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The Neanderthal in the karst: First dating, morphometric, and paleogenetic data on the fossil skeleton from Altamura (Italy)

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ABSTRACT

In 1993, a fossil hominin skeleton was discovered in the karst caves of Lamalunga, near Altamura, in southern Italy. Despite the fact that this specimen represents one of the most extraordinary hominin specimens ever found in Europe, for the last two decades our knowledge of it has been based purely on the documented on-site observations. Recently, the retrieval from the cave of a fragment of bone (part of the right scapula) allowed the first dating of the individual, the quantitative analysis of a diagnostic morphological feature, and a preliminary paleogenetic characterization of this hominin skeleton from Altamura. Overall, the results concur in indicating that it belongs to the hypodigm of *Homo neanderthalensis*, with some phenetic peculiarities that appear consistent with a chronology ranging from 172 ± 15 ka to 130.1 ± 1.9 ka. Thus, the skeleton from Altamura represents the most ancient Neanderthal from which endogenous DNA has ever been extracted.

Introduction

The Lamalunga cave opens in the limestone of the Murgia plateau at an elevation of 508 m a.s.l., near the town of Altamura (Puglia, Italy; Agostini, 2011). It constitutes the upper part of a larger karstic complex where stalactites, stalagmites, and flowstones occur together with "coralloid" formations, which mostly represent the last phase of calcite precipitation caused by spray/aerosol phenomena. This complex consists mainly of a subhorizontal gallery that had developed at a shallow depth from the surface, intercepted by pits that had originally opened to the surface but which have subsequently been clogged by detritus. In this context, the discovery of a virtually complete fossilized hominin skeleton in an excellent state of preservation gives rise to interesting taphonomic considerations. Particularly, faunal remains found in some of the galleries are often isolated bony elements accumulated in depressed areas of the cave, suggesting that they

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were transported and dispersed by water. This was not the case with the human skeleton, given that it is largely represented and concentrated in a small area. Thus, we may hypothesize that, after death and decomposition of the body, the skeleton collapsed where it has been found. Thus far, no lithic tools have been found in the cave.

Even though the skeleton is partly incorporated into calcite concretions and is covered by coralloid formations, most of the bones are visible (see Fig. 1; see also Supporting Online Material [SOM] Fig. 1), including the cranium (upside down), the mandible, and several postcranial elements. From the photographs available and direct observations made in situ by one of us (GM), the skeleton appears to exhibit a mixture of archaic and derived features, which fit the range of variation typical of European hominins of the late Middle/early Late Pleistocene (Manzi et al., 2011). In fact, even though a number of Neanderthal traits can be seen—particularly in the face and in the occipital bone—there are features that distinguish this specimen from the more typical morphology of *Homo neanderthalensis*, such as the shape of the brow ridges, the relative dimension of the mastoids, and the general architecture of the cranial vault.

Nevertheless, for many years after its discovery, the only information we had on this extraordinary fossil skeleton was based primarily on on-site photographs and observations (Pesce Delfino and Vacca, 1993), which were biased by the presence of calcite formations. More recently, a survey in the cave was carried out as part of a new project commissioned by the local authorities, with the aim of carefully removing an isolated skeletal fragment. Subsequently, in February 2011, other samples were taken, including calcite material suitable for U/Th dating.

Therefore, for the first time, we are able to report quantitative data for the skeleton from Altamura, including its first dating, the morphometric analysis of an aspect of its post-cranial morphology (part of the right scapula), and a preliminary paleogenetic characterization.

Material and methods

The sample

The skeleton from Altamura is in an excellent state of preservation with virtually every bone belonging to a single adult individual preserved in the rather small space in which it was found. In fact, all bones were concentrated at the end of a narrow corridor known as the “ramo dell'uomo” (“branch of man”) and generally do not appear to be damaged or distorted, with the exception of a few elements identified in a smaller chamber behind the area where the main assemblage was found (SOM Fig. 1).

