

Original article

# The rodents from the Late Miocene *Oreopithecus*-bearing site of Fiume Santo (Sardinia, Italy)<sup>☆</sup>

*Les rongeurs du site miocène supérieur à Oreopithecus de Fiume Santo (Sardaigne, Italie)*

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## Abstract

The locality of Fiume Santo (Sardinia, Italy) represents the westernmost extension of endemic *Oreopithecus*-bearing faunas. Here we describe the rodent fauna recovered at this site, which only includes the murids *Huerzelerimys oreopithecus* and *Anthracomys lorenzi*, and the glirids *Anthracoglis engesseri* nov. sp. and *Anthracoglis* nov. sp. *I. A. engesseri* nov. sp. differs from *Anthracoglis marinoi*, the other species of this genus known so far, by its larger size, wider upper cheek teeth and more reduced accessory ridges, particularly in the upper cheek teeth. *Anthracoglis* nov. sp. I is only known by a single tooth and cannot be adequately characterized. The fauna seems to be a mixture of elements from the V-1, V-2 and V-3 local zones of the Baccinello-Cinigiano basin (Tuscany, Italy), with *H. oreopithecus* being characteristic from zone V-1 and *Anthracoglis lorenzi* from zone V-3. Nevertheless, a few remains of *A. lorenzi* have been also recovered from V-2 assemblages at Baccinello and *A. engesseri* nov. sp. is also recorded in Monte Bamboli, which is correlated to V-2 faunas. Accordingly, a correlation to V-2 zone of the Baccinello-Cinigiano basin is preferred. Finally, the structure and composition of the rodent assemblage is compared to those of the Tuscan sites. The Fiume Santo assemblage resembles the insular faunas of Tuscany by its low species richness, although it is more balanced. This may be related to slight chronological or environmental differences between the two areas or to the existence of a geographical barrier.

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**Keywords:** Insular faunas; Small mammals; Muridae; Gliridae; New species; Late Miocene; Hominoidea

## Résumé

La localité de Fiume Santo (Sardaigne, Italie) représente l'extension la plus occidentale des faunes endémiques à *Oreopithecus*. Nous décrivons ici la faune de rongeurs de ce site, qui ne comprend que les muridés *Huerzelerimys oreopithecus* et *Anthracomys lorenzi*, ainsi que les gliridés *Anthracoglis engesseri* nov. sp. et *Anthracoglis* nov. sp. *I. A. engesseri* nov. sp. diffère de *Anthracoglis marinoi*, l'autre espèce de ce genre connue à ce jour, par sa plus grande taille, des dents jugales supérieures plus larges et des crêtes accessoires plus réduites, notamment sur les dents jugales supérieures. *Anthracoglis* nov. sp. I n'est connu que par une seule dent et ne peut être correctement caractérisé. La faune semble être un mélange d'éléments des zones locales V-1, V-2 et V-3 du bassin Baccinello-Cinigiano (Toscane, Italie), *H. oreopithecus* étant caractéristique de la zone V-1 et *Anthracoglis lorenzi* de la zone V-3. Néanmoins, quelques restes de *A. lorenzi* ont également été retrouvés dans des assemblages de la zone V-2 à Baccinello, et *A. engesseri* nov. sp. est également enregistré au Monte Bamboli, corrélé aux faunes de la zone V-2. De fait, une corrélation avec la zone V-2 du bassin Baccinello-Cinigiano est favorisée. Finalement, la structure et la composition de l'assemblage de rongeurs sont comparées à celles des sites toscans. L'assemblage de Fiume Santo ressemble aux faunes insulaires de Toscane par sa faible richesse spécifique, bien qu'il soit plus équilibré. Cela peut être relié à de légères différences chronologiques ou environnementales entre ces deux régions, ou bien à l'existence d'une barrière géographique.

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**Mots clés :** Faune insulaire ; Petits mammifères ; Muridae ; Gliridae ; Nouvelle espèce ; Miocène supérieur ; Hominoidea

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## 1. Introduction

The Late Miocene land mammal record of Italy includes just a few tens of localities, which evidence a complex palaeogeographic history. During most of the Miocene, Italy was an archipelago isolated from the European mainland. Up to three distinct bioprovinces can be recognized during this time span: the Abbruzzi-Apulia, Tusco-Sardinia and the Calabria-Sicily areas (Rook et al., 2006). The two former bioprovinces are characterized by highly endemic faunas and do not share a single taxon with each other. This suggests that they represent two distinct emerged areas with completely independent palaeobiogeographic histories, one on the Adriatic side of Italy (Abbruzzi-Apulia) and the other on the Tyrrhenian side (Tusco-Sardinia). The Messinian faunas of the Calabria-Sicily area include non-endemic mammals related to North African and European taxa (Rook et al., 2006).

