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News and Views

Early dates for 'Neanderthal cave art' may be wrong

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Current evidence suggests that some Neanderthal populations engaged in modern human-like forms of symbolic behavior, including: the extensive and systematic use of ochers and other prepared mineral pigments (i.e., paint; Dayet et al., 2014; Heyes et al., 2016); use of perforated shells and various other modified and unmodified objects and substances as ornaments (e.g., 'jewelry'), including bird feathers (Finlayson et al., 2012) and claws (Radovčić et al., 2015); manufacture of elaborate structures of unknown purpose inside deep cave passages (Jaubert et al., 2016); and engraving of non-figurative markings on bones (Majkic et al., 2017) and cortical areas of flaked stone artifacts (Majkic et al., 2018), and also on immobile rock surfaces (i.e., at Gorham's Cave; Rodríguez-Vidal et al., 2014). Scientific opinion is deeply divided over the meaning of these behaviors—the empirical evidence for which, in some instances, is not yet unanimously accepted. Indeed, the notion that even late-surviving Neanderthals had acquired aspects of cognitive 'modernity', either independently or through direct cultural contact (including interbreeding) with the first modern humans to enter Europe, remains a subject of lively debate.

In a recent paper, Hoffmann et al. (2018a) contended that parietal artworks from Spain date back to at least 64.8 ka, and were hence created by Neanderthals. These rock art dates, if verified, would be the world's oldest dated examples of cave art by far and consequently dramatically alter current thinking about the cognitive abilities of Neanderthals (Appenzeller, 2018). For some authorities, these sensational and widely publicized rock art dates provide the long-awaited 'smoking gun' evidence that incontestably demonstrates that Neanderthals and modern humans were, in terms of cognitive ability, strikingly similar. Hoffmann et al. (2018a) asserted that prior claims for Neanderthal art and symbolic behavior lack firm empirical support. However, we believe that similar ambiguities and problems exist in their current study, leading us to question the reliability of their rock art dating results.

Following the publication of the study by Hoffmann et al. (2018a), Pearce and Bonneau (2018) have also expressed caution about these datings. However, the main critique by the latter authors relates to what they regard as a disconcertingly wide range of dates obtained from multiple speleothems over the same motif. Such critique is naïve, because the dates being questioned purportedly provide minimum age estimates for the underlying artwork. Speleothem growth can be affected by several highly localized factors such as changes in the drip positions and/or water flows feeding the speleothems, which can start and stop forming at different times as a result. A similar view is also expressed in a response to Pearce and Bonneau (2018) by Hoffmann et al. (2018b).

Our own critique focuses on two key points: (1) whether dated red markings on flowstone curtains are evidence for rock art production; and (2) potential problems with the sampling methodology used to infer extremely old minimum ages for clearly discernible rock art motifs. Our paper is not intended to represent a full review of rock art dating using speleothems (for a comprehensive review, see Aubert et al., 2017), nor do we evaluate other contentious claims for Neanderthal art and symbolism. We refer only to what we regard as shortcomings in the identification of parietal art motifs and the stratigraphic relationship between the dated samples and pigment layers reported by Hoffmann et al. (2018a).

These researchers used uranium-series analysis to date Neanderthal 'artworks' in the form of red marks on flowstone curtains at Ardales. Spanish rock art specialists have produced many detailed analyses of Paleolithic cave art in the study region. However, data available in Hoffmann et al.'s (2018a) paper do not adequately explain the origin or materiality of the red markings in question. Consequently, it is not clear to us that these red marks are from paint or relate to rock art production. Red marks can occur naturally on limestone caves, particularly flowstone and other drapery, from numerous causes such as through organic compounds

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(microorganisms), but also oxides transported in groundwater from clays and soils (Kusky and Cullen, 2010; White and Culver, 2011). Indeed, the sediments above Ardales contain abundant red iron oxide sources within Triassic redbeds (Martín-Algarra et al., 2009).

