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## **Cosmogenic nuclide dating (using $^{10}\text{Be}$ - $^{26}\text{Al}$ in quartz and meteoric $^{10}\text{Be}$ ) from West Mediterranean archaeological-paleontological sites in Orce, southern Spain, and Guefaït, eastern Morocco**

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In this paper we apply cosmogenic nuclide dating to the selected key archaeological sites in the western Mediterranean region (southern Spain and Morocco), to provide better chronological constraints to sites where previous geochronological data were scarce, scattered or unresolved. Our knowledge on the early hominin dispersal out of Africa, e.g., timing, causes, pathways, remain incomplete. Situated in the continental edges, the western Mediterranean region, both European and African sides, hosts numerous key archaeological-paleontological sites. Here, we focus on two areas: Orce, near Granada, in southern Spain and Guefaït in eastern Morocco. Orce, situated in the Guadix-Baza basin, one of the largest Neogene-Quaternary paleolakes in Europe, the area hosts several key archaeological-paleontological sites such as Barranco León and Fuente Nueva-3. Magnetostratigraphy revealed that the lake sequences extend from late Pliocene to early Pleistocene, which are in general agreement with biochronology based on mammal fossils. Early effort on absolute dating, e.g., ESR based on quartz, remained difficult in largely calcareous environment, though apparent Early Pleistocene ages obtained from a few archaeological layers in the area are largely consistent with age interval expected from magnetostratigraphy (~1.1-1.8 Ma, i.e., between Jaramillo and Olduvai subchrons). The second site, Guefaït-4 is a paleontological site in Ain Beni Mathar-Guefaït Basin in east Morocco, an intermontane depression filled with Neogene-Quaternary sediments, where formation and evolution history of the basin has been little known. Recent paleomagnetic study in a relatively well-exposed stratigraphic sections in northern part of the basin, proposed that lower part of sediment sequences, below the paleontological unit, is either near the top of Gauss chron (i.e., >2.6 Ma) or the top of Olduvai subchron (~1.8 Ma). While mammal-fossil biostratigraphy favours the former interpretation, ESR dating (Ti centre) on sediment quartz obtained Early Pleistocene age (~1.6-1.8 Ma), leaving possibility in both interpretations. In this study, we apply  $^{10}\text{Be}$ - $^{26}\text{Al}$  burial dating, and also meteoric  $^{10}\text{Be}$  dating where applicable, in the selected sites in Orce, southern Spain, and Guefaït, eastern Morocco in an attempt to refine chronologies. Analytical feasibility and difficulty applying cosmogenic  $^{10}\text{Be}$ - $^{26}\text{Al}$  method on quartz to, in general, carbonate-rich environment are discussed, as well as validity of assumptions associated with these approaches via comparison with independent geochronological data (e.g., magnetostratigraphy, ESR).

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