

Middle and Upper Pleistocene natural environment in the Roman area: climate, vegetation and landscape

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SUMMARY: The natural environment of the Rome area is outlined by the palaeobotanical and palynological studies from the diatomite deposit of Riano Romano and by the long pollen sequence of Valle di Castiglione near Rome. The middle and upper Pleistocene climatic and vegetational fluctuations recorded in Latium highlight a considerable variety of landscapes, compared to what is known in other European countries. Even within Latium, it is possible to recognize different floristic and vegetational features through correlation of the various studied sites, responding with an exceptional sensitivity to the diversity of the environmental situations typical of the ecological ecotone of the region.

1. FOSSIL PLANTS AT RIANO ROMANO

One of the most important palaeobotanical and palynological sites studied in relation to fossil elephants in Latium is the diatomite deposit of Riano Romano, where a wealth of fossil leaves, seeds and fruits, coupled with pollen analysis, revealed the existence of a lush forest, dominated by *Pterocarya fraxinifolia* (Follieri 1958, 1962). No other natural archive has been discovered in Italy with floristic and vegetational characters so similar to the forest currently occupying the plains of the Caucasian region between the Black Sea and the Caspian Sea. The landscape at Riano Romano was characterized by a very dense forest, interrupted by marshes and wide lacustrine basins, with a remarkable plant biodiversity compared to the coeval records of vegetation in central and northern Europe. The modern analog of this landscape may be found in areas with over 2000 mm mean annual precipitation, favouring the development of such a dense forest that only few plants can grow in the darkness under the canopy.

The Colchic forest represented in the pollen analysis of Riano Romano, dated to approx.

300 Ka Bp by fission tracks and by K/Ar measurements, shows three forest phases with different floristic composition: a mixed oak forest at the basis, followed by a period with dominant *Pterocarya* and by a final phase with *Carpinus* and *Abies*. The arboreal pollen is always more abundant than the non-arboreal pollen, confirming the picture provided by the macrofossils, indicating the local presence of some thirty woody taxa currently living in the coastal areas of Georgia, facing the Black Sea. Some of them are Tertiary relicts, like *Pterocarya* and *Zelkova*, accompanying various species of maples, ashes, limes, hornbeams, living together with *Fagus sylvatica*, *Abies alba*, *Ilex aquifolium*, *Vitis vinifera* and *Hedera helix* (Fig. 1).

2. THE POLLEN RECORD OF VALLE DI CASTIGLIONE

The long pollen sequence from Valle di Castiglione, an artificially dried out crater lake near Rome, is a chronostratigraphical and palaeoenvironmental foundation of the Campagna Romana for the whole time interval of the last 250,000 years (Fig. 2).

