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Original article

Late Messinian rodents from Verduno (Piedmont, NW Italy): Biochronological, paleoecological and paleobiogeographic implications[☆]

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ABSTRACT

The stratigraphic and paleoenvironmental context of the Verduno fossil vertebrate locality is discussed herein based on its rodent record. The Verduno section crops out in the southern part of the Tertiary Piedmont Basin (TPB), and can be included in the Messinian post-evaporitic Cassano Spinola Fm., chronologically corresponding to the so-called Lago-Mare event. Rodents are represented by a relatively rich assemblage. Murids are by far the most diverse and abundant, with at least four taxa, including the common *Centralomys benericettii* and *Paraethomys meini*, and the rare *Apodemus gudrunae* and *Occitanomys* sp. Cricetids are represented by a single species, *Apocricetus* cf. *A. barrierei*. *Muscardinus* aff. *M. vireti* appears to be the only glirid present at Verduno. The Verduno rodent assemblage shares some taxa with other Messinian post-evaporitic localities from Italy bearing continental vertebrate remains, such as Brisighella (central Italy) and Moncucco Torinese (NW Italy) (e.g., *C. benericettii*, *P. meini*) and, possibly, with Ciabòt Cagna (NW Italy). However, the general structure of these four Messinian assemblages displays substantial differences, which may reflect different palaeoenvironmental conditions.

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1. Introduction

The present study is part of a broader research work focused on the analysis of the structure and composition of the Late Miocene vertebrate communities of the Piedmont region. The modern stratigraphic study of the Messinian deposits of the Tertiary Piedmont Basin (TPB), as well as the analysis of the geodynamic processes that controlled the sedimentation in the basin before, during and after the Messinian Salinity Crisis, were started by Sturani in the 1970s. From the beginning of such stratigraphic researches, continental deposits were identified at the top of the Messinian succession. These deposits are characterized by the presence of brackish molluscs (the so-called *Congerina* beds; Sturani, 1973, 1976) and have been traditionally assigned to the Cassano Spinola Conglomerates Fm. (Boni and Casnedi, 1970; Ghibaudo et al., 1985; Clari et al., 2008; Bernardi et al., 2010; Dela Pierre et al., 2011). Messinian remains of terrestrial vertebrates are extremely rare in Piedmont, up to date known exclusively from the site of Ciabòt Cagna, near Corneliano d'Alba (Cavallo et al., 1993).

Extensive exploration of the Messinian deposits of the TPB, carried out in the last few years by the paleontologists of the Università degli Studi di Torino, led to the discovery and study of two new sites, Moncucco Torinese and Verduno, in the northern and southern part of the TPB, respectively.

The vertebrate assemblage of Moncucco Torinese has been the subject of a preliminary analysis (Angelone et al., 2011), which evidenced the presence of a relatively large number of taxa, including several small mammals. The site of Verduno is known just for the presence of a few carnivoran remains (*Hyaenictitherium* sp. and *Eucyon monticinensis*) randomly collected along the banks of the Tanaro River (Sardella, 2008). The purpose of this paper is to present the rodent remains collected in this site during the excavation campaign organized in July 2010 by the Dipartimento di Scienze della Terra, Università degli Studi di Torino, and to discuss their stratigraphic and paleoenvironmental implications. Besides rodents, the other vertebrate remains collected at Verduno during the excavation campaign are currently under study and will be described in a forthcoming paper.

2. Geographic and geological settings

The site of Verduno is located in the southern part of the TPB near the town of Alba, in the Cuneo Province (Fig. 1). The

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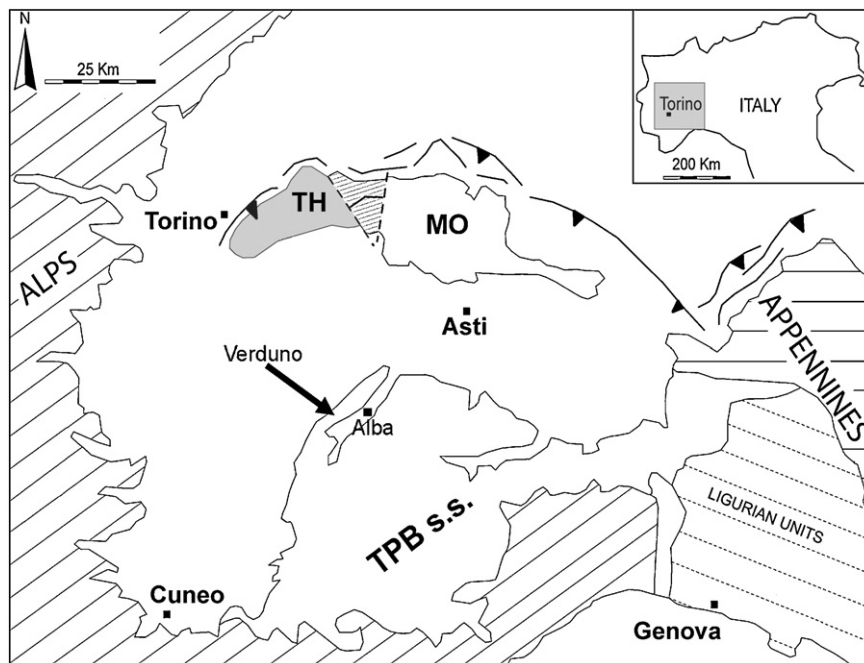


