Pollen, herds, jasper and copper mines: economic and environmental changes during the 4th and 3rd millennia BC in Liguria (NW Italy)

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This paper reviews the interdisciplinary projects carried out during the last 25 years in eastern Liguria (NW Italy). These have brought together archaeologists, geographers, palaeobotanists and historians in a series of research exercises based upon many different types of evidence: archaeological excavation and survey, ecological analysis of existing landscapes, geoarchaeological, anthracological and palynological analyses. Taken together, the results of this research provide a rich source of material for developing an understanding of how humans in eastern Liguria have interacted with the landscape through time. The influence of human activity on the vegetation of Liguria, in the Late Neolithic, Copper Age (Chalcolithic) and Bronze Age, is part of a complex system of agricultural activity mainly involving transhumant pastoralism. Several peat sites and buried soils have supplied the palaeoecological data that indicate the considerable effect of this economic activity on the landscape: a reduction in fir woodland, a decrease in arboreal species and an increase in the diversity of light demanding herbaceous and fern taxa. The environmental and economic changes during the 4th and 3rd millennia BC in eastern Liguria are also testified to by the starting of quarrying and mining activities to obtain both red jasper and copper.

Keywords: Ligurian Apennines, peat sites, buried soils, mining activities, pollen analysis, pastoralism

Introduction

Interdisciplinary research carried out during the last 25 years in eastern Liguria (NW Italy) has investigated several millennia of interactions between human occupation, the use of resources and modification of the environment, traces of which are still detectable in the present landscape and in soil profiles. Soils and vegetation underwent changes caused by intensive and/or extensive exploitation of the agro-silvo-pastoral systems, established between the 4th and 3rd millennia BC (Courty *et al.* 1989, 305–9; Cruise 1990; 1991; Lowe 1991; Maggi and Nisbet 1991; Maggi 2000; 2004a). This research shows the importance of cultural factors, such as demographic pressure, social organisation, technological advancement and economic change, in the evolution of the cultural landscape (Maggi 2004b). More recently, environmental archaeology has refocused on the connection between the different systems, the production activities and the historical ecology of the site. In fact, historical models show that human activities not only affected, but also controlled, environmental resources at a local scale, and can be employed as 'analogues' for longer/global scale palaeoecological assessment (Maggi *et al.* 2003).

The region of Liguria is a predominantly mountainous area (Fig. 1). Eastern Liguria is the northernmost section of the northern Apennine chain and the

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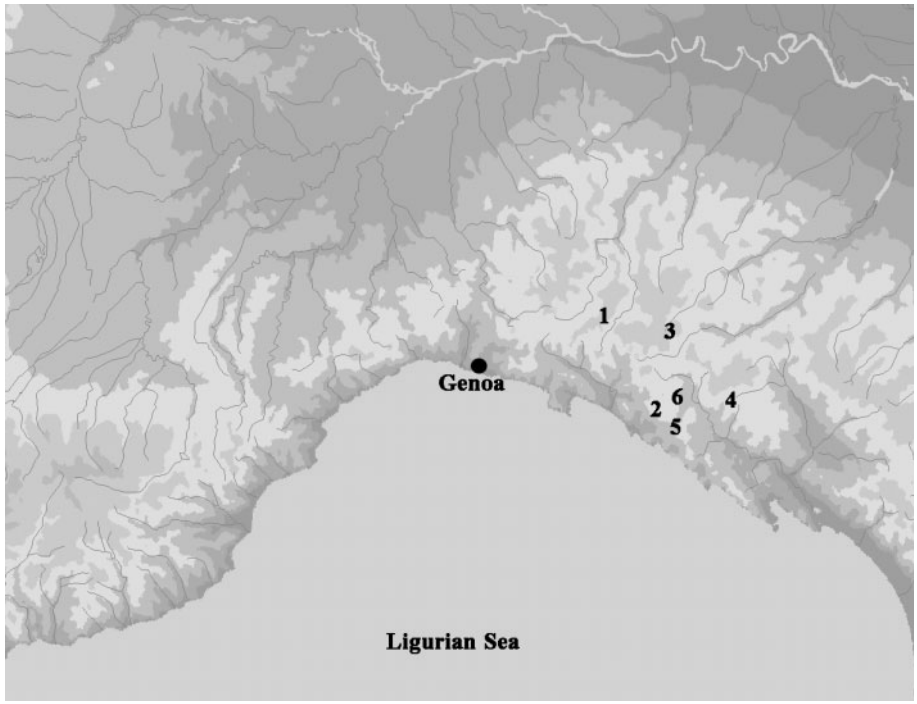

