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Late Pleistocene–Holocene landscape evolution in Fossa Bradanica, Basilicata (southern Italy)

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ABSTRACT

Studies in the middle Basento river basin supported by reliable chronological data (tephra layers and a number of absolute datings) have allowed the reconstruction of Late Pleistocene–Holocene geomorphological evolution of the middle to low Fossa Bradanica area (Basilicata, southern Italy). The original Upper Pleistocene hillslope has been dissected by deep gullies leaving relict slope pediments. Holocene filling of the Basento river valley and gullies occurred as a succession of downcut and fill episodes. A first phase of accumulation occurred in the Late Neolithic, which was followed by a downcutting between 4500 and 3700 cal. yr BP. A second deposition phase took place in the Greek–Roman period between 2800 and 1620 cal. yr BP, which was interrupted at around 2500 cal. yr BP. Another downcutting phase took place between 1620 and 1500 cal. yr BP, followed by a deposition phase between 1440 and 1000 cal. yr BP. After 1000 cal. yr BP a deep downcutting took place. Evidence collected with this study, coupled with climate data recorded in other Italian and European locations, suggests that filling and downcutting episodes in Fossa Bradanica were predominantly climate-driven. Anthropogenic impact only intensified or weakened these processes.

1. Introduction

The landscape of Fossa Bradanica in Basilicata, southern Italy, reflects a long history of tectonic activity, sea-level changes and climate shifts. Drainage systems respond to such events by changing valley erosion and deposition patterns. Channel gradients, stream discharge, and sediment flux may respond rapidly to tectonic or eustatic movements, to changes of precipitation regime, to deforestation and agricultural practices. Anthropogenic activity has been considered by some authors as a significant factor for the landscape evolution. Nonetheless, it is always difficult to state which of the two factors (climatic versus human) is to be considered as the driving mechanism behind the valley fill accumulation or downcutting. Some sedimentary sequences also show that during the Holocene, the deposition style must have shifted abruptly from one cause to another (Wilkinson, 1999). The first investigations on the Holocene evolution in Basilicata were carried out by Neboit (1977, 1980, 1983), Brückner (1982, 1983, 1986, 1990), Brückner and Hoffman (1992), Boenzi et al. (1986) and Abbott and Velastro (1995). They studied both the deposits filling the incisions and those forming the Upper Holocene terraces in the Bradano, Basento and Cavone river basins. Neboit (1977, 1980, 1983), Brückner (1982, 1983, 1986, 1990) and Brückner and Hoffman (1992) suggest that valley bottom deposition in the main rivers mostly occurred during the Greek–Roman period, when the extensive land use caused accelerated erosion processes within basin areas. Neboit rules out the influence of climate-driven processes, since during the Holocene no arid or semi-arid climatic phases have been recorded. Abbott and Velastro (1995) suggest that in southern Italy two significant accumulation phases occurred throughout the Middle to Late Holocene: one during the Neolithic, the other during the Iron Age. The latter, could have been caused by the intense land use that occurred during the Greek colonization period (Adamasteanu, 1974).

Grove (2001) favoured the climatic forcing mechanism by hypothesizing that in Mediterranean areas many of the recent Holocene accumulations (*sensu* Vita-Finzi, 1969) could have been produced during cold–wet periods, as happened during the Little Ice Age. Grove (1988) and Grove and Rackham (2001) state that valley fills in Mediterranean countries are contemporaneous with Alpine glacier growth.

The goal of this work is to highlight the Late Pleistocene and Holocene evolution of Fossa Bradanica, focusing on a small area of the middle valley of the Basento river basin. In particular, we reconstructed the Quaternary evolution of this area by means of analyses of both terrace deposits and valley fills, with the aim of stressing the relative role of climate conditions versus anthropogenic activities.

We consider this area as a good test site because of the contemporaneous occurrence of: well exposed Pleistocene and Holocene

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deposits; tephra marker layers, whose chemical and mineralogical composition and stratigraphic position allow a precise correlation with well known explosive eruptions of the Campanian volcanic districts (Phlegrean Fields and Vesuvius); well-preserved artifacts useful for sediment dating and paleo-landscape reconstruction. The combined analysis of these data allowed interpretation of the chronological sequence of the morphogenetic processes that occurred in the study area through the Late Pleistocene and Holocene.

2. Study area and methods

The study area is located south-west of Pomarico, between Masseria Glionne (40°28′49″N, 16°31′06″E) and Masseria Trincicanaro di Capo (40°27′07″N, 16°33′30″E) on the north side of the Basento river (Fig. 1). It is characterized by a modified Mediterranean climate, with a mean annual precipitation of 750 mm, mean July temperature of 22 °C and a mean January temperature of 7 °C (Piccarreta et al., 2004, 2005). The vegetation cover is a man-modified, scrub oak-pine woodland with a mixed shrub understory.