The physicochemical analysis of pigments has been increasingly practiced in rock art and human evolutionary research for decades (Chalmin and Huntley, 2017). Characterizing the chemical composition, structure and micromorphology of pigments, especially in cross-section, can provide information about their source(s), the manner in which they were applied to a panel ('chaîne opératoire') and postdepositional alteration. Such investigations are especially worthwhile where the cultural origin of images is uncertain (such as the aforementioned red marks on flowstone curtains at Ardales). For instance, detailed forensic investigations have been a critical part of arguing that the earliest examples for symbolic/artistic expressions made by Neanderthals and earlier hominins were deliberate (Dayet et al., 2014; Rodríguez-Vidal et al., 2014; Joordens et al., 2015; Majkić et al., 2018). To our knowledge, the red marks on flowstone curtains at Ardales have never been the subject of similar investigations.

Even if Hoffmann et al. (2018a) were to demonstrate that some or all of the dated red marks constitute paint (and are thus definitely cultural), it remains possible that the pigment on the curtains is unrelated to rock art production. For instance, it has long been presumed on the basis of excavated archaeological findings that Neanderthals painted themselves with red (and black) pigments—although how, and why, is unresolved. Given this, it is possible that the presence of red paint on some cave decorations may be explained by one or more secondary transfer events, such as painted skin or clothing fortuitously coming into contact with cave walls (Medina-Alcaide et al., 2018). There may be a number of explanations for how paint used by Neanderthals was unintentionally transferred to flowstone curtains, without the need to evoke rock art as the causative mechanism. It is germane to note, for instance, that pigment residues are commonly identified on stone tools, but one would have to make a very strong case that pigment-stained tools were deliberately painted (i.e., that they are 'portable art'), when the most parsimonious scenario is obviously that they were ocher-processing implements or were used to work painted material culture objects.

Our main criticism of Hoffmann et al. (2018a) study relates to the authors' dating of identifiable parietal art of a type long assumed to be have been created by modern humans (Bahn and Vertut, 1997). Specifically, they argue that Neanderthals produced a linear symbol (La Pasiega) and a hand stencil (Maltravieso) based on uranium-series dating of supposedly overlying carbonate deposits (Hoffmann et al., 2018a). As the authors point out, "The key condition is demonstrating an unambiguous stratigraphic relationship between the [dated carbonate] sample and the art whose age we wish to constrain" (Hoffmann et al., 2018a:912). However, establishing this relationship is not necessarily straightforward. In our opinion, it is possible that Hoffmann et al. (2018a) unintentionally dated carbonate deposits that were a part of the rock face, or 'canvas', upon which the images were created, and which may be far older than the artworks.

At La Pasiega and Maltravieso, Hoffmann et al. (2018a) did not cut a section through the carbonate deposits into the 'canvas', nor did they completely expose the underlying paint. Doing so would have allowed them to clearly observe the stratigraphic relationship between the layers of dated carbonate materials, the paints of the adjoining visible artworks, and the 'canvas'. Instead, in each case the team scraped the carbonate deposit until they considered that it was changing color (Hoffmann et al., 2018a). This was seen as indicating that they were coming close to the underlying paint of the artwork, and hence they stopped sampling at this point. The team then dated the sampled carbonate under the belief that it had formed on top of the paint layer corresponding to the nearby artwork, and thus could provide a minimum age for the art. But without directly exposing any part of the putative paint layer it is not possible to be certain that an apparent color change demonstrates that it is paint underneath the carbonate (Aubert et al., 2017). The color change noted during sampling might only be an indication of the proximity of 'canvas', not paint. Indeed, it is possible that, owing to differential weathering, the part of the 'canvas' covered over by carbonate deposits could be different in color to exposed areas of 'canvas', to the point where it could be mistaken for paint if not directly observed. Moreover, in our view, a color change is not evident from most images in the paper (Hoffmann et al., 2018a).

