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Back from the dead: Another response to the contextual bases of the Rising Star 'deliberate body disposal' hypothesis

Significance:

The hypothesis that >1500 Middle Pleistocene hominin bones represent the remains of complete corpses deposited deliberately in Rising Star Cave by conspecifics is provocative. This is because intentional handling of dead bodies might imply these hominins had developed a uniquely human sense of mortality salience >235 000 years ago. We assess the contextual bases of this hypothesis and find they do not, in fact, provide its unequivocal support. In sum, critical assessment of relevant geological and taphonomic data disallows falsification of the null hypothesis that the assemblage formed as the result of a non-anthropogenic process(es). Because so, the 'deliberate body disposal' hypothesis remains unsupported.

The large assemblage of hominin fossils from Rising Star Cave (RSC) (South Africa) is one of the most remarkable palaeoanthropological finds ever made. Analyses of its contents expand our understanding of the taxonomy, functional morphology, and tempo and mode of human evolution. Perhaps the most intriguing aspect of the RSC fossils is, however, what they might be able to tell us about the behaviour of the hominin individuals from which they derive. Most dramatically, it is argued that the RSC bones are from the corpses of hominins that were placed deliberately in the cave by conspecifics. Fossil-bearing areas in addition to the original Dinaledi Chamber have recently been recorded in the RSC system, including the U.W. 110 locality that has yielded 34 craniodental specimens of a single hominin juvenile.[1] Allusion to the stratigraphic context of these newly described fossils – i.e. that it appears 'similar to the U.W. 102b area of the Lesedi Chamber, in which cranial fragments and teeth from a single, immature individual were found on the surface and in the shallow, sub-surface contexts in sediments that rested on a horizontal chert shelf approximately 80cm above the cave floor'[1(p.10)] – has reignited scientific and popular discussion of the extraordinary claim that it is 'likely that some [intentional] hominin agency was involved in the deposition'[1(p.13)] of the RSC hominin materials. We appreciate the challenge RSC poses to researchers in terms of its difficult working conditions and complex stratigraphy. Videos of the cave system not only reinforce this appreciation but, in combination with published descriptions of its stratigraphy, geomorphology, and fossil assemblages, also afford us this opportunity to comment on two salient contextual underpinnings of what Dirks et al.[2(p.29)] refer to as the 'deliberate body disposal' hypothesis.

1. Entry into the Dinaledi sub-system today requires travel up the Dragon's Back (DB) and then descent through a narrow 12-m vertical fissure termed the 'Chute'. Elliott et al.[3(p.16)] reiterate the assertion from previous publications that 'the Chute was the only viable access point during the time that the hominin material accumulated, and thereafter'. The DB is a large dolomite block that, after its detachment from the cave ceiling at some point in antiquity, posed a significant impediment to the access of sediments and fauna into the Dinaledi sub-system, including especially hominins that might have been transporting deceased conspecifics. The timing of the DB collapse is thus of considerable significance for the 'deliberate body disposal' hypothesis. Robbins et al.[4(p.19)] date this event provisionally to sometime between 290 and 225 kiloannum (ka), which coincides broadly 'with the period when [hominins] most likely interacted with the Dinaledi sub-system'. It seems, then, that prior to this time range, access into the Dinaledi sub-system would not necessarily have required a journey up and over the DB and then down the Chute but perhaps, instead, a more manageable 5-m ascent up a dolomite sill followed by a short span *under* the still-attached DB block. This scenario helps make sense of the laminated orange-red muds found throughout the RSC system. Although some of these deposits may have formed through vadose water drip, most are interpreted as slackwater sediments that resulted from suspension settling of hydrologically transported clay and silt.[5] Erosional remnants of these muds occur throughout the cave system, including some several metres above the current floor in the Dinaledi Chamber itself. The arrival of these formerly extensive deposits must have involved water that originated outside the Dinaledi sub-system and travelled through the DB Chamber some 350 ka[4(p.18)], and, thus, before the deposition of the hominin fossils. Fluvial activity of some kind also must be implicated in these sediments' eventual erosion and dispersal deeper into the cave system via floor drains during and after the deposition of the hominin fossils. This not only highlights accessibility to the Dinaledi sub-system but also demands consideration of non-anthropogenic (i.e. hydraulic) mechanisms of bone deposition in the cave. Of course, such accessibility would also apply to hominins as they (potentially) moved into and out of the cave's chambers. However – and importantly – the recovery of baboon remains in a fissure just off the Chaos Chamber[3] demonstrates that the mere presence of large-bodied primates deep within the cave system need not necessarily require deliberate disposal by conspecifics.

2. Three key claims stand out to us about the taphonomic history of the hominin fossils from the Dinaledi Chamber[2]: (1) complete corpses were deposited within the chamber; (2) there is a lack of damage created by mammals on the hominin fossils; and (3) the remains were never exposed on the landscape outside of the cave. We have already scrutinised the first two claims elsewhere.[6] In summary: (1) the published RSC hominin skeletal part frequencies indicate either that complete corpses did not enter the chamber, or that, if they did, they then experienced some level of disturbance after their original deposition within the chamber; and (2) the poorly preserved cortices of the fossils may have obscured evidence of carnivore tooth marks and other taphonomic damage. The legitimacy of these concerns rests on how closely the frequencies of skeletal

parts from the 2013–2014 excavated assemblage match that of the portion of the assemblage that remains in the chamber as well as on the results of a comprehensive microscopic analysis of the cortical surfaces of all the fossils. The third claim relies, in part, on patterns of sub-aerial weathering damage to bone cortices. Linear cracks consistent with Behrensmeyer's[7] Stage 1 are common on the hominin fossils. Dirks et al.[2(p.33)] acknowledge that these standards – which, after all, were constructed for bones exposed aboveground – are not completely applicable to subsurface environments. They do assert, however, that because the bones do not exhibit damage indicative of extended surface exposure, the observed weathering must be due to the swelling and shrinkage of bone exposed to wet-dry cycles within the recesses of the cave. Pokines et al.[8] do in fact demonstrate through actualistic work that moisture-induced swelling and shrinkage can produce linear cracks similar to those observed on the hominin bones. However, they also note[8(p.438)] that it is 'unknown if fluctuations in interior karst feature humidity can bring about sufficient wet-dry cycles to exposed surface bone to cause weathering changes, so this topic of research needs exploration in field and additional laboratory settings'. To our knowledge, actualistic work has not confirmed that sub-aerial weathering damage to macromammal bones can occur deep within a cave system. Even if this were the case, environmental conditions within RSC are relatively constant today and were likely 'stable and dry for at least the last ca. 300 ka'[5(p.914)], so it remains an open question whether the RSC bones experienced wet-dry cycles of sufficient amplitude to create the observed weathering damage.

In light of these concerns, we continue to question the plausibility of the RSC 'deliberate body disposal' hypothesis. We agree that the RSC fauna is exceptional for its extremely high proportion of hominin fossils. But careful consideration of hominin skeletal part representation, acknowledgement that poorly preserved bone cortices have biased the identification of possible surface damage, and, as discussed here, appreciation of the potentials that the RSC fauna is hydraulically derived and/or is wholly or partially autochthonous, all mean that its formation is still quite uncertain.

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