In May 2009, in agreement with the Soprintendenza per i Beni Archeologici della Puglia, we obtained permission from the Direzione Regionale per i Beni Culturali e Paesaggistici della Puglia to remove a piece of bone from the Lamalunga skeleton. We chose a bone from the smaller chamber behind the skeleton for the following reasons: 1) to obtain a bone with minimum contamination, in view of the paleogenetic investigations to be carried out; 2) to avoid interfering directly with the main assemblage of bones before a full and thorough 3D laser survey could be performed; and 3) to avoid bones with extensive calcite concretions. Thus, with the aid of the speleologists of the Centro Altamurano Ricerche Speleologiche (CARS) of Altamura, the sample was recovered by one of us (MM) in July 2009, following sterile collection procedures and according to a procedure inspired by laparoscopic surgery (SOM Fig. 2).

The sample consists of the articular portion of the right scapula, in which the glenoid fossa, the neck, part of the spine (without the acromion), and the root of the coracoid process were preserved. In contrast to most of the bones of the main assemblage, it was free from major concretion apart from a superficial film of calcite. When discovered, the scapula was fractured in two main parts—the articular portion that was extracted and a large part of the body visible on the cave floor—while other small fragments were also present and scattered in an area of about 40 cm^2 (SOM Fig. 1). It is

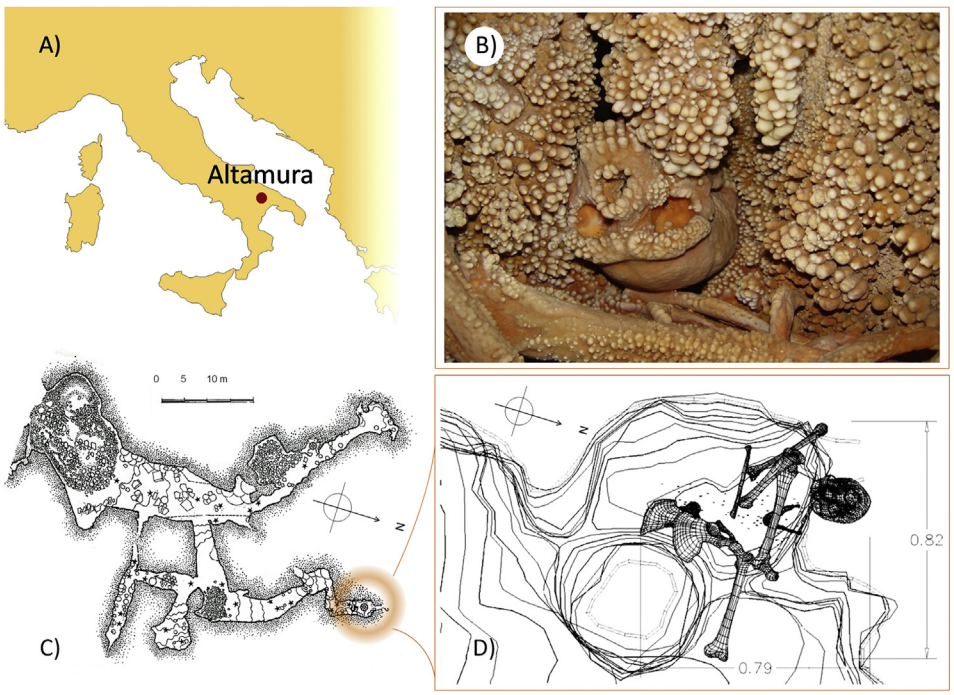

Figure 1. A) Position of Altamura within the Italian peninsula; B) hominin bones and calcite formations around the cranium (part of the mandible and right femur are visible); C) general topography of the northern part of the Lamalunga karstic system; note on the left the accumulation of detritus that represents the infilling of the probable main original access point from the external surface; and D) distribution of the main bones of the skeleton at the end of the so-called “ramo dell'uomo” (compare SOM Fig. 1). Drawing and data of Fig. 1D are from Vacca and Pesce Delfino (2004).

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