Our research in limestone karst areas of Sulawesi (Aubert et al., 2014) has focused on dating small cauliflower-like calcitic growths found in association with rock art (Fig. 1A–C). Known as coralloid speleothems, or 'cave popcorn', these are similar to features dated by Hoffmann et al. (2018a) such as Maltravieso. We have identified coralloids that appear to overlie rock art and which initially seem ideal for providing minimum ages for associated motifs. However, closer inspection sometimes reveals remnants of paint on the exterior surface of the coralloid (Fig. 1D). In other cases, we have cut a section through the coralloid, revealing that there is no paint inside it or on the surface of the 'canvas' below. In both scenarios, it is clear that the coralloid was present on the 'canvas' prior to the creation of the artwork. So some coralloids associated with rock art are outwardly deceptive: either artists painted around these small raised areas on the 'canvas' (practically impossible for stencil art) or they were painted over and weathering has since removed the paint (Fig. 1D). The surest way to assess their suitability for dating is to cut a section from coralloid to 'canvas', or to expose the underlying paint, which, in our experience, tends to have a more vibrant hue than exposed areas of paint from the same artwork, presumably owing to its preservation for many millennia under calcite (i.e., the paints laminated in calcite have not undergone major oxidation or other alternations).

Cave art provides an invaluable and irreplaceable record of ancient human visual culture, and it is never a simple matter or an easy choice from an ethical perspective to justify its partial destruction for scientific research. However, archeology, by nature, often involves the destruction of the primary evidence, including the exhumation of stratified archaeological deposits and the sampling of sediments and/or human fossils for scientific investigation such as ancient DNA analysis and dating—the archaeological study of rock art is no different. The removal of speleothem near parietal art is destructive. It is therefore crucial to find the right balance between impacts to a site/artifact and the archaeological questions to be answered by such destruction. If a sample is to be submitted for scientific dating, its relationship to the artwork should be unquestionable. Depending on the archaeological question to be answered, such as studying art development through time, it is sometimes justifiable to sample through the pigment layer in order to obtain maximum ages. In our view, it is more important to avoid sampling sites that could further damage the artwork, such as areas located above parietal art on the cave walls where water flows could leach freshly exposed calcium carbonate from sampling sites and redeposit it on the artwork below.

Neanderthals could have made rock art of some kind but owing to sampling problems, in particular, we do not believe that this has been sufficiently demonstrated by Hoffmann et al.'s (2018a) study.