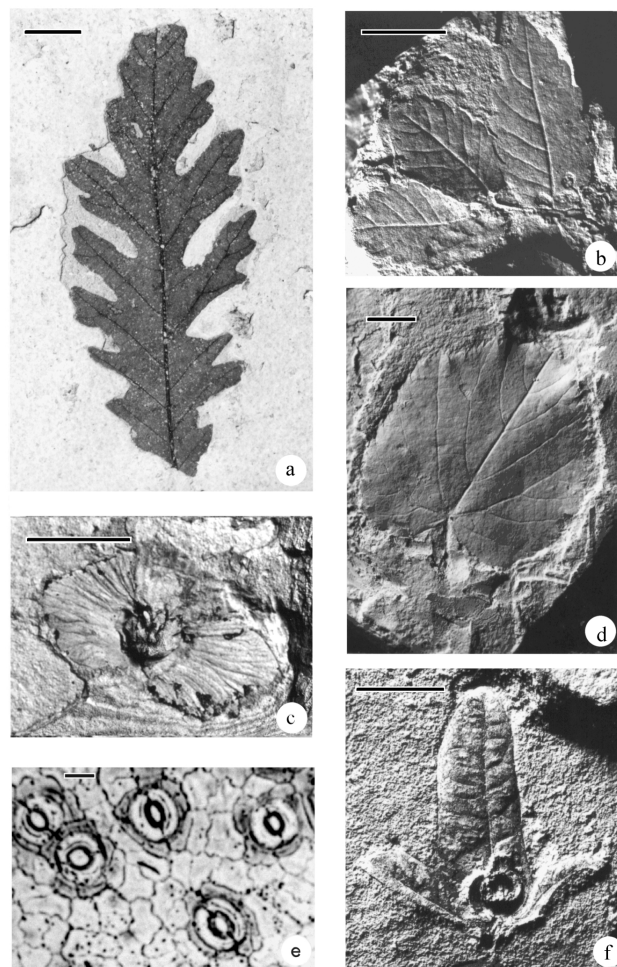


Fig.1 - Riano Romano. Fossil leaves and fruits from the diatomite (approx. 300,000 BP): a) leaf of *Quercus cerris* L., b) leaf impressions of *Zelkova crenata* Spach., c) winged fruit of *Pterocarya caucasica* C. A. Mey., d) leaf impression of *Tilia cordata* Mill., e) cuticle of *Ilex aquifolium* L., f) fruit of *Carpinus betulus* L. - In e) the scale bar corresponds to 20 µm; in the other pictures the scale bar is 1 cm.

This exceptional record of the floristic, vegetational, climatic, biostratigraphical, palaeoecological characters of the region allows a detailed reconstruction of the events occurred during two complete interglacial-glacial cycles (Follieri *et al.* 1988). The chronology of the sequence has been estimated on the basis of a number of radiocarbon dates, counts of annual laminations in the sediments, comparison with marine oxygen isotope curves, synchronization with the precession of equinoxes.

The late Quaternary landscapes of the Rome area may be described by two general vegetation types, alternating in response to the fre-

quent climatic fluctuations: a forest-dominated type, and an open vegetation type, characterized by steppes and grasslands, particularly important during the glacial phases of the Pleistocene. The open formations are the commonest vegetation types, interrupted by relatively short forest phases. In fact the pollen record from Valle di Castiglione indicates that, during the last quarter of million of years, only in 1/10 of the time are the percentages of arboreal pollen higher than 80%, a value indicating true forested situations. Grasslands with reduced arboreal component characterize the most frequent landscape of the Campagna

Romana, while the diffusion of forest communities occurred only in specific climatic conditions, similar to the present ones.

The floristic composition of the forest phases recorded in the sediments of Valle di Castiglione is substantially different from that of central and northern Europe. The various vegetational phases are clearly distinct from one another on the basis of their floristic composition, presence of taxa in extinction and dominant trees (Follieri & Magri 1998). For example, the forest phases Roma I and Roma II, corresponding to marine oxygen isotope stages 7e and 7d respectively, show the presence of *Pterocarya*, but with *Carpinus* dominant in the first case and *Fagus* dominant in the second.

During the Eemian (broadly corresponding to oxygen isotope stage 5e) *Pterocarya* is absent, but *Zelkova* shows a remarkable expansion, in a woodland dominated by evergreen oaks. On the whole, the Mediterranean component of the vegetation is more abundant during the Eemian than during the Holocene.

In the following forest phase, St Germain I, correlated with oxygen isotope stage 5d, the highest percentages of deciduous oaks are found, but beech and fir are also abundant.

The vegetational features of the Valle di Castiglione pollen record enable a number of general remarks to be made towards a first palaeoclimatic interpretation. The most schematic form of representation of the past vegetation is provided by the Arboreal Pollen (AP) percentage (Fig. 2) indicating the physiognomic character of the vegetation that is the most general and understandable: its structure. This can provide a first indication of the general wetness of the climate: the forest phase corresponding to St Germain I, with an average AP percentage of 90%, has the features of a wet phase, whereas the open vegetation period between St Germain I and St Germain II (20% AP) represents arid conditions. Further climatic information may be obtained from an analysis of the vegetation composition: the differentiation of the forest vegetation into Mediterranean, submontane and montane, according to the present-day geographical distribution, corresponds in fact to a rough dis-

inction of climatic features. Mediterranean vegetation bears summer dryness, but not excessive winter cold. Submontane and montane forest vegetation, with prevalent deciduous trees, instead needs summer wetness – greater for the montane belt – and tolerates cool winters. The simultaneous presence of the three types of forest vegetation, which in the past could live, as today, at different elevations, indicates that when the moisture conditions remained such as to permit the trees to live, the temperature conditions were mainly suitable both for Mediterranean vegetation and for submontane as well as for montane vegetation. All the same, the prevalence of the one type of vegetation or the other testifies that during the various forest phases differences occurred in the seasonal distribution of the temperatures and of precipitation. Thus the climate of the Eemian, with prevalent Mediterranean vegetation, must have been characterized by mild, rainy winters and dry summers; the climate of Roma II and St Germain I, typified by montane vegetation and by the maximum peaks of concentration, must have been characterized by considerable general wetness, with abundant rains in the summer as well.

