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Chronology of the cave interior sediments at Gran Dolina archaeological site, Atapuerca (Spain)

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ABSTRACT

The so-called "Gran Dolina site" (Atapuerca mountain range, N Spain) is a karstic cavity filled by sediments during the Pleistocene, some of which contain a rich ensemble of archaeological and paleontological records. These sediments have contributed significantly to our understanding of early human dispersal in Europe but, in contrast, older, interior facies deposits have received much less of attention. The stratigraphy of Gran Dolina reveals an abrupt sedimentary change of interior to entrance facies from bottom to top, reflecting a significant paleoenvironmental change that promoted the accumulation of sediments transported from the vicinity of the cave by water or "en masse". Since the major magnetic polarity reversal known as the Matuyama-Brunhes boundary (0.78 Ma) was detected within the TD7 unit in the middle of the stratigraphic section, we carried out a new combined paleomagnetic, radiometric (U-Pb), and electron spin resonance (ESR) dating study of the lower part of the sequence in order to constrain the chronology of the interior facies at Gran Dolina. U-Pb analysis of speleothems did not produce age information as the samples proved to be extremely unradiogenic. The magnetic stratigraphy of the cave interior sediments reveals a dominant reverse magnetic polarity, coherent with a Matuyama age, and interrupted by a normal polarity magnetozone interpreted as the Jaramillo Subchron (1.0–1.1 Ma). ESR ages on quartz grains from the upper part of the interior facies sediments are coherent with such an interpretation. We conclude that the fluvial deposits (interior facies) that constitute the cave floor began accumulating before 1.2 Ma. The development of large cave entrances at Gran Dolina occurred shortly after the Jaramillo Subchron but before ca 900 ka ago.

1. Introduction

Research at the Lower Paleolithic cave site of Gran Dolina, Sierra de Atapuerca (northern Spain) (Fig. 1), has led to major advances in our understanding of human evolution and occupation of Eurasia in the Pleistocene. The Gran Dolina site has produced thousands of fossils and artifacts since 1995, when the first hominin remains were reported, and soon became a Pleistocene landmark in studies of early human settlement outside the African continent (Carbonell et al., 1995, 2008). Stratigraphic layer TD6 of Gran Dolina has yielded over 170 human fossil remains, more than 200 lithic artifacts, classified as Mode 1, as well as several thousand small and large vertebrate remains (Bermúdez de Castro et al., 1997; Carbonell et al., 2005; Bermúdez de Castro et al., 2008; Ollé et al., 2013). The initial paleomagnetic dating at Gran Dolina revealed a switch from reverse to normal geomagnetic polarity above TD6 level,

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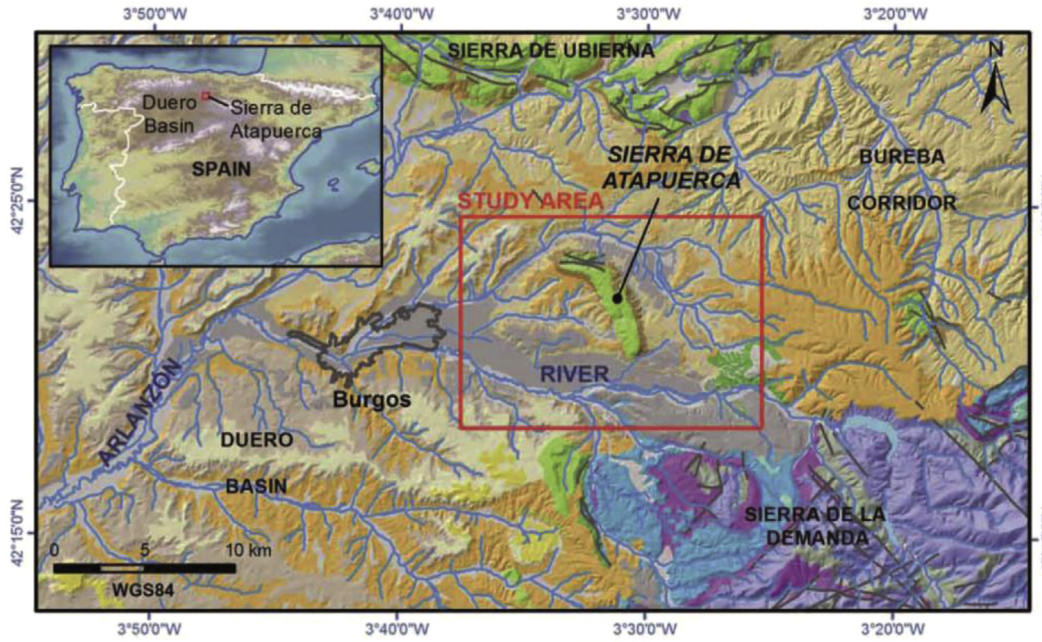

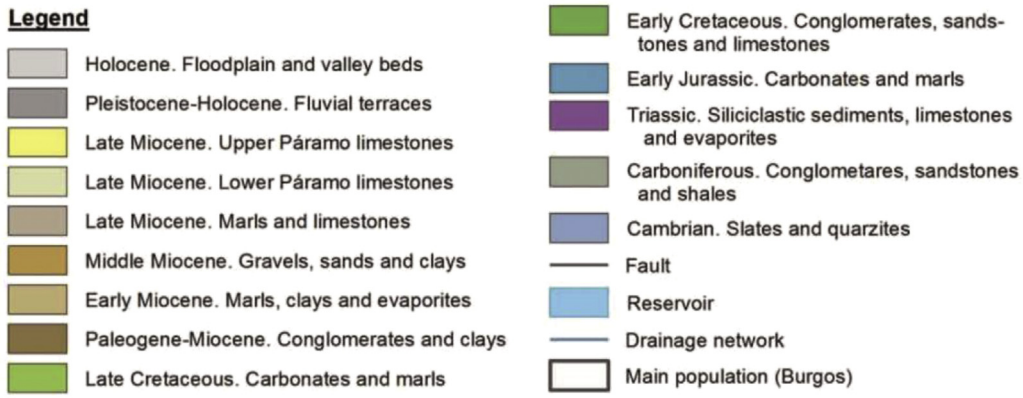

Fig. 1. Regional geological map of the study area showing the main lithological units (above), and a 3D view of the Atapuerca Mountain Range (Benito-Calvo and Pérez-González, 2015).