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Combined ESR/U-series chronology of Acheulian hominid-bearing layers at Trinchera Galería site, Atapuerca, Spain

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ABSTRACT

The Sierra de Atapuerca, northern Spain, is known from many prehistoric and palaeontological sites documenting human prehistory in Europe. Three major sites, Gran Dolina, Galería and Sima del Elefante, range in age from the oldest hominin of Western Europe dated to 1.1 to 1.3 Ma (millions of years ago) at Sima del Elefante to c.a. 0.2 Ma on the top of the Galería archaeological sequence. Recently, a chronology based on luminescence methods (Thermoluminescence [TL] and Infrared Stimulated Luminescence [IRSL]) applied to cave sediments was published for the Gran Dolina and Galería sites. The authors proposed for Galería an age of 450 ka (thousands of years ago) for the units lower GIII and GII, suggesting that the human occupation there is younger than the hominid remains of Sima de los Huesos (>530 ka) around 1 km away.

In this paper, we present new results obtained by combined Electron Spin Resonance/Uranium-series (ESR/U-series) dating on 20 herbivorous teeth from different levels at the Galería site. They are in agreement with the TL results for the upper part of the stratigraphic sequence (GIV and GIIIb), in the range of between 200 and 250 ka. But for the GIIIa to GIIb levels, the TL ages become abruptly older by 200 ka while ESR ages remain relatively constant. Finally, the TL and ESR data agree in the lowest part of the section (GIIa); both fall in the range of around 350–450 ka. Our results suggest a different interpretation for the GII, GIII and GIV units of Galería and the upper part of Gran Dolina (TD10 and TD11) than obtained by TL. The ESR/U-series results are supported by a Bayesian analysis, which allows a better integration between stratigraphic information and radiometric data.

Introduction

The Sierra de Atapuerca, located in northern Spain (Fig. 1a), has provided an incredible amount of palaeontological and archaeological data documenting human prehistory in Europe during the last million years (Rodríguez et al., 2011). Structurally, the Sierra de Atapuerca is an overturned anticline with a NE vergency and Iberian NNW–SSE direction (Pineda and Arce, 1997). Recent investigations combining geomorphological evolution analyses of the

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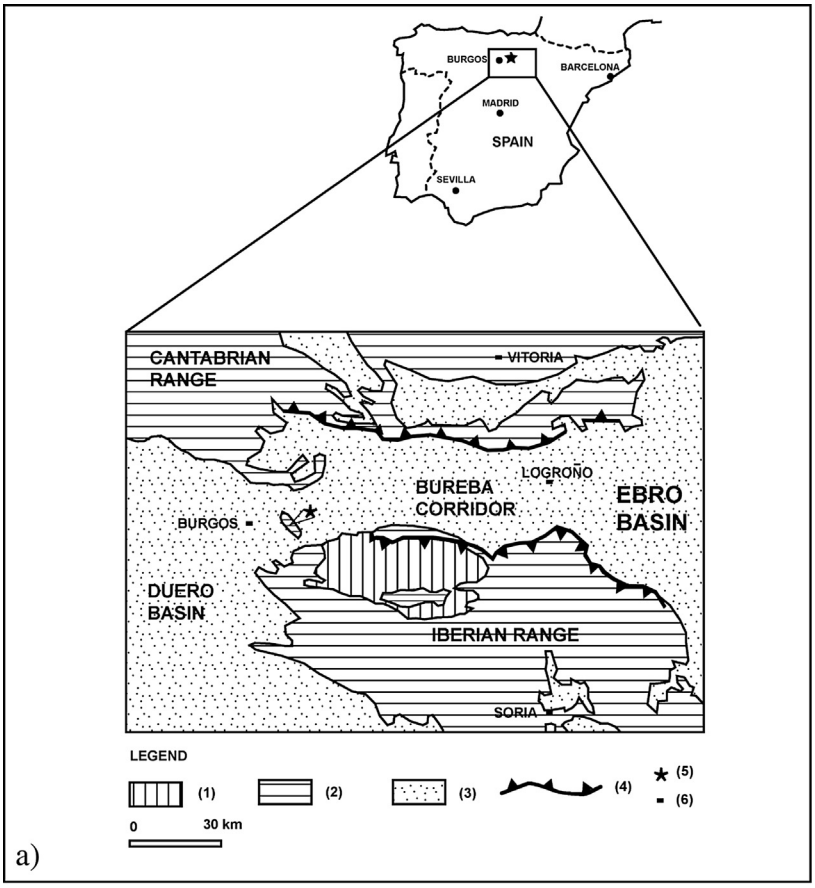

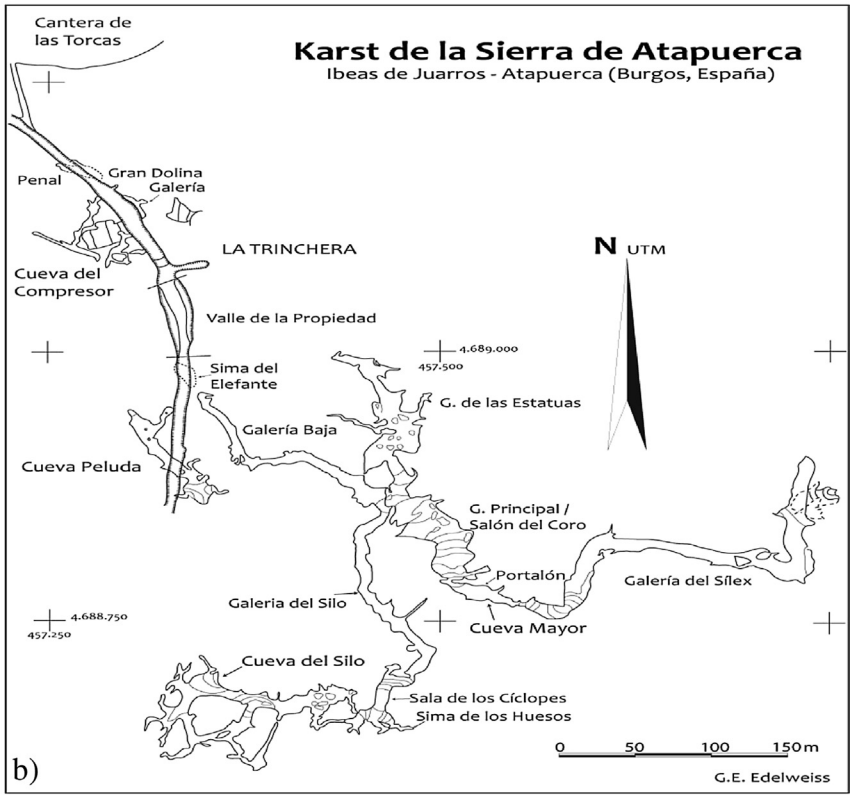

Figure 1. a) General geological context of the Sierra de Atapuerca (Burgos). Caption: (1) Palaeozoic; (2) Mesozoic; (3) Cenozoic; (4) Overthrust; (5) Site; (6) Cities. b) Location of main prehistorical sites in the Trinchera del Ferrocarril.