Figure 1 Liguria: 1) Moglie di Ertola; 2) Bargone; 3) Prato Mollo; 4) Piana Damisa; 5) Monte Loreto; 6) Valle Lagorara

geology is dominated by Upper Jurassic Ophiolites (basalts, serpentinites, gabbros and granites) and associated sedimentary deposits (Branch 2004). In the Ligurian Apennines, there are several peat sites (e.g. Pian del Lago, Prato Mollo, Casanova, Lago Nero, Moglie di Ertola), buried soils (e.g. Case Cordona, Piana Damisa), the earliest copper mines known so far in western Europe (Monte Loreto and Libiola) and one red jasper quarry (Valle Lagorara one of the rare cases of open-air stone quarries known in Europe). Micromorphological, anthracological and palynological analyses suggest that since the 4th millennium BC environmental change has been connected with human activities such as clearance of woodland by fire, in order to create pastures and open areas, whilst economic changes are testified to by the starting of quarrying and mining activities in order to obtain both red jasper and copper. Currently available information on the Late Holocene in Liguria suggests interactions between the economy of the inland mountainous area (mainly summer pastoral activity on lighter soils) and the lower valley and coastal belt (winter grazing, agriculture on alluvial soils).

Pollen analyses from some eastern Apennine peat bogs (such as Casanova in Cruise 1991; Rovegno in Branch 2004; Lago Riane and Lago Lagastro in Branch 2004) suggest that during the Copper Age a widespread destruction of forest by fires occurred in the upper parts of the conifer woodland. Soil micromorphological studies show that clearance activities were intensive and were followed by erosion of the forest soils. It can be suggested that 3rd millennium pastoralism was a major aspect of a broad subsistence spectrum, representing the development of effective exploitation of the upland resources. The practice of 'alpeggio' was developed through the Copper Age (3600–2200 BC) and Early Bronze Age (2200–1800 BC). Reliable documentation for the opening up of pastures, which were created by thinning the woodland using controlled fires, was obtained more than 15 years ago from the study of the site of Prato Mollo (Maggi 2004b). The plant names follow Pignatti (1982).

Prato Mollo

Prato Mollo (1480 m a.s.l.) is one of several peat sites in Eastern Liguria, where palynological and sedimentological records have been investigated (by R. I. Macphail and G. M. Cruise: Baffico *et al.* 1987; Courty *et al.* 1989, 305–9): the site is a shallow depression, on the southern slopes of M. Aiona and M. Nero, where Mesolithic and Copper Age flint artefacts have been recovered. The fir forest around Prato Mollo underwent a major decline during the period (Bln 3132) 4300 ± 60 BP (3079–2642 cal. BC-2σ) to (Bln 3131) 4130 ± 60 BP (2889–2472 cal. BC-2σ), probably in response to multiple widespread fires (Courty *et al.* 1989, 305–9; Maggi 2004b). Most researchers agree on a hypothesis of invasive human

exploitation during the late 4th–3rd millennium BC cal.

As the fir forest was opened up locally, some pollen *taxa*, which were transported up from lower altitudes, e.g. oak, elm became statistically more important. Open *Fagus* woodland expanded greatly and became dominant after the *Abies* forest had been cleared (Baffico *et al.* 1987).

