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Palaeoenvironmental and palaeoclimatic reconstruction of the latest Pleistocene–Holocene sequence from Grotta del Romito (Calabria, southern Italy) using the small-mammal assemblages

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ABSTRACT

The habitat weighting method, the Simpson diversity index and the mutual climatic range method are applied to the small-mammal assemblage of Grotta del Romito (southern Italy) in order to reconstruct the environmental and climatic fluctuations that occurred during the latest Pleistocene–Holocene sequence of the cave. The analysed strata have a discontinuous chronological range from the middle-late Gravettian (ca. 24 ka uncal. BP) to the Mesolithic–Sauveterrian (still radiometrically undated). Gravettian and Epigravettian layers were excavated inside the cave, Mesolithic layers in the rockshelter outside the cave. The small-mammal assemblage shows significant differences along the sequence; a turning point is detected in strata D29-D11, coinciding with the end of Heinrich Event 1 (H1) and the beginning of the Bølling–Allerød interstadial (between ca. 14.9–14 ka cal. BP). These data are in accordance with the previously obtained environmental data for Grotta del Romito, as well as with other continental climatic and environmental changes detected at a regional scale.

1. Introduction

The Late Pleistocene is a geochronological age that began with the Eemian interglacial (ca. 126 ka BP) and ended at ca. 11.7 ka BP, which represents the beginning of the Holocene (Walker et al., 2009). The latest Pleistocene is the last phase of this age, basically represented by Marine Isotope Stage 2 (MIS2) and the beginning of the MIS1 (ca. 14.7 ka BP) (Lisiecki and Raymo, 2005). These stages are highlighted in all geological sources as the most intense glacial phase, characterized by rapid and major climatic changes (Vermeersch, 2005), and ranging chronologically from ca. 27 to 11.7 ka BP. MIS2 contains two Heinrich Events (H2 and H1), dated respectively to ca. 24 ka BP (H2) and to 16 ka BP (Oldest Dryas or H1), and also the glacial maximum (LGM), the period of maximum marine regression (Clark et al., 2009), with a controversial chronological range, for some authors it ranges from ca. 23 to 19 ka BP (Ravazzi et al., 2007) and for other it ranges from ca. 26.5 to 19 ka BP (Clark et al., 2009). This glacial maximum phase is followed by the most recent phase of MIS2, known as the Late Glacial (the beginning of the MIS1), which precedes the Holocene and ranges chronologically from ca. 14.7 to 11.7 ka BP. During this period there occurs a set of climatic fluctuations called the Bølling–Allerød interstadial, and the Younger Dryas or H0. The transition between the glacial and interglacial conditions occurs with a first rapid increase in temperature to levels very similar to those of today, which takes place about 14.5 ka BP, corresponding to the Bølling–Allerød interstadial (Ravazzi et al., 2007). This period is followed by a climatic cooling, dated to ca. 12.6 ka BP and characterized in some areas by a loss of vegetation coverage and a return to steppe conditions, known as the Younger Dryas or H0 (Ravazzi et al., 2007). The Younger Dryas–Holocene transition is dated to ca. 11.7 ka BP, and is characterized by an increase in temperatures and precipitation. The Holocene is overall a stable period from the thermal point of view, during which the changes in average annual temperatures are always contained within 2 °C, with a single negative peak evident at 8.2 ka cal. BP (Orombelli and Ravazzi, 1996). This epoch is divided into four sub-periods reflected in climate change and vegetation: Preboreal (11.7–9 ka BP), considered a period of transition with hints of climatic improvement; Boreal (9–8 ka BP), characterized by a temperature increase and a continental climate; Atlantic (8–5 ka BP), where the Holocene climatic optimum occurs; Subboreal (5–2.5 ka BP), where the climate is cooler with continental traits.

It is in this climatic context that the latest Pleistocene–Holocene (Upper Palaeolithic–Mesolithic) archaeological sequence of the Romito site (including the sequences of the cave and the rockshelter) is located,

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considered one of the most important Upper Palaeolithic–Mesolithic archaeological records in the western Mediterranean region (Martini et al., 2003, 2007; Martini and Lo Vetro, 2005). This archaeological excavation provides a high-resolution, well-dated, continental stratigraphic succession from ca. 24 ka uncal. BP to the Neolithic (Martini et al., 2004, 2007; Martini and Lo Vetro, 2005, 2007, 2011), through a period of considerable climate change that deeply affected the local environment (Colonese et al., 2007; Ghinassi et al., 2009). Against this background, the aim of this paper is to undertake the environmental and climatic reconstruction of the latest Pleistocene–Holocene archaeological sequence of the Romito site (rockshelter and cave) according to the small-mammal assemblages (of insectivores, bats and rodents), comparing our results with previous environmental interpretations of the sequence based on sedimentological analysis (Ghinassi et al., 2009), terrestrial-shell studies (Colonese et al., 2007) and large-mammal studies (Bertini Vacca, 2012). In addition to this, we place our data in a broader context incorporating other disciplines, such as the studies of continental pollen and sedimentary lakes in Italy (Nimmergut et al., 1999; Narcisi, 2001; Magny et al., 2006), studies of other Italian sites with a similar chronology and comparable small-mammal associations, such as Grotta della Serratura (Bertolini et al., 1996), Cava Filo (Berto, 2013), Grotta della Ferrovia (Bartolomei, 1966), Grotta Paglicci (Berto, 2013) and Riparo Tagliente (Berto, 2013), as well as the global context of the climate changes that occurred during the latest Pleistocene–Holocene period.

