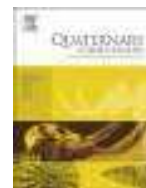




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The sequence at Carihuela Cave and its potential for research into Neanderthal ecology and the Mousterian in southern Spain

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ABSTRACT

Hitherto unpublished ¹⁴C and ²³⁰Th–²³⁴U determinations from Carihuela Cave (Granada province, Andalusia, Spain) raise a possibility of late survival here of Neanderthals and their Mousterian technocomplex into an advanced stage of the Late Pleistocene (MIS-3), when anatomically-modern humans with Upper Palaeolithic toolkits were penetrating the region, and when also several carnivore taxa competed for access to the cave. Previous palaeopalynological studies are reinforced by new pollen analyses of samples extracted from coprolites. The palaeoecological and sedimentological records bear comparison with new data from the Padul peat deposits in the Sierra Nevada, and are in line with the view that there was late persistence of the Mousterian in Granada. There is a pressing need for renewed international multidisciplinary research at Carihuela Cave, with up-to-date lithostratigraphical and dating techniques that can expand on results obtained from fieldwork undertaken by a previous generation of researchers. Carihuela Cave continues to hold out great promise for analysing Neanderthal palaeoecology during the Late Pleistocene up to the appearance in southeastern Iberian Peninsula of anatomically-modern Upper Palaeolithic people, particularly with regard to the earlier phases of the Middle Palaeolithic at the cave which await intensive excavation but apparently extend back in time to the last interglacial period.

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1. Introduction

We highlight the potential of Carihuela Cave for further studies on Late Pleistocene archaeology and human evolution concerning Neanderthals and early anatomically-modern humans in the southern Iberian Peninsula. We take into account many geochronological dates from the cave (¹⁴C, ESR, and ²³⁰Th–²³⁴U), both new determinations presented here, as well as older ones including several that are not well known. We present new pollen analyses of

samples extracted from coprolites. We consider the available information regarding the chronology and palaeoecology of the Pleistocene sequence. In order to resolve outstanding problems of interpretation and reach definitive conclusions there is urgent need for renewed systematic re-excavation within a multidisciplinary research programme.

2. The site

Carihuela Cave (3° 25' 47"W, 37° 26' 56"N; 1020 m a.s.l.) lies in Piñar municipality, 45 km northeast of Granada, on the northern slope of the Sierra Arana, in eastern Andalusia, southern Spain

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- Murcia, Spain. Proceedings of the National Academy of Sciences of the USA 105, 20631–20636.
- Walker, M.J., Ortega, J., Parmová, K., López, M., Trinkaus, E., 2011a. Morphology, body proportions, and postcranial hypertrophy of a female Neandertal from the Sima de las Palomas, southeastern Spain. Proceedings of the National Academy of Sciences of the USA 108, 10087–10091.
- Walker, M.J., Ortega-Rodríguez, J., López-Martínez, M., Parmová, K., Trinkaus, E., 2011b. Neandertal postcranial remains from the Sima de las Palomas del Cabezo Gordo, Murcia, southeastern Spain. Am. J. Phys. Anthropol. 144, 505–515.
- Walker, M.J., López Martínez, M., Ortega-Rodríguez, J., Haber-Urriarte, M., López-Jiménez, A., Avilés-Fernández, A., Polo Camacho, J.-L., Campillo-Boj, M., García-Torres, J., Carrión-García, J.S., San Nicolás-del Toro, M., Rodríguez-Estrella, T., 2012. The excavation of the buried articulated Neandertal skeletons at Sima de las Palomas (Murcia, SE Spain). Quat. Int. 259, 7–21.
- Walker, M.J., López, M.V., Haber, M., Trinkaus, E., 2017a. The context of the Sima de las Palomas Neandertals. In: Trinkaus, E., Walker, M.J. (Eds.), The people of Palomas. Neandertals form the Sima de las Palomas del Cabezo Gordo, south-eastern Spain. "Anthropology series 19". Texas A&M University Press, College Station, Texas, USA, pp. 4–18.
- Walker, M.J., Sontag-González, M., Haber-Urriarte, M., López-Martínez, M., Black, S., Schwenninger, J.-L., 2017b. Preliminary dating of deep layers at Sima de las Palomas del Cabezo Gordo (Torre Pacheco, Murcia, Spain). In: (7th Annual Meeting of the European Society for the Study of Human Evolution ESHE Leiden, The Netherlands, 21–23 September 2017) Proceedings of the European Society for the Study of Human Evolution, vol. 6, p. 210.
- Wigand, P.E., 1978. The Neolithic and Bronze Age levels of Cariguela de la Pinar, Granada, Spain. Tesis doctoral. Washington State University, Inédita.
- Willman, J.C., Maki, J., Bayle, P., Trinkaus, E., Zilhão, J., 2012. Middle Paleolithic human remains from the Gruta da Oliveira (Torres Novas), Portugal. Am. J. Phys. Anthropol. 149, 39–51.
- Wolf, D., Kolb, R., Alcaraz-Castaño, M., Heinrich, S., Baumgart, P., Calvo, R., Sánchez, J., Ryborz, K., Schafer, I., Bliedtner, M., Zech, R., Zöller, L., Faust, D., 2018. Climate deteriorations and Neandertal demise in interior Iberia. Sci. Rep. 4 (8), 7048. <https://doi.org/10.1038/s41598-018-25343-6>.
- Wood, R.E., Barroso-Ruiz, C., Caparrós, M., Jordá-Pardo, J.F., Galván-Santos, B., Higham, T.F.G., 2013a. Radiocarbon dating casts doubt on the late chronology of the Middle to Upper Palaeolithic transition in southern Iberia. Proceedings of the National Academy of Sciences of the USA 110, 2781–2786.
- Wood, R.E., Higham, T.F.G., de Torres, T., Tisnérat-Laborde, N., Valladas, H., Ortiz, J.E., Lalueza-Fox, C.S., Sánchez-Moral, S., Cañaveras, J.C., Rosas, A., Santamaría, D., de la Rasilla, M., 2013b. A new date for the neandertals from El Sidrón cave (Asturias, Northern Spain). Archaeometry 55, 148–158.
- Wood, R.E., Arrizabalaga, A., Camps, M., Fallon, S., Iriarte-Chiapusso, M.-J., Jones, R., Maroto, J., de la Rasilla, M., Santamaría, D., Soler, J., Soler, N., Villaluenga, A., Higham, T.F.G., 2014. The chronology of the earliest upper palaeolithic in northern Iberia: new insights from L'Arbreda, labeko Koba and La viña. J. Hum. Evol. 69, 91–109.
- Zilhão, J., Villaverde, V., 2008. The Middle paleolithic of Murcia. Treballs arqueol. 14, 229–248.
- Zilhão, J., Banks, W.E., d'Errico, F., Gioia, P., 2015. Analysis of Site Formation and Assemblage Integrity Does Not Support Attribution of the Uluzzian to Modern Humans at Grotta del Cavallo. PLoS One 10, e0131181. <https://doi.org/10.1371/journal.pone.0131181>.
- Zilhão, J., Anesin, D., Aubry, T., Badal, E., Cabanes, D., Kehl, M., Klasen, N., Lucena, A., Martín-Lerma, I., Martínez, S., Matias, H., Susini, D., Steier, P., Wild, E.M., Angelucci, D.E., Villaverde, V., Zapata, J., 2017. Precise dating of the middle-to-upper paleolithic transition in Murcia (Spain) supports late neandertal persistence in Iberia. Helvion 3, e00435.