Pian del Lago (Bargone)

Pian del Lago (830 m a.s.l.) is a small peat-filled basin with a maximum depth of 6 m. It is situated on the seaward slopes of Mount Roccagrande at Casarza Ligure, inland from Sestri Levante, just 9 km from the coast, in what is now a highly eroded heath landscape.

The stratigraphy covers the whole Holocene through to the Middle Ages: the bottom dates to (GnR 21307) 10870±90 BP (11040–10640 cal. BC-2σ) and the top to (GnR 21308) 700±60 BP (1220–1400 cal. AD-2σ).

The pollen diagram, which is being studied by G. M. Cruise (Fig. 2), shows the presence of domesticated cereals at levels dated to two to four centuries before 5000 BC. It is well known that cereal pollen is relatively heavy and that wind does not transport it over great distances. The agriculture is therefore local or peri-local (the pollen could have been transported by sheep or goats coming to drink) (Cruise *et al.* 1998; Cruise and Maggi 2000; Maggi 2004b).

The first sign of domesticated cereals is followed by the first appearance of *Vitis* pollen, which is also definitely earlier than 5000 BC (Cruise and Maggi 2000). Charred remains (grape pips) of *Vitis vinifera* L. are known from various settlements of the earliest Neolithic in northern Italy (Castelletti and Rottoli 1998).

During the Late Neolithic, around 4300–4200 BC, *Olea* pollen becomes more abundant and frequent: this probably indicates that olive trees were being domesticated. If they were cultivated, this activity would be localised towards the lower valley. The nut-bearing tree, walnut (*Juglans*), appears in the earliest centuries of the Copper Age, between 3500 and 3000 BC (Cruise *et al.* 1998; Cruise and Maggi 2000; Maggi 2004b).

Preliminary results of the research show that the vegetation and the soils of the area around Pian del Lago were disturbed by grazing during the Neolithic, the Copper Age and the Bronze Age. Although the intensive use of fire for controlling the vegetation was only unequivocally attested to during the Iron Age and the Roman period, when there is evidence of greater impact from deforestation, heathland expands and pollen of the Sweet Chestnut (*Castanea sativa* Miller) appears in layers dated to around 400 BC (Maggi 2000; 2004b).

Piana Damisa

In the early 1970s, investigations began in eastern Liguria of the so-called 'Castellari', which are open-air sites, characteristic of the Bronze Age and Late Iron Age. Usually, these are located strategically on rocky hilltops, probably functioning as control sites for both pastures and watershed routes, as part of a short distance transhumance system. The prehistoric introduction of mobile pastoralism in a region like Liguria, which offers potential upland pasture at a short distance from the coast, provided the local population with a substantial economic resource, allowing an increase in the carrying capacity of the area and therefore a rise in population (Maggi 2004b).

At Piana Damisa (600 m a.s.l.), in a broad field located about 1·2 km south of the Bronze Age site of Castellaro di Zignago and 1·1 km north to Castellaro di Vezzola (also Bronze Age), several test trenches revealed the existence of an extensive buried soil, radiocarbon dated to the Late Bronze Age: (Beta 100354) 3180±50 BP (1525–1380 cal. BC-2σ) and (Beta 100355) 3160±50 BP (1515–1305 cal. BC-2σ).

The lack of artefacts and features such as pottery, hut remains and so on, suggests that this site did not have any residential function. Micromorphological analyses (carried out by C. Ottomano) suggest that the buried soil was formed as a consequence of activities such as clearance of woodland by fire, in order to create pastures and open areas. The considerable organic enrichment of the Bronze Age soil suggests that the site was intensively visited by stock. It seems that the area, after such Bronze Age transformation, never went back to woodland (Ottomano *et al.* in press).

