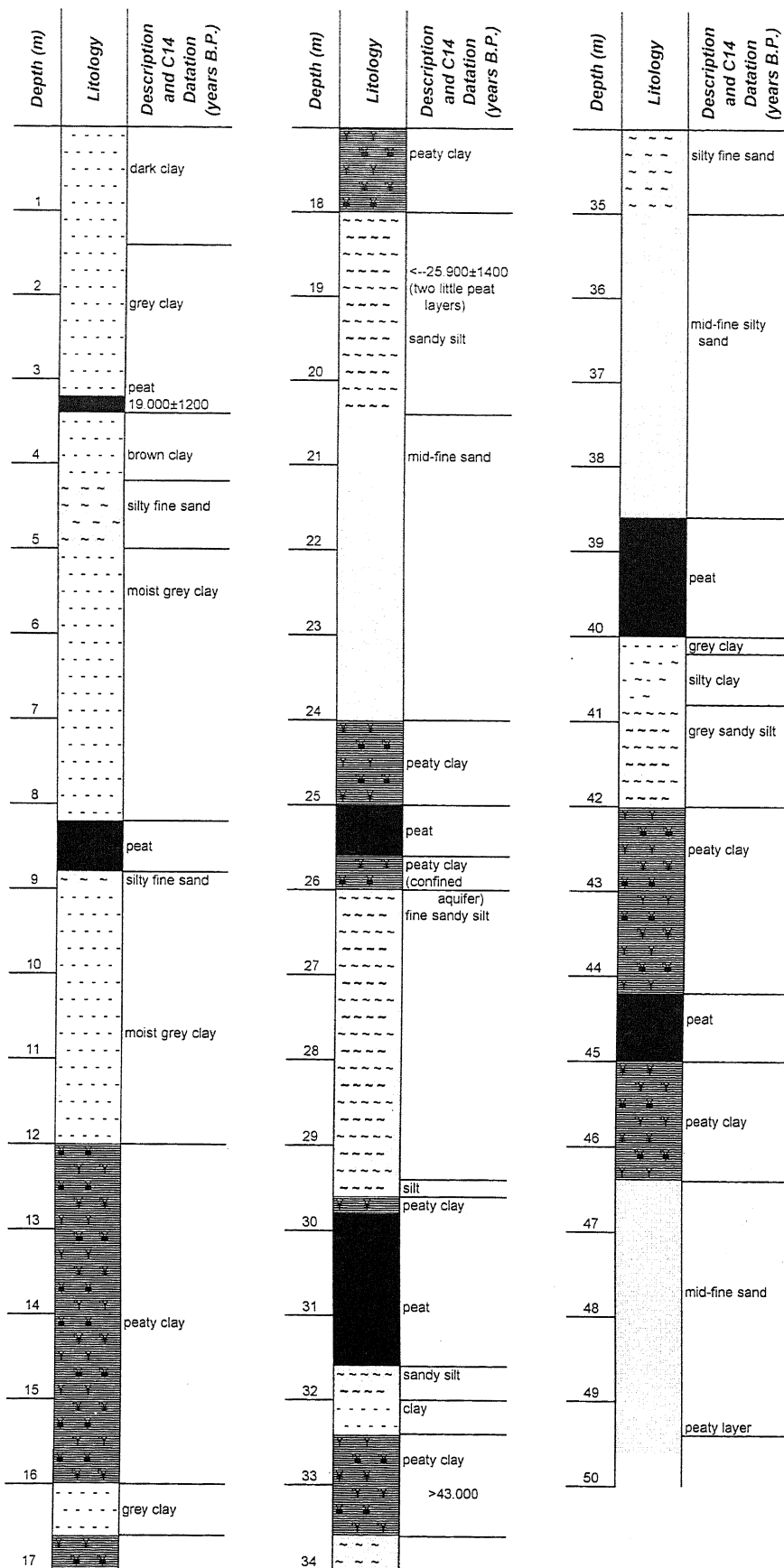
3. FIRST RESULTS: DISCUSSIONS AND FUTURE WORK PLANNING

The stratigraphic column in Figure 2 shows that the drilled sediment core includes peat, clay, silt and sand layers of variable thickness. A feature constantly observed throughout the whole core is the predominance of finer sediments over coarse fractions. Such a sedimentation pattern, interrupted by three layers of grey sands (probably of fluvial origin) further suggests that accumulation took place in a low energy environment. Because there is no evidence of sedimentation gaps, e.g., erosion surfaces, oxidized levels and tectonic dislocations, we inferred that the sedimentary suite represents a reliable, continuous record. The total thickness of the alluvial sediments remains unknown, as the 50 m-deep

drilling did not reach the basement.

Peat layers, ranging from a few cm up to a few m in thickness, are frequent throughout the core. As a rule, the peat levels, low in water content and very compact, show thin vegetal detritus that, irrespective of the stratigraphic position (= age) appears little affected by diagenetic breakdown. However, any inference on origin and paleoenvironmental significance of the peaty material needs an adequate microscopic identification. So far, we found that the uppermost peat levels have a high content of Bryophytae spores (ca. 60% of the total pollen) whereas in the deeper peat prevail the Pteridophytae spores (between 50 and 90% of the total pollen).

