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Further evidence for eagle predation of, and feeding damage on, the Taung child

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We present new evidence supporting the hypothesis that a large raptor was responsible for the death of the *c.* 2.0-Myr-old Taung child, holotype of the early hominin species *Australopithecus africanus.* We compare the Taung child's skull with those of monkeys killed and eaten by modern crowned eagles, *Stephanoaetus coronatus,* in the Ivory Coast's Tai Forest. Close inspection of primate feeding remains from these large, powerful raptors reveals scratch marks in the orbital, frontal, temporal, parietal and occipital regions. Scratches similar in size and distribution are also present on the Taung child's skull. The new taphonomic evidence, combined with previously recognized similarities in breakage patterns and other assemblage characteristics, bolsters the case that a large bird of prey was responsible for the death of the juvenile hominin from Taung.

Introduction

In 1995, Berger and Clarke proposed that the *c.* 2.0-Myr-old Taung child (Fig. A in supplementary material online at www.sajs.co.za), holotype of the early hominin species *Australopithecus africanus,* and associated faunal assemblage from the Taung site in the North West province of South Africa, had been collected by a large bird of prey.[1] Much debate concerning this hypothesis followed due, in part, to the apparent lack of evidence of direct eagle predation on the Taung skull itself and the presumption at the time that raptors were not capable of killing and lifting animals as large as juvenile hominins.[2–4] Evidence from a growing number of studies on raptor–primate interactions has since demonstrated conclusively that extant birds are capable of transporting the remains of primates in the estimated body-size range of juvenile early hominins.[8–11] Further, damage patterns on bones in faunal assemblages made by extant raptors were found to be similar to those present in the Taung fossil assemblage.[1] Studies of African crowned eagles (*Stephanoaetus coronatus*) in particular establish the capacity of at least one large raptor to kill large mammals, to collect substantial bone assemblages, and to leave taphonomic signatures similar to those found on primates and other animals recovered from the Taung site.[12]

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Damage to the Taung child's skull

Direct evidence of eagle-type damage on the Taung hominin was recognized in 2006 in the form of gouges and punctures in the orbits of the fossil[13] (Fig. 1). This evidence was discovered when comparisons were made with damage described from extant monkeys killed and eaten by crowned eagles in the Tai Forest, Ivory Coast.[14]

More detailed examination of the collection of Tai Forest primates led to the identification of additional evidence arising from predation by eagles and we believe this newly recognized taphonomic signature is also present on the Taung fossil itself. Figures 2–5 illustrate several monkey skulls from the Tai Forest assemblage. Beyond the more obvious modifications such as orbital damage and puncture marks are scratches across the frontal area, around the orbits, and in other areas of the skull. These indentations are difficult to discern, but can be more readily detected when a light source is directed at the specimen from the side. Figures B–D online show several close-up views of the frontal and orbital areas and maxillae of the Taung child. It is apparent that the types of scratches known to result from eagle processing activities are present on the Taung child's face. Because