Moglie di Ertola

This peat bog is a source for the environmental history of the Trebbia/Aveto watershed The plateau, locally called 'mogge' (1115 m a.s.l.) (Fig. 3), was subject to a preliminary investigation in 2001 (Guido *et al.* 2003). In June 2004 and in July/August 2005 two campaigns of environmental archaeological research were carried out (De Pascale 2004c; 2005), following several preliminary campaigns that focused

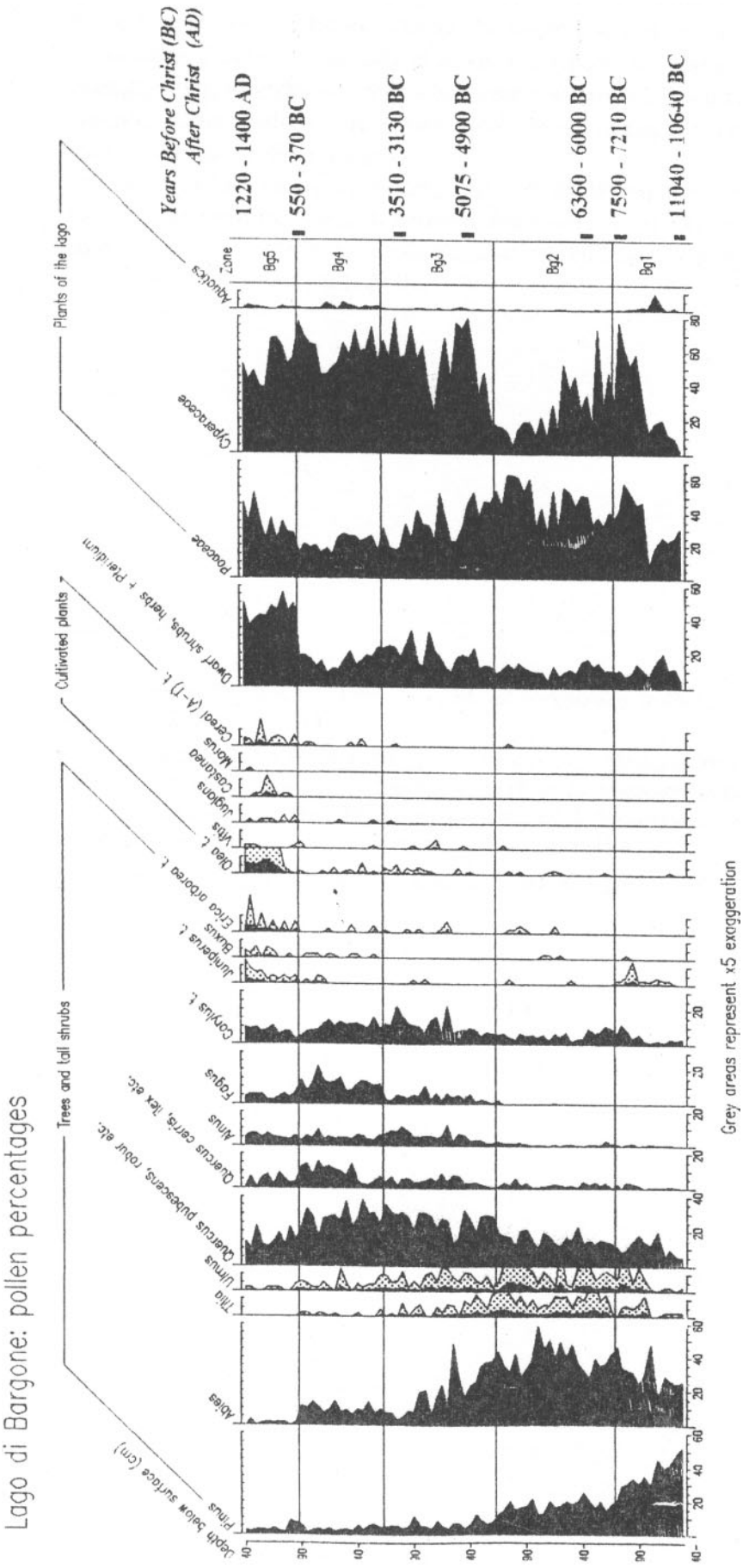

Figure 2 Pian del Lago (Bargone): pollen diagram (Cruise and Maggi 2000)