2. Grotta del Romito

Grotta del Romito (39° 54' N, 15° 55' E) is located in the Lao Valley in southern Italy, at an altitude of 275 m above sea level, and ca. 12 km in a bee-line from the Tyrrhenian Sea (Fig. 1). The region has a rugged, high-relief topography with mountain peaks over 2000 m high descending steeply towards the coast. The cave is situated at the foot of a rocky cliff on the right side of a narrow creek tributary of the Lao River, which itself is less than 1 km away. The cave is in a Jurassic limestone containing reddish-brown mudstone interbeds, underlain by a darkish-grey Triassic dolostone, the dominant rock type of the area, and overlain by Miocene calcarenites that form the upper part of the local topography. A deeper bedrock, comprising brownish-grey schist with thin metaquartzite beds, crops out in the upper reaches of the creek. Boulders that lie on the slope in front of the entrance are the collapsed remains of a rockshelter (known as Romito rockshelter), which would have connected to the main cave during the Palaeolithic period to form a large living space (Ghinassi et al., 2009; Craig et al., 2010; Martini and Lo Vetro, 2011).

The site has a long history of excavation. It was first excavated in the 1960s by Paolo Graziosi (Graziosi, 1962, 1971), who opened some archaeological trenches both in the cave and under the rockshelter (Fabbri et al., 1989; Mallegni and Fabbri, 1995; Boscato et al., 1996). In 2000 a new project of archaeological excavations was begun inside the cave, enlarging the old trench (Graziosi's research) and yielding, on both the west and east sides, well-preserved Palaeolithic deposits (Martini and Lo Vetro, 2005, 2007, 2011; Martini et al., 2007). This systematic excavation exposed an important sequence of archaeological units (from A to N), consisting of deposits of similar colour, grain size and texture and bearing several archaeological layers (often palaeosurfaces) formed during episodes of intensive human occupation. The succession ranges from the middle and late Gravettian (units L-I-H-G) to the early Epigravettian (unit F), middle (or evolved) Epigravettian (lower unit E) and late Epigravettian (upper unit E and units D-C-B). Unit A comprises subrecent reworked material (Fig. 2). These units have been dated with a high resolution to ca. 24–12 ka BP (Table 1). The different units have been grouped and correlated with the NGRIP δ^{18}O curve (Reimer et al., 2013) according to their calibrated chronological affinities (Fig. 3). Moreover, the excavations inside the cave have provided a large lithic assemblage dominated by microlithic backed points and blades (Martini et al., 2006, 2007). The large-mammal assemblage from the final Epigravettian units shows these layers to be dominated by ibex (*Capra ibex*) and wild boar (*Sus scrofa*) and to a lesser extent by red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*), chamois (*Rupicapra* sp.), aurochs (*Bos primigenius*) and horse (*Equus ferus*) (Martini et al., 2007; Bertini Vacca, 2012). Previous environmental studies of this sequence have shown that during the Last Glacial Maximum (ca. 23–16 ka BP) human occupations were quite sporadic due to intense episodes of water runoff into the cave (Ghinassi et al., 2009). At the regional scale, the oxygen isotopic composition of land snail shells suggests that the area also experienced an abrupt and

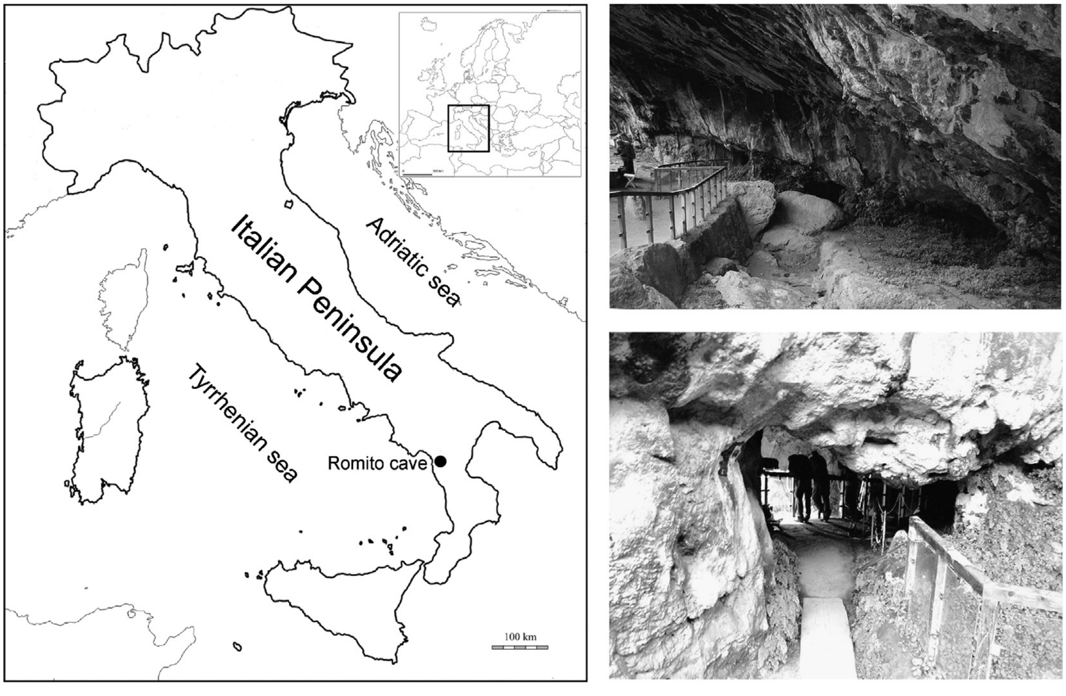

Fig. 1. Location of Grotta del Romito (left), view of the rockshelter (right top) and of the cave entrance (right bottom).