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# Tectonics, sea-level changes and palaeoenvironments in the early Pleistocene of Rome (Italy)

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ABSTRACT

The historical site of the Monte Mario lower Pleistocene succession (Rome, Italy) is an important marker of the Pliocene/Pleistocene boundary. Recently, the Monte Mario site was excavated and restudied. A spectacular angular unconformity characterizes the contact between the Monte Vaticano and the Monte Mario formations, which marks the Pliocene/Pleistocene boundary. Biostratigraphical analyses carried out on ostracod, foraminifer, and calcareous nannofossil assemblages indicate an Early Pliocene age (topmost Zanclean, 3.81–3.70 Ma) for the underlying Monte Vaticano Formation, whereas the Monte Mario Formation has been dated as early Pleistocene (Santernian, 1.66–1.59 Ma). Palaeomagnetic analyses point to C2Ar and C1r2r polarity chrons for the Monte Vaticano and the Monte Mario formations, respectively. The Monte Mario Formation consists of two obliquity-forced depositional sequences (MM1 and MM2) characterized by transgressive systems tracts of littoral marine environments at depths, respectively, of 40–80 m and 15–20 m. The data obtained from foraminifer and ostracod assemblages allow us to reconstruct early Pleistocene relative sea-level changes near Rome. At the Plio/Pleistocene transition, a relative sea-level drop of at least 260 m occurred, as a result of both tectonic uplift of the central Tyrrhenian margin and glacio-eustatic changes linked to early Pleistocene glaciation (Marine Isotope Stage 58).
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## Introduction

The Monte Mario succession has historically played a role in discussions about the definition of the global stratotype for the Pliocene/Pleistocene boundary. At the 18th International Geological Congress (London, 1948), the International Commission on Stratigraphy suggested that the Pliocene/Pleistocene boundary stratotype should be placed at the base of the Italian Calabrian stage, in accordance with the first indication of climatic deterioration in the Italian Neogene succession (Pillans and Naish, 2004). At that time, the occurrence of "northern guest" molluscs in the Mediterranean fauna was considered as the first indication of significant climatic deterioration. Following these criteria, at the 19th International Geological Congress (Algiers, 1952), four Italian sections containing "northern guests" were considered as potential reference sections for the Pliocene/Pleistocene boundary: the Monte Mario section near Rome (Blanc et al., 1954), the Castell'Arquato section near Piacenza (Di Napoli, 1954), the Santerno section near Imola (Ruggieri, 1954), and the Val Musone section near Ancona (Selli, 1954). None of these sections was subsequently accepted, but in 1977 the proposal for the location of the Pliocene/Pleistocene boundary stratotype at the Vrica section (Crotone, Calabria, southern Italy) was first proposed (Selli et al., 1977) and then formally ratified by IUGS in 1985 (Basset, 1985). Regardless, several authors consider the Monte Mario section, which contains the "northern guest" mollusc *Arctica islandica* at the base of the Pleistocene strata, a regional reference section of the Pliocene/Pleistocene boundary in central Italy.

The present multidisciplinary study on the Monte Mario succession was designed to allow us to compare it with the Vrica section and with other Mediterranean Pliocene/Pleistocene successions. Moreover, it provides indications about tectonic versus glacio-eustatic forcing in the evolution of the Pliocene–Pleistocene syn-rift sedimentary basins at the Tyrrhenian margin of the Apennines.

The marine sedimentary succession that crops out at Monte Mario and Monti della Farnesina (Rome, Italy, Fig. 1) has been studied since the early 19th century (Brocchi, 1820; Ponzi, 1872). Within the Monte Mario succession, these authors recognized the presence of a well-developed unconformity separating the Pleistocene strata from the underlying Pliocene sediments. Moreover, the Pliocene deposits were

