

Bearing the weight: Technical recovery of brown bear fossils (*Ursus arctos*) from Algar do Vale da Pena, Portugal

Pleistocene · Holocene · citizen science · Alcobaça · excavation techniques

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Acknowledgments. Darío Estraviz-López is recipient of a PhD grant by Fundação para a Ciência e a Tecnologia (2020.05395.BD). This abstract is a result of project "Louri-Qave" funded by the PIIHM (Plano de Incentivo a Investigação Horácio Mateus) from GEAL-Museu da Lourinhã. We are thankful to the Parque Natural das Serras de Aire e Candeeiros and the municipality of Alcobaça for their authorization for the intervention. Special thanks to Sérgio Medeiros (GPS), Sérgio Barbosa (CEAE-LPN) and all the other people and institutions who made possible this recovery: GPS, CEAE-LPN, NEC, CIES, VERTLINE Lda., FLOEMA Lda. and , SUBMATE Lda.

The Algar do Vale da Pena is a cave that was discovered during limestone mining works around 1980, at the Natural Park of Serras de Aire e Candeeiros, Portugal. The entrance to the cave, through the collapsed roof, is a 30 meter near-vertical well, inaccessible without means of vertical progression and specialized equipment. Soon after the discovery of the cave, bone material belonging to bears and hundreds of bear claw marks were located inside it. Nevertheless, the technical descent and the extraordinary difficulties of retrieving the calcite flowstones that encased the bones prevented scientists from undertaking excavations for nearly 40 years. Since 2016 a series of expeditions by a team of paleontologists from NOVA University and Museum of Lourinhã recovered more than 20 disarticulated remains from five bone accumulations, separated more than five meters apart, which given the level of erosion and breakage, are para-autochthonous in origin. These are interpreted as belonging to different individuals. Morphological characters, like a relatively elongated third phalanx, the clear separation of paracone-metacone of the first upper molar and the ventral position of the mandibular condyle; as well as numerous morphometric characters, allow to ascribe the remains to *Ursus arctos*. Nevertheless, the main finding from the cave is a complete skull with an articulated mandible; which denotes absence of transport, encased within a 180 kg calcite flowstone, including other skeletal remains as well, which could not be extracted from the cave until 2021. This block was removed with the help of members of several speleological groups. It promises a wealth of information about fossil brown bears, being the most complete bear fossil ever recovered in Portugal. It is currently being dated through magnetostratigraphy and prepared. We consider this intervention as an extraordinary example of citizen science applied to paleontology.