3. THE LAST GLACIAL

The last glacial vegetation is relatively well known in the Lazio region, on the basis of five long pollen records, which can be clearly correlated by radiometric dates and pollen biostratigraphic characters (Follieri *et al.* 1998): Valle di Castiglione (Follieri *et al.* 1988, 1989), Lagaccione (Magri 1999), Lago di Vico (Magri & Sadori 1999), Stracciaccappa (Giardini 1993) and Valle di Baccano (Ciuffarella 1996).

The history of vegetation indicates that this region, which at present shows the characters of an ecotone, was particularly sensitive to the weak climatic fluctuations of the last glacial, inducing repeated and sometimes significant diffusions of trees. The region was a privileged area for the survival of thermophilous and mesophilous trees during the whole glacial period, even when extensive ice sheets covered central and northern Europe.

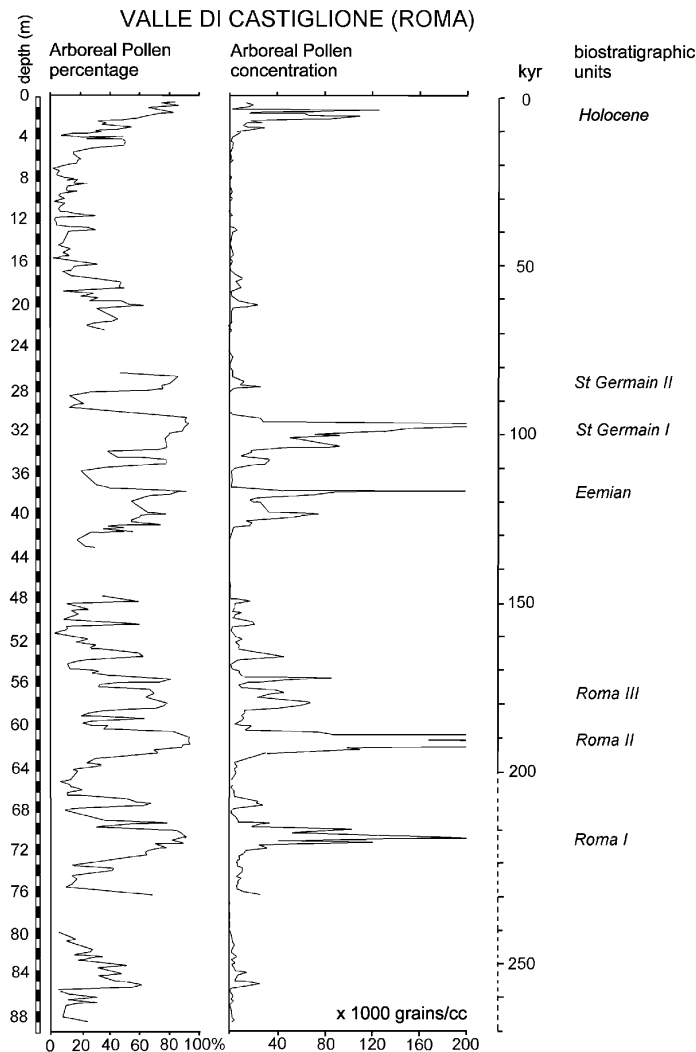


Fig.2 - Synthetic pollen diagram from Valle di Castiglione (modified after Follieri *et al.* 1988).

The considerable length and continuity of these pollen records have made it possible to follow the history of many arboreal taxa in the region. Some tree taxa (e.g. *Abies*) are found at all the sites at the same time; they can be used to characterize the forest periods at a regional scale. Other taxa (e.g. *Fagus*) display locally different behaviour in the various sequences. Some other taxa (e.g. *Picea*), not living any more in Latium, are found in the pollen records only for limited time intervals. It clearly appears that the pollen data from the long records of the region make it possible to char-

acterize the various biostratigraphic units on the basis of the floristic features, and to distinguish regional and local aspects of the vegetation (Follieri *et al.* 1998).

4. CONCLUSION

The Quaternary environments of the Rome area are described in considerable detail by the palaeobotanical and palynological studies carried out in the region, contributing in a substantial way to the palaeontological, geomorphological and lithostratigraphical investiga-

tions. In fact the palaeobotanical data provide not only a reconstruction of the floristic and vegetational features, but also of important palaeoecological and palaeoclimatic details in a well-defined chronological framework obtained from continuous records.

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