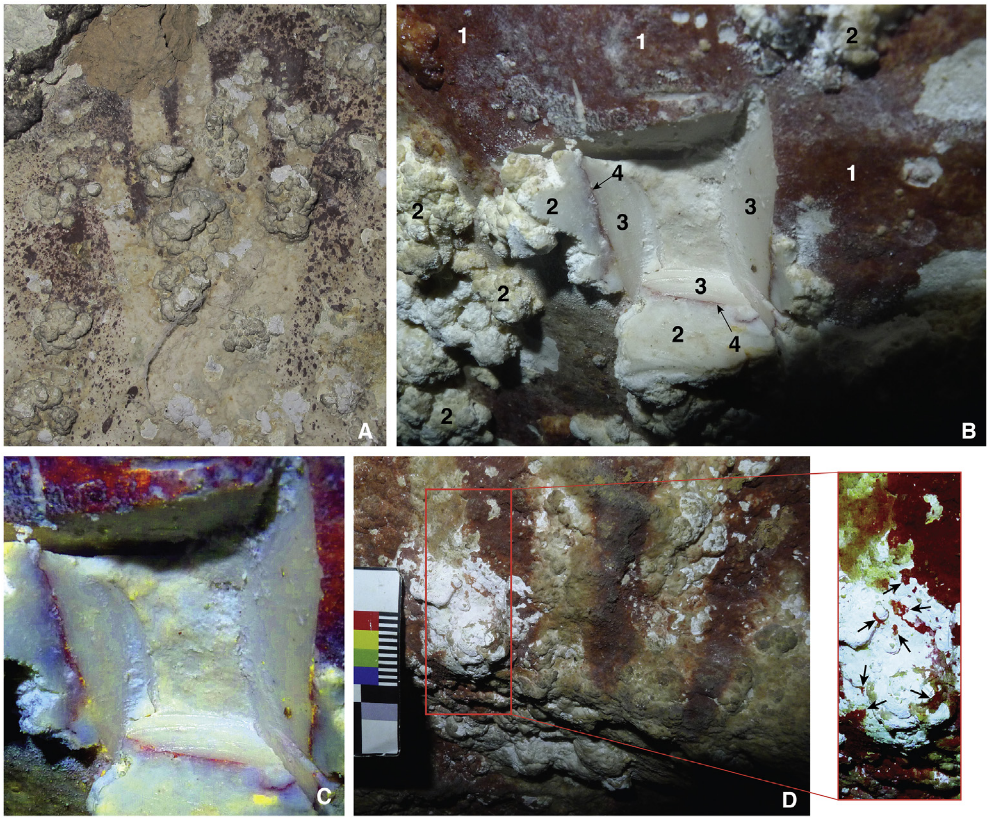

Figure 1. Coralloid speleothems associated with rock art on Sulawesi. A) Hand stencil partly covered with coralloids. B) Section of a sampled coralloid overlying a hand stencil, revealing the stratigraphic relationship between the carbonate deposit and associated artwork; 1 = red paint from the stencil; 2 = coralloid; 3 = interior of the rock face (i.e., the 'canvas') on which the stencil was made; 4 = layer of red pigment that is continuous with the paint of the adjacent stencil and is overlaid by the sampled coralloid. C) Close-up of sample area in B, with the image enhanced using DStretch software (Clogg et al., 2000). D) Traces of red paint on the external surface of a highly weathered coralloid that was clearly present on the 'canvas' prior to the creation of this stencil art. The inset panel shows this image enhanced using DStretch software; arrows highlight remnants of paint still visible on the heavily exfoliated surface of the coralloid.