Fig. 1. Geographic setting. The arrow indicates the position of the Verduno fossil site. TH: Torino Hill; MO: Monferrato; TBP s.s.: Tertiary Piedmont Basin *sensu stricto*. From Angelone et al. (2011).

fossiliferous deposits are restricted to the upper portion of a succession, known in the literature as the “Pollenzo section” (Bernardi et al., 2010; Dela Pierre et al., 2011; Fig. 2), well exposed along the Tanaro River. The Pollenzo section is part of the Alba succession and documents the sedimentary processes that occurred during the Messinian at the boundary between marginal and basinal areas in the southern portion of the TPB (Dela Pierre et al., 2011). Overall, the Pollenzo section has provided relevant data for the improvement of the knowledge of events related to the Messinian Salinity Crisis (Bertini and Martinetto, 2011; Dela Pierre et al., 2011).

The base of the Pollenzo section consists of marine pre-evaporitic sediments of the Marne di S. Agata Fossili Fm., which are overlain by the evaporites of the Alba Primary Lower Gypsum Unit, corresponding to the Vena del Gesso Fm., formerly known as the Gessoso-Solfifera Fm. (Roveri and Manzi, 2007). This unit consists of euxinic shales and different types of gypsum lithofacies that testify the evaporitic interval of the Messinian Salinity Crisis (5.96–5.55 Ma; CIESM, 2008; Dela Pierre et al., 2011). The basal portion of the post-evaporitic deposits corresponds to the Valle Versa Chaotic Complex, characterized by slumped mudstones with displaced meter-sized gypsum slabs, whereas the upper portion consists of fresh- and brackish-water deposits (muddy and silty beds crossed by sandy and gravelly layers) of the Cassano Spinola Conglomerates Fm. (Dela Pierre et al., 2011). This unit was deposited in the terminal phase of the Messinian Salinity Crisis, approximately from 5.5 to 5.33 Ma (CIESM, 2008; Dela Pierre et al., 2011). The uppermost layers of the Cassano Spinola Conglomerates Fm. are characterized by greenish marls whose upper part progressively becomes more bioturbated (Bernardi et al., 2010). This unit is followed by a 30–40 cm-thick muddy black layer. Many traces of bioturbation are present in this level, such as galleries filled by gray marls of the overlying Argille Azzurre Fm. Because of the presence of the nanofossil species *Reticulofenestra zancleana*, the lowermost portion of the Argille Azzurre Fm. of the Pollenzo section can be assigned to the lower Zanclean MNN12a calcareous nanofossils subzone (Bernardi et al., 2010).

3. Stratigraphy of the excavation site

The excavation site is located approximately 20 m below the “black layer” marking the Mio-Pliocene boundary, and 25 m above the slumped marls of the Valle Versa Chaotic Complex, thereby implying that the vertebrate-bearing layers clearly belong to the Cassano Spinola Conglomerates Fm. It is very difficult to define in great detail the exact stratigraphic position of these fossiliferous layers within the section because of the inadequate knowledge of the stratigraphic and sedimentological features of the Cassano Spinola Conglomerates Fm. at Pollenzo which is also affected by faulting, and, more importantly, because the upper part of this section is covered by a very thick layer of deposits derived from the annual floods of the Tanaro River.

Five distinct stratigraphic layers can be recognized in the excavation site, with a maximum thickness of about 2 m (Fig. 3). The three lower layers can be followed laterally for tens of meters as they crop out in the bed of the Tanaro River. The two upper layers show the typical features of the fluvial facies (Einsele, 1992) and are laterally discontinuous, following the erosive surfaces over which they lay on. The fossil remains come from layers 1, 2 and 5. The succession is schematically summarized on Fig. 3 and can be described as follows from top to bottom:

- layer 5 (20–50 cm) lies on an erosive surface and consists of cross-bedded conglomerates with subcentimetric pebbles, mainly of gypsum. This layer is separated from layer 4 by an erosive surface. Fossils are represented by remains of small mammals;
- layer 4 (50–90 cm) is characterized by sub-horizontal or, more rarely, oblique laminated greenish to gray sands. The base is made of by conglomerates. These barren sediments lay over an erosive surface. A portion of this layer is covered by the current deposits coming from Tanaro river flooding;
- layer 3 (10–15 cm) consists of gray to greenish clays with sub-horizontal or slightly oblique, partially laminated silty clays. There are no fossils;

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