Figure 3 Moglie di Ertola: the plateau locally called 'mogge' (1115 m a.s.l.) — an aerial view. On the left is the excavation area

Figure 4 Moglie di Ertola: waterlogged trees buried in a peat layer. The tree in the centre is the Abies dated (Beta 158361) 4220 $\pm$ 60 BP; 2σ: 2920–2620 cal. BC. Some 'slices' were taken for dendrological studies

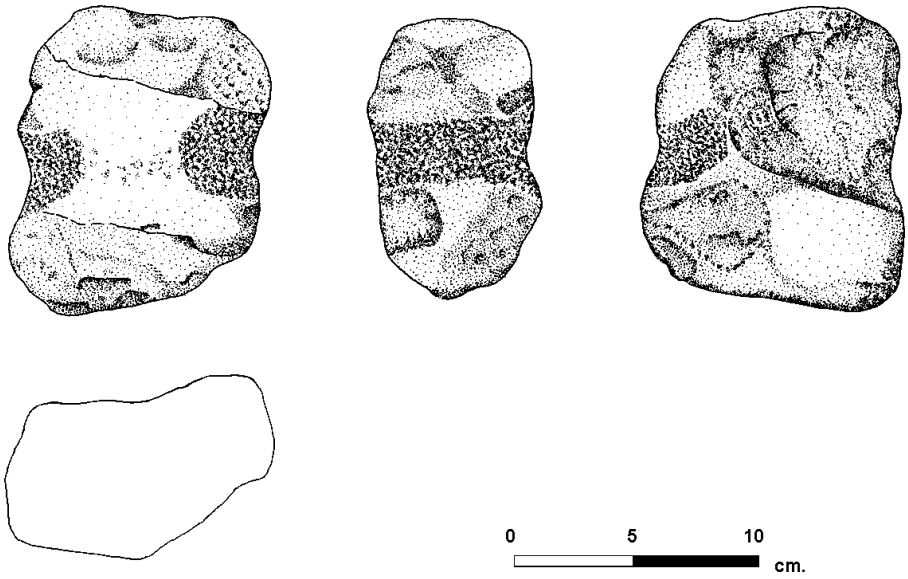

Figure 5 Monte Loreto: hammer stone grooved for hafting

on the historical ecology of the site (Maggi *et al.* 2003).

The remains of a stone structure could testify to the existence of a dam (still to be dated); the top 'clay' layer could have been intentionally deposited in order to drain the peat bog.

Several waterlogged trees, buried beneath a layer of peat containing evidence for the possible shredding of ash trees, as well as the occurrence of charcoal, could provide the key to an understanding of the natural and anthropogenic events during the last thousand years in this part of the Ligurian Apennines. One waterlogged *Abies* tree, found in the sediment profile on the lower edge of the plain gave a radiocarbon date of (Beta 158361) 4220 ± 60 BP (2920–2620 cal. BC-2σ). Soil samples were analysed for pollen at four different depths: the peat layer is almost exclusively rich in *Abies* pollen and an increase in *Alnus*, *Fagus*, *Corylus*, *Quercus* deciduous and herbs of damp and marginal grassland (Guido *et al.* 2003).

The excavation revealed the original contour of the small water basin, which contained several large fallen trees (Fig. 4); these were sampled for identification purposes.

