Holocene environmental reconstruction in Southern Calabria (Italy): an integrated anthracological and pedological approach

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Summary: *A multidisciplinary approach based on anthracological and pedological analysis on soil profiles is used to reconstruct past environment in two archaeological sites of Calabria (South Italy): Cecita Lake and Palmi. The soils of Cecita span from late Neolithic/early Eneolithic to Greek and Roman ages. The second site includes a late Neolithic to late early Bronze Age to undifferentiated historical succession. Pedological analysis show the occurrence of clay coatings in the Neolithic soils from both sites, suggesting a climate with high moisture availability and some seasonal contrast, enhanced by warm-humid conditions during the late early-middle Holocene climatic optimum. The post-Neolithic soils show more abundant short-range order minerals than phyllosilicates and no clay coatings, indicating a transition towards prolonged humid conditions. Between these climatic phases severe land degradation is recorded, testified by human impact and soil erosion, well-documented by pedoanthracological results at Cecita. Here, charcoal fragments from Neolithic soils are dominated by deciduous oak-forest, whereas a transition to a mountain pine forest is recorded in the Roman soils. A stable oak forest characterizes, instead, the landscape at Palmi from the Neolithic onward.*

Key words: *pedoanthracology,* Quercus *deciduous type,* Pinus *group* sylvestris*, Cecita Lake, Palmi*

INTRODUCTION

Multidisciplinary research is an essential tool in reconstructing past environment and landscape. In this poster we present the application of archaeoanthracological analysis, together with pedoanthracology and pedology, for understanding environmental changes in two different areas of Calabria (South Italy).

THE STUDY AREA

The two studied sites are Cecita Lake and Palmi, situated in north-central inland and south-western coastal Calabria, respectively. Cecita Lake is an artificial lake located on the Sila Massif at about 1130-1140 m asl in a tectonic depression filled up, probably since late Early-Middle Pleistocene through Late Pleistocene, by fluvial-lacustrine sediments related to a palaeo-lake. The main vegetation is composed by beech (*Fagus sylvatica*) and oak forest (*Quercus cerris*). The high mountain belt is made of conifers dominated by pine (*Pinus laricio*) and fir (*Abies alba*). Human occupation along lake shores from late Neolithic to early Eneolithic (5800-5350 years BP) and from Greek time (6th to 3rd century BC) to the Roman Age (3rd – 1st century BC to 5th – 6th century AD) is documented by settlements and archaeological finds. The excavation close to Palmi (Piani della Corona site) is situated on a wide terrace at about 500 m asl, along the southern Tyrrhenian coast of Calabria. A pedostratigraphic succession already described by Bernasconi *et al.* (2010) is present, including late Neolithic settlements and artifacts (about 6500-5800 years BP). They are partly truncated and buried by anthropogenic disturbance, that displays repeated ploughing traces of undifferentiated historical epochs, separated by a late early Bronze Age paleosurface (about 4000-3700 years BP). This surface is in turn affected by marks of archaeological structures and ploughing.

MATERIALS AND METHODS

The methodology has envisaged a first geomorphological and pedological characterization and description of the soil profile and the subsequent collection of soil samples for pedological and anthracological analysis. In the case of Cecita Lake only late prehistoric and Roman soils were sampled. They all consist of surface A horizons, in places affected by repeated prehistoric to modern ploughing traces (Ap). In the Neolithic soil the A horizon exhibits scarce clay coatings in pores and overlies a Bw horizon. At Palmi the upper profile was sampled: the deep argillic (Btb) horizon dated to late Neolithic, the late early Bronze Age paleosurface (Ab) and, above this Bronze Age paleosurface, the upper stratigraphic succession consisting of brown anthropogenically disturbed organic-mineral (Ap) horizons, archaeologically not well dated because of their reworking for agricultural practices (Bernasconi *et al.*, 2010). The deepest part of

the soil profile is going to be dated by AMS dating to have the most ancient chronological limit. The samples were water-sieved with mesh sizes of 2, 1, 0.5 and 0.25 mm. Charcoal fragments with > 2 mm size were sorted; the taxonomical determinations have been made by a stereo lens and an incident light microscope at magnification 100x, 200x and 500x, using wood anatomy atlases and reference collections of wood.

RESULTS AND DISCUSSION

Soils from both sites partly developed on volcanic ash and display variable Andisol-like features related to formation of some amounts of short-range order minerals. Ash composition, the pedostratigrahic position and some radiometric dates suggest a provenance from late Pleistocene/Holocene explosive eruptions of the Aeolian Islands (Scarciglia *et al.*, 2008; Bernasconi *et al.*, 2010). Micromorphological observations performed in thin sections prepared from undisturbed soil samples highlighted the occurrence of clay coatings in the Neolithic layers of both sites, and their relict significance (e.g. Kemp, 1998). These features suggest climatic conditions characterized by high moisture availability and some seasonal contrast, enhanced by a warm-humid climate. Therefore, main soil development may have occurred during the late early-middle Holocene climatic *optimum* (Scarciglia *et al.*, 2008; Bernasconi *et al.*, 2010; Pelle *et al.*, 2010). The post-Neolithic soil horizons show more abundant short-range order minerals than phyllosilicates and no or very rare clay coatings, suggesting climatic changes towards overall prolonged humid (and probably cooler) conditions. Between the two distinct climatic phases identified during and after the Neolithic, severe land degradation is also recorded, testified by human impact and soil erosion. Archaeo and pedoanthracological data from Cecita give good evidence of it. In fact, charcoal fragments from Neolithic soils are dominated by deciduous oak forest (mainly *Quercus* deciduous type), whereas a transition to a mountain pine forest dominated by *Pinus sylvestris* group is recorded in the Roman soils. Preliminary soil charcoal data from Palmi, instead, suggest a stability of forest cover characterized by a deciduous oak forest; in fact this *taxon* is present both in the Neolithic and in the post-Bronze Age horizons. It is noteworthy the presence of *Abies,* belonging today only to mountain vegetation, identified in a Neolithic horizon. It cannot be ruled out that also some effects of climate drying (e.g. Mayewski *et al.*, 2004; Di Donato *et al.*, 2008) could have enhanced land degradation after the Neolithic climatic *optimum*, as also coherent with above decrease or interruption of clay illuviation in younger soils. However, in the mountainous area of Cecita Lake, the decline of the deciduous oak forest could mainly be caused by the human overexploitation of the forest resource. To better determine the significance of climate or human influence in this area two new soil profiles from Cecita Lake are going to be analyzed pedoanthracologically, with the aim to have a more detailed chronological succession and a more accurate date for the shift from the deciduous oak forest to the mountain pine forest. New AMS dating is going to be done. AMS dating is required also for both data concerning the silver fir and post Bronze Age oak found at Palmi.

CONCLUSIONS

The anthracological and pedological analysis carried out in Palmi (south-western Calabria) suggest a stability of forest cover form Neolithic to the post-Bronze Age. At Cecita Lake (north-central Calabria) the data shows a transition from a deciduous oak forest dominant in the Neolithic soils to a mountain pine forest characterizing the Roman soils. In the mountainous area of Cecita Lake, this shift could be mainly caused by the human overexploitation of the forest resource. New analyses are going to start to clarify this aspect.

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