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References

Appenzeller, T., 2018. Europe's first artists were Neandertals. Science 359, 852–853.
Aubert, M., Brumm, A., Ramli, M., Sutikna, T., Saptomo, E.W., Hakim, B., Morwood, M.J., van den Bergh, G.D., Kinsley, L., Dosseto, A., 2014. Pleistocene cave art from Sulawesi, Indonesia. Nature 514, 223–227.
Aubert, M., Brumm, A., Taçon, P.S.C., 2017. The timing and nature of human colonization of Southeast Asia in the Late Pleistocene: a rock art perspective. Current Anthropology 58, S553–S566.
Bahn, P.G., Vertut, J., 1997. Journey Through the Ice Age. University of California Press, Berkeley.
Chalmin, E., Huntley, J., 2017. Characterizing rock art pigments. In: David, B., McNiven, I.J. (Eds.), The Oxford Handbook of the Archaeology and Anthropology of Rock Art. https://doi.org/10.1093/oxfordhb/9780190607357.013.48.
Clogg, P., Díaz-Andreu, M., Larkman, B., 2000. Digital image processing and the recording of rock art. Journal of Archaeological Science 27, 837–843.
Dayet, L., d'Errico, F., Garcia-Moreno, R., 2014. Searching for consistencies in Châtelperronian pigment use. Journal of Archaeological Science 44, 180–193.
Finlayson, C., Brown, K., Blasco, R., Rosell, J., Negro, J.J., Bortolotti, G.R., Finlayson, G., Sánchez Marco, A., Pacheco, F.G., Vidal, J.R., Carrión, J.S., 2012. Birds of a feather: Neanderthal exploitation of raptors and corvids. PLoS One 7, e45927.
Heyes, P.J., Anastasakis, K., De Jong, W., Van Hoesel, A., Roebroeks, W., Soressi, M., 2016. Selection and use of manganese dioxide by Neanderthals. Scientific Reports 6, 22159.
Hoffmann, D.L., Standish, C.D., García-Diez, M., Pettitt, P.B., Milton, J.A., Zilhão, J., Alcolea-González, J.J., Cantalejo-Duarte, P., Collado, H., de Balbín, R., Lorblanchet, M., Ramos-Muñoz, J., Weniger, G.-Ch., Pike, A.W.G., 2018a. U-Th dating of carbonate crusts reveals Neandertal origin of Iberian cave art. Science 359, 912–915.
Hoffmann, D.L., Standish, C.D., Pike, A.W.G., García-Diez, M., Pettitt, P.B., Angelucci, D.E., Villaverde, V., Zapata, J., Milton, J.A., Alcolea-González, J.J., Cantalejo-Duarte, P., Collado, H., de Balbín, R., Lorblanchet, M., 2018b. Dates for Neanderthal art and symbolic behaviour are reliable. Nature Ecology & Evolution 2, 1044–1045.
Jaubert, J., Verheyden, S., Genty, D., Soulier, M., Cheng, H., Blamart, D., Burlet, C., Camus, H., Delaby, S., Deldicque, D., Edwards, R.L., 2016. Early Neanderthal constructions deep in Bruniquel Cave in southwestern France. Nature 534, 111–114.
Joordens, J.C., d'Errico, F., Wesselingh, F.P., Munro, S., De Vos, J., Wallinga, J., Ankjærgaard, C., Reimann, T., Wijbrans, J.R., Kuiper, K.F., Mücher, H.J., 2015. *Homo erectus* at Trinil on Java used shells for tool production and engraving. Nature 518, 228–232.
Kusky, T.M., Cullen, K.E. (Eds.), 2010. Encyclopaedia of Earth and Space Science. Infobase Publishing, New York.
Majkić, A., Evans, S., Stepanchuk, V., Tsvelykh, A., d'Errico, F., 2017. A decorated raven bone from the Zaskalnaya VI (Kolosovskaya) Neanderthal site, Crimea. PLoS One 12, e0173435.
Majkić, A., d'Errico, F., Stepanchuk, V., 2018. Assessing the significance of Palaeolithic engraved cortexes. A case study from the Mousterian site of Kiik-Koba, Crimea. PLoS One 13, e0195049.
Martín-Algarra, A., Mazzoli, S., Perrone, V., Rodríguez-Cañero, R., Navas-Parejo, P., 2009. Variscan tectonics in the Malaguide Complex (Betic Cordillera, southern Spain): stratigraphic and structural Alpine versus pre-Alpine constraints from the Ardales area (Province of Malaga). I. Stratigraphy. Journal of Geology 117, 241–262.
Medina-Alcaide, M.Á., Garate-Maidagan, D., Ruiz-Redondo, A., Sanchidrián-Torti, J.L., 2018. Beyond art: The internal archaeological context in Paleolithic decorated caves. Journal of Anthropological Archaeology 49, 114–128.
Pearce, D.G., Bonneau, A., 2018. Trouble on the dating scene. Nature Ecology & Evolution 2, 925–926.
Radovčić, D., Sršen, A.O., Radovčić, J., Frayer, D.W., 2015. Evidence for Neandertal jewelry: Modified white-tailed eagle claws at Krapina. PLoS One 10, e0119802.
Rodríguez-Vidal, J., d'Errico, F., Giles Pacheco, F., Blasco, R., Rosell, J., Jennings, R.P., Queffelec, A., 2014. A rock engraving made by Neanderthals in Gibraltar. Proceedings of the National Academy of Sciences USA 111, 13301–13306.
White, W.B., Culver, D.C. (Eds.), 2011. Encyclopaedia of Caves. Academic Press, Oxford.