The next campaigns will focus on understanding: i) the morphological evolution of the water basin and its transformation into a peat bog; ii) the reason(s) for the presence of many fallen trees in three of the buried layers so far recorded; iii) the origin and associations of the charcoal fragments

Figure 6 The jasper quarries of Valle Lagorara

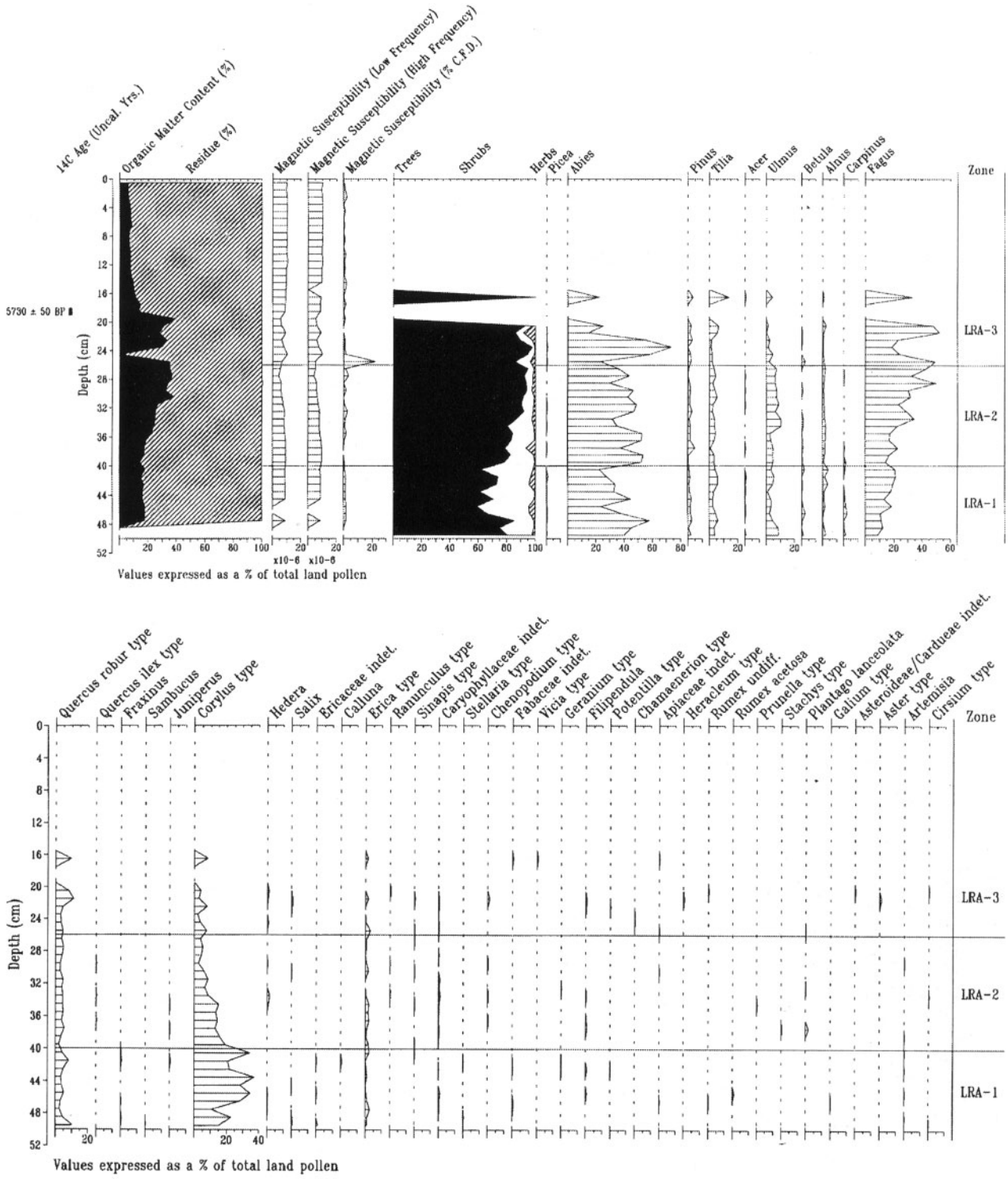

Figure 7a Valle Lagorara: pollen diagram (Branch 2002) – values are expressed as a % of total land pollen

(mainly *Abies*) found in the grey mud underlying the peat layer.