Most of what is known about the Tusco-Sardinian palaeobioprovince is documented by the faunas from the Baccinello-Cinigiano basin in southern Tuscany. The earliest fossil finds date back to the 19th century and were recovered from lignite mines (Savi, 1843; Gervais, 1872; Major, 1873). The Tuscan faunas have deserved considerable attention because of the recovery of a fossil great ape, *Oreopithecus bambolii*, in the Monte Bamboli coal mine, as well as in other mines in the region. *Oreopithecus* deserves the doubtful honour of being the fossil primate for which the greatest number of different phylogenetic hypotheses has been proposed. It has been considered as a cercopithecoid, a hominoid, a hominid and even a simian descendent from Eocene artiodactyls (for a review, see Delson, 1987). All these works have referred to *Oreopithecus* as a “bizarre” or “enigmatic” primate and the reconstructions of its postural and locomotor behaviour are as distinct as the reconstruction of its phylogenetic relationships. More recent studies have related this taxon to other European Miocene hominoids such as *Hispanopithecus* (Moyà-Solà and Köhler, 1997) and have interpreted its postcranial anatomy as indicative of habitual bipedality combined with some climbing adaptations (Köhler and Moyà-Solà, 1997; Moyà-Solà et al., 1999; Rook et al., 1999). The faunas of the Tusco-Sardinian palaeobioprovince are often referred to as *Oreopithecus* faunas and consist of an endemic and taxonomically poor assemblage without carnivores other than otters (*Tyrrhenolutra*, *Paludolutra*). Hürzeler and Engesser (1976) were the first to recognize the endemic insular character of these faunas and remarked that many mammals show typical specializations such as markedly hypsodont cheek teeth and continuously growing incisors (e.g., the bovid *Maremmia*; Hürzeler, 1983). The peculiar anatomical adaptations of *Oreopithecus* would also be a product of an insular evolution (Moyà-Solà and Köhler, 1997). The endemic rodents show a tendency to attain large sizes and to develop high-crowned cheek teeth (Hürzeler and Engesser, 1976). These include a giant dormouse known by a single molar (*Gliridae* nov. gen. et nov. sp. in Engesser, 1983), the much smaller dormouse *Anthracoglis marinoi* (Engesser, 1983), and the mice *Huerzelerimys oreopithecii*, *Anthracomys lorenzi* and *Anthracomys majori* (Engesser, 1989).

The dating of the *Oreopithecus* faunas has been problematic because of their endemism. The Baccinello-Cinigiano basin succession has been divided into four different biochronological units named V-0 to V-3 (Lorenz, 1968; Engesser, 1989; Rook et al., 1996). The V-1 and V-2 faunas are completely endemic but the V-0 and V-3 assemblages are not, allowing some constraints on the age of the *Oreopithecus* faunas. The occurrence of the non-endemic murid *Huerzelerimys vireti* in the V-0 assemblage allowed Engesser (1989) to propose a tentative correlation of this unit with Mein's Mammal Neogene (MN) Zones. This murid indicates a MN11 age for V-0, while the presence of *Apodemus*, *Celadensia* and *Hystrix* in the V-3 assemblage points towards an MN13 age (Engesser, 1989; Rook et al., 2000). Therefore, the *Oreopithecus* faunas were short lived, spanning less than 2 million years, from ~8.5 to ~6.5 Ma (approximate chronological boundaries for the MN zones following Agustí et al., 2001). The chronology of the endemic faunas has been further refined thanks to the radiometric dating of  $7.5 \pm 0.03$  Ma for a volcanic layer within the Baccinello succession, placed between units V-1 and V-2 (Rook et al., 2000).

In the early 1990s a new *Oreopithecus*-bearing site, named Fiume Santo, was discovered in north-western Sardinia during the construction of a parking area near a thermo-electric power station (Cordy and Ginesu, 1994; Cordy et al., 1995; Rook et al., 2006a). This finding allowed the expansion of the geographical range of the endemic *Oreopithecus*-bearing faunas in the northern Tyrrhenian area from Tuscany to Sardinia. Furthermore, the fossils recovered at Fiume Santo do not show the extensive deformation and distortion present in the specimens recovered in the lignite mines of Tuscany. The Fiume Santo site has been intensively sampled and has delivered a rich fauna that includes both macro- and microvertebrates. The macrovertebrates were described by Abbazzi et al. (2008) and include many other endemic taxa shared with the Tuscan sites besides *Oreopithecus* (*Maremmia*, *Umbrotherium*, *Tyrrhenotragus*, *Eumaiocoerus*). On the basis of the macromammal assemblage Abbazzi et al. (2008) correlated Fiume Santo to the V-2 unit of the Baccinello-Cinigiano basin. Regarding the small mammals, Cordy et al. (1995) listed the murid *Valerimys* aff. *turoliensis* (sic) and a large-sized glirid. Thanks to the continuous works carried out at the Fiume Santo site by the team of the University of Florence, a rich microvertebrate sample that includes ~200 rodent cheek teeth is now available. In this work we describe these rodent remains and we provide further data on the chronology and palaeoecology of the Fiume Santo fauna.

## 2. Material and methods

The material described in this paper is provisionally housed at the Earth Sciences Department of the University of Florence (collection numbers refer to as FS-#). Once the study of the site will be accomplished, the final repository of the entire Fiume Santo fossil collection will be in the archives of the *Soprintendenza per i Beni Archeologici per le Provincie di Sassari e Nuoro*. The classification of rodents used in this work follows McKenna and Bell (1997) while the terminology of the

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