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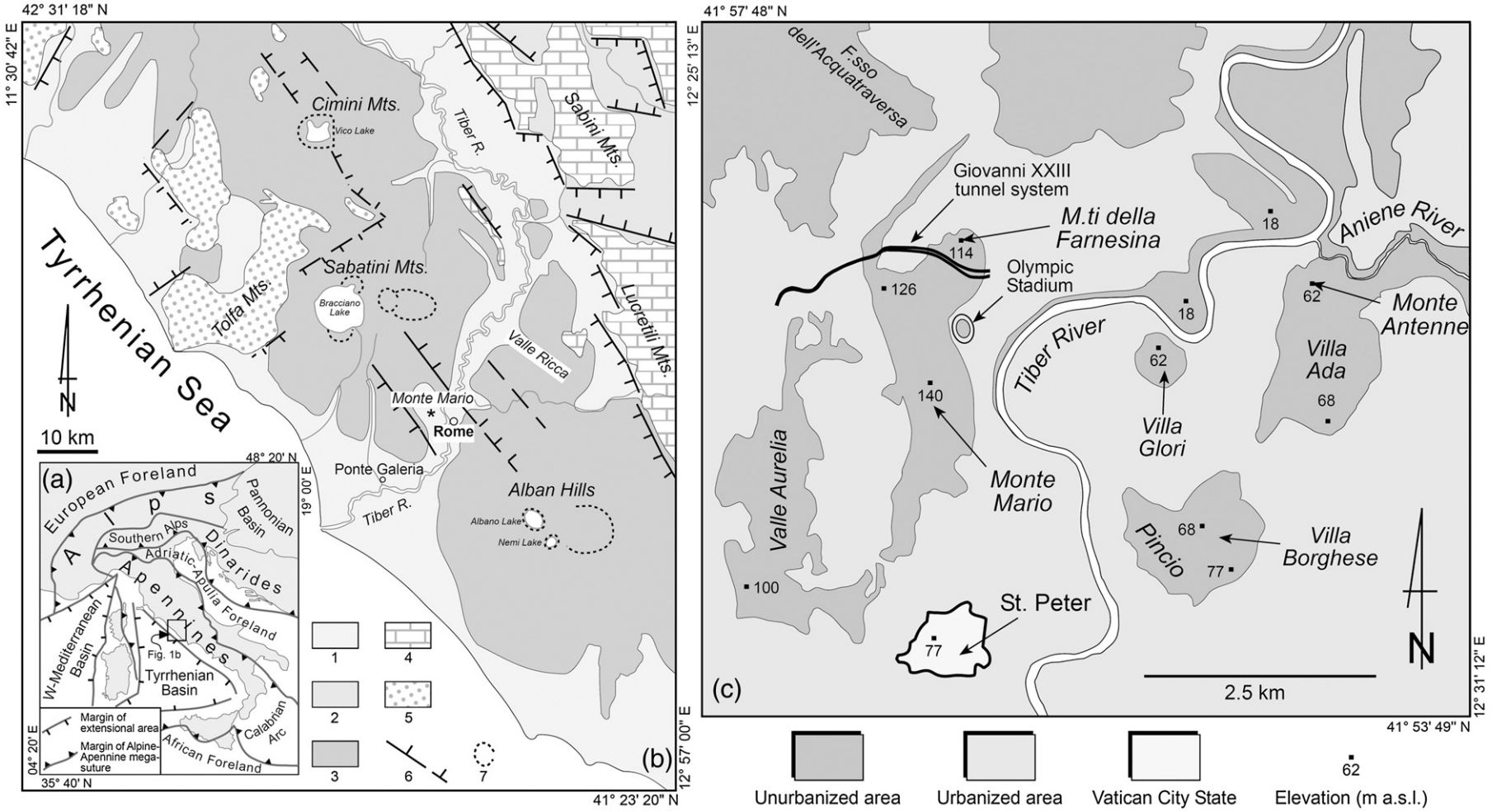


**Figure 1.** a) Structural sketch map of Italy and surrounding region. b) Geological sketch map of the central Italy Tyrrhenian margin. 1) Marine and continental deposits (Pliocene–Quaternary); 2) continental deposits (Villafranchian); 3) volcanics (Quaternary); 4) Meso-Cenozoic shallow- and deeper-water carbonates; 5) crystalline Paleozoic basement and sub-Ligurian (Cretaceous–Paleogene) allochthonous units; 6) extensional fault; 7) caldera and crater rim. c) Detail of the city map of Rome with the location of the Giovanni XXIII tunnel system.

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