Quarrying activities: Monte Loreto and Valle Lagorara

At Monte Loreto (367 m a.s.l.), located in the hinterland of Sestri Levante, prehistoric copper mines and ore-dressing facilities are documented, having been recorded in various places along the slopes of the mountain. Eleven radiocarbon dates demonstrate that early mining and ore exploitation occurred from the mid-4th to the early 3rd millennium cal. BC (Maggi and Pearce 2003; 2005). The prehistoric technique used apparently involved extracting only

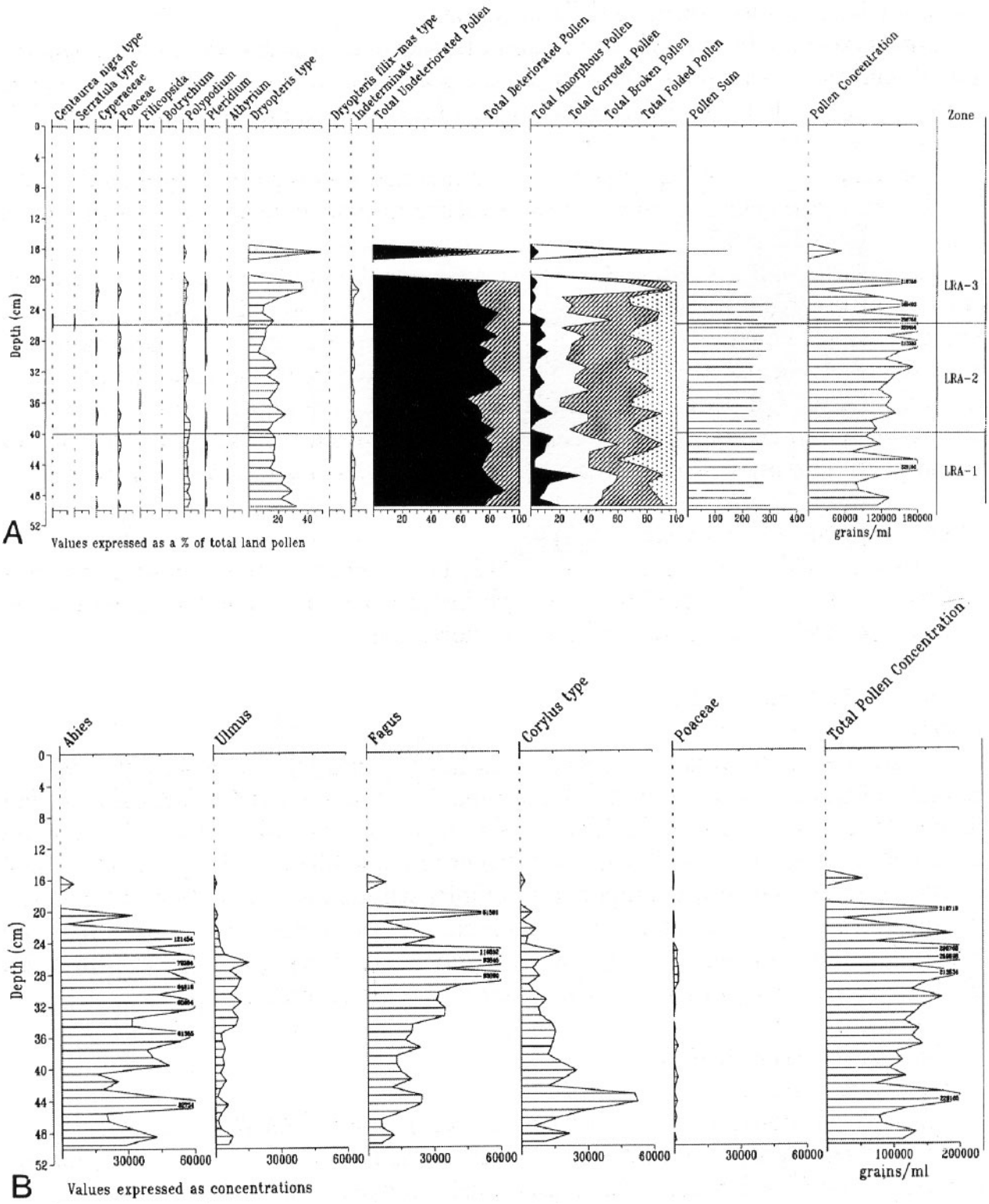

Figure 7b Valle Lagorara: pollen diagram (Branch 2002) – values are expressed as concentrations