A general geological and morphological analysis has been carried out using stereoscopic aerial photographs (scale 1:30,000) and topographic maps (scale 1:25,000). Detailed field survey has been carried out to reconstruct the stratigraphic sequence of terrace and fluvial deposits and to collect samples for successive laboratory analyses. In particular, we sampled in detail three stratigraphic successions (CAP 1, CAP 2 and CAP 3). They were chosen because of their good exposure, easy correlation through marker horizons, and the presence of features highly indicative of paleoenvironmental conditions. For each sequence we analysed sediment grain size, structures and composition. Gravelly beds and sets of lenses made of cross-laminated sand alternating with fine gravel material have been interpreted as channel deposits. Finer loamy material in massive continuous beds, showing laminations or ripple marks, has been interpreted as overbank deposits. Brownish and dark-brownish layers yielding charcoals, land snails, root marks and calcium carbonate concretions have been interpreted as palaeosols.

A reliable chronological dataset, consisting of several ^{14}C datings (see Table 1), tephra horizons (related to known eruptions that occurred in the Campanian region) and a few preserved artifacts (mainly potshards and a burial), allowed a detailed reconstruction of the events that occurred in the study area, particularly during the Middle to Late Holocene.

Tephra layers were analysed for their characteristic chemical, mineralogical compositional, and glass particle morphology, which helped attribute them to well known explosive eruptions. The archaeological material has been studied by Dr. A. De Siena, from Soprintendenza Archeologica della Basilicata. Radiocarbon-dated material has been processed at CEDAD — CEnter for DAting and Diagnostics (laboratory code LTL), University of Salento (Lecce, Italy),

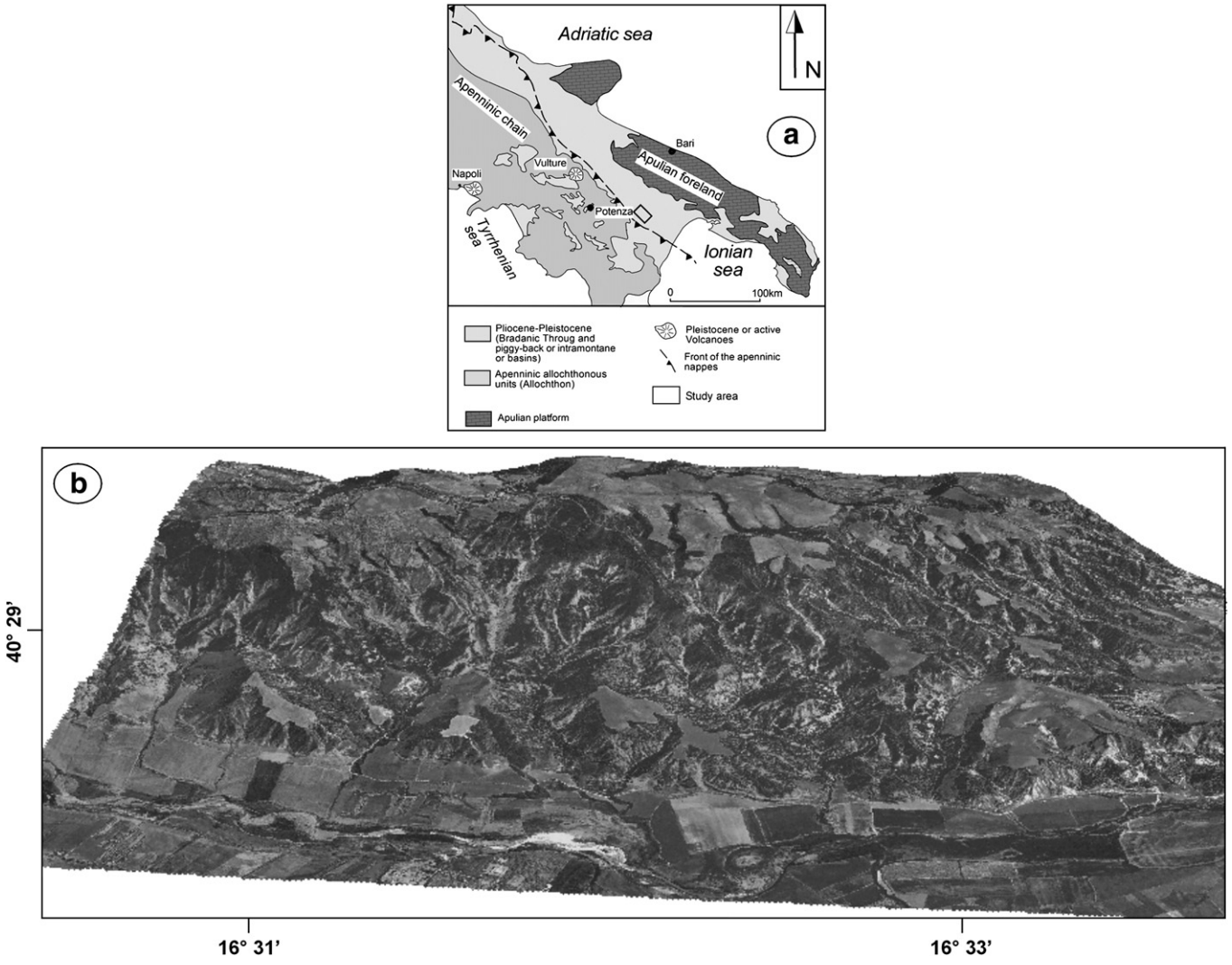

Fig. 1. Study area location (a) and its 3D oblique aerial view (b).