It is worth noting that peat- and organic matter rich-levels are generally interbedded within sediments completely lacking organic matter (OM). This rules out that the OM accumulated following a downward mobilization and subsequent trapping by a geochemical barrier. On this basis, it is argued that the OM originated syngenetically with the sediment layers and, therefore, its occurrence actually records a sequence of sedimentation episodes under low energy conditions, like those occurring in fluvio-lacustrine and/or swampy environments, the only compatible with enhanced development of aquatic vegetal biomass and its subsequent preservation through time. In this perspective, it was considered meaningful to perform radiocarbon dating on the OM from 3.3-3.4, 18.6-18.7 and 33.3-33.4 m deep. The conventional (uncalibrated) radiocarbon age, measured according to the standard analytical protocol (Calderoni & Petrone, 1992; Calderoni & Venanzi, 1989), were $19,000 \pm 1,200$, $25,900 \pm 1,400$ and $>43,000$ yr BP respectively. Because chronological data for the studied sequence were lacking, it was quite unsuspected that the basin infilling ended well before Holocene. In particular, the age for the uppermost sample (3.3-3.4 m deep) dated level (19,000 yr BP) is strikingly old and it cannot be ruled out that more recent peat layers were locally exploited to be used as fuel or in farming. Downcore the dated 18.6-18.7 m deep level, it is shown a notable clustering of



peaty levels, a feature suggesting frequently recurrent changes of the climate pattern and/or of the hydrological regime. The lowermost dated peat level (33.3-33.4 m), deep within the core, resulted behind the reach of radiocarbon dating and, on the basis of the 3σ statistical criterion, yielded the *ante quem* age of 43,000 yr BP.

Concerning the pollen abundance and distribution, because most of the 30 planned analyses are still in progress, we just deal with the uppermost portion of the core. Prior to pollen and spores analysis the sediments were treated according to the method of Bertolani Marchetti (1960). The subsequent identification through routine microscopy was performed by means of the usual identification manuals and reference slides. In addition, it has been recorded the degree of preservation of each observed grain according to Berglund & Ralska-Jasiewiczova (1986). Pollen detected in level 3.3 to 3.4 m deep revealed a significant predominance of herbaceous vegetation (NAP: 76%), mostly represented by hygro/hydrophilous plants and subordinatedly by *Artemisia* and *Chenopodiaceae*. Arboreal plants (AP) are just represented by a few pollen grains of *Pinus* (*P. sylvestris* L. exceeds *P. mugo* Turra), *Larix* and *Betula*: an assemblage typical of cold climate. Upcore, in the grey clay at 2.4 to 2.5 m depth, NAP drops to 53% and mainly consists of *Artemisia*, *Gramineae*, *Caryophyllaceae* and *Chenopodiaceae*. All these plants, the most fre-

Fig. 2 - Stratigraphy and ^{14}C datations of the sequence of "Le Valli", Galzignano.

Stratigrafia e datazioni ^{14}C della sequenza di "Le Valli" presso Galzignano.

quent in the steppe vegetation, are indicative of dry climate. This finding agrees with the correspondent severe decrease of the hygro/hydrophilous plants that here are represented by a few pollen types. On the contrary, the pollen percentage of AP rises to 40% because of contributions by *Pinus sylvestris*, *P. mugo*, *Larix* and *Juniperus* (this latter being a further component of steppe vegetation). From both analyses, it can be noticed that neither *Quercus* nor other components of *Quercus-Carpinetum boreoitalicum* (Pignatti) were detected. Although such pollen data need to be confirmed in further levels of the upper part of the core, so far it results that the analysed sediments deposited in the basin during a cold phase of Würm 3 (Panizza, 1985; Renault-Miskovsky & Leroy-Gourhan, 1981). In this perspective it appears that the upper levels examined could be slightly older compared with the deepest core from Arquà Petrarca for which pollen of dry and cold climate plants and subordinate thermophilous plants were reported (Lona, 1957).

Following a preparatory process, the peat from the depth of 3.3 m was analysed to detect insect remnants (Coope, 1986). So far fragments of Coleoptera have been isolated. Their ultimate identification, based on comparison with related modern specimens, is in progress.

Finally, to meet the objective of the research, we planned the future work as follows:

(i) To detail the chronostratigraphy of the sediment suite by means of radiometric dating;

ii) To select the most proper tools for improving the knowledge on the origin and significance of the sediments;

iii) To detail the pollen records by analysing selected levels in order to detect the most important vegetational (thus climatological) changes occurred since the Würm glaciation up to the end of Pleistocene;

iv) To perform the paleoentomologic analysis to combine the results with the palynologic data.

ACKNOWLEDGEMENTS

The coring operation and preliminary research were carried out with the financial support of the Regional Park of Colli Euganei and C.N.R. (89.05289.CT13).

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Ms received : May 6, 1996

Sent to the A. for a revision: June 25, 1996

Final text received: July 18, 1996

Ms. ricevuto: 6 maggio 1996

Inviato all'A. per la revisione: 25 giugno 1996

Testo definitivo ricevuto: 18 luglio 1996