the ore, leaving the surrounding rock largely untouched, except where it was necessary to widen the works for access. The prehistoric mining features comprised tool and probable fire-setting marks on gallery walls. In a fissure investigated between 1999 and 2003 there were, moreover, layers rich in charcoal and a radiocarbon date (Beta-135159) of 4090 ± 60 BP (2875–2475 cal. BC-2σ) was obtained. The fill of this fissure also contained hammer stones and Copper Age pottery.

Seven hundred complete and fragmented hammer stones (Fig. 5), many showing damage from use, were

collected during the fieldwork campaigns. They are mostly of basalt, dolerite, sandstone, diorite and gabbro. The source of some of these rocks lies some kilometres from the site (De Pascale 2004a; 2004b). The hammers have single or double notches or are grooved for hafting. It is interesting to note that the same particularly hard types of rock were also used at the contemporary jasper quarries of Valle Lagorara (Fig. 6), located near Monte Loreto. Excavations at the latter site, a large open-air red jasper quarry, revealed that, from 3500 to 2500 cal. BC, it was mainly exploited for the production of small, oval chipped bifaces. These are the pre-forms for foliate arrowheads, typologically identical to those found in settlements and burials of the same period (Campana and Maggi 2002).

The analysis of 1461 pieces of carbonised wood allowed the identification of several aspect of the woodland during the prehistoric occupation of the valley. The analyses provided evidence of a rather variable context that does not demonstrate significant selection of particular woods by prehistoric human communities. The impression given is that this was an environment of somewhat mixed vegetation with passageways probably comprising horse-brush within the local vegetation, and with human interaction of some importance (Nisbet 2002).

The palynological and lithostratigraphical data indicate that, in the early Holocene, the local vegetation comprised a mosaic of evergreen and deciduous woods. The presence of beech, a tree that has always colonised a rather wide area, is particularly interesting considering the proposed chronology (Fig. 7a-b). The period GrN 21807) 6730 ± 50 BP (5680–5500 cal. BC-2σ) is marked by a decline in hazel, a reduction in the diversity of herbaceous pollen types and an increase in values for beech, indicating a local colonisation, perhaps at the expense of the fir. Pollen values for elm and lime also increase, demonstrating a general expansion of deciduous woodland. The period (GrA 5180) 6360 ± 60 BP (5440–5210 cal. BC-2σ) is characterised by a reduction in tree pollen and could be related to clearance. The increase in *Fagus* pollen at the expense of *Abies* pollen is similar to that seen other pollen diagrams in southern Europe. This event was highly diachronous; many site records show only a trace of *Fagus* pollen during the Middle Holocene, while others show a sharp increase in pollen values (Braggio *et al.* 1991; Lowe *et al.* 1994; Pons 1992; Watson 1996; Watts *et al.* 1996a; 1996b). Whereas the expansion of *Fagus* in Valle Lagorara appears as an asynchronous event, with radiocarbon dates from the peat basins and lakes of the northern Apennines, extend between about 6600 and 3500 BP. The expansion of *Fagus* in Valle Lagorara precedes 6700 BP, representing the oldest discovery of the Italian increase in *Fagus* in the northern Apennines. The causes are not clear: the possibilities of climatic change toward cold and humid conditions, on the one hand, and an increase in human pressure (for example, to feed animals), on the other, counterbalance each other. However, the results from Lagorara, indicating an expansion of *Fagus* in a context of changing sedimentation processes, are symptomatic of human disturbance of the forest (Branch 2002).

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