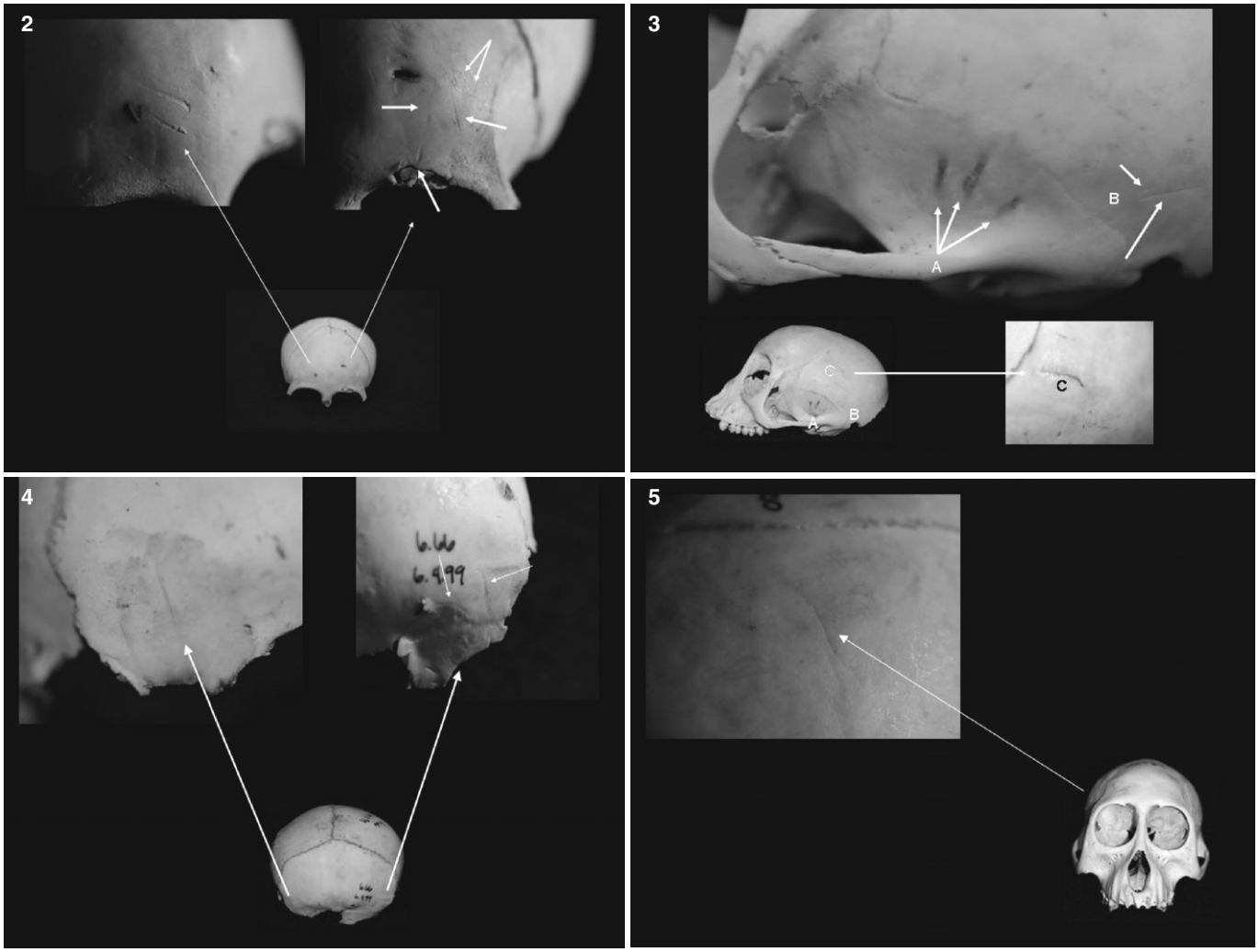


Fig. 1. Proposed raptor-caused damage in the base of the orbits of the Taung child (after Berger[13]).

of the physical state of the Taung fossil, it was unnecessary to highlight these scratches, but because of potential damage to the skull, we were unable to take peels of these scratches for observation in a scanning electron microscope. Microscopic examination of these scratches, however, confirms their similarity to the modern damage caused by African crowned eagles (Fig. 6).

In addition to the activities of carnivorous birds, there are at least two other explanations for the presence of scratches on the Taung hominin skull, so we are careful to consider whether they resulted from another animal/agent during the kill or via processing post mortem, or preparation of the fossil skull by Raymond Dart. Regarding the second possibility, it is true that Dart used relatively primitive methods for extracting the face from the encasing breccia.[15] In his autobiographical account of the discovery of the Taung skull, however, Dart clearly states that 'on the 73rd day, December 23, the rock parted', implying that the breccia fell away from the face and was not removed by scratching with an implement.[15] Dart goes on to state that 'I could view the face from the front, although the right side was still embedded'.[15] This statement implies the possibility that Dart prepared the right of the face with implements that could have caused scratching. However, the Taung face has scratches on both the left and right sides, which we feel mitigates against the likelihood that all of these scratches were made during preparation by Dart.

We cannot rule out the possibility that the scratches found on the Taung skull were the product of an agent other than a bird of prey, but we can say with certainty that the damage suffered by the cranium—including intra-orbital breakages, circum-orbital scratches, braincase punctures and the scratched indentations described herein—is consistent with damage known to result



Figs 2–5. Scratches on monkeys preyed upon by crowned eagles (*Stephanoaetus coronatus*) in the Ivory Coast's Tai Forest. The irregular scratches are widely distributed over the skull including frontal and orbital areas (Fig. 2), temporal and parietal regions (Figs 3, 5) and occipital regions (Fig. 4).

from killing and processing activities of extant raptors on primate prey. The indentations are generally irregular in diameter, length, and linearity/curvature, and most show no apparent orientation pattern. They can, therefore, be readily distinguished from the highly patterned, closely spaced, grooves that result from rodent gnawing (Fig. E online).[16] The marks do not exhibit the character of geological abrasion.[17] Furthermore, our examination of fossil primates, including hominins, from sites such as Sterkfontein, Makapansgat and Gladysvale did not show similar scratches, thus supporting the idea that these marks are unusual and probably not a product of preparation in the laboratory.

We therefore suggest, in the absence of more detailed accounts of crowned eagle feeding behaviour, that many if not most of these marks were made while either chicks or adults held the skull during feeding and de-fleshing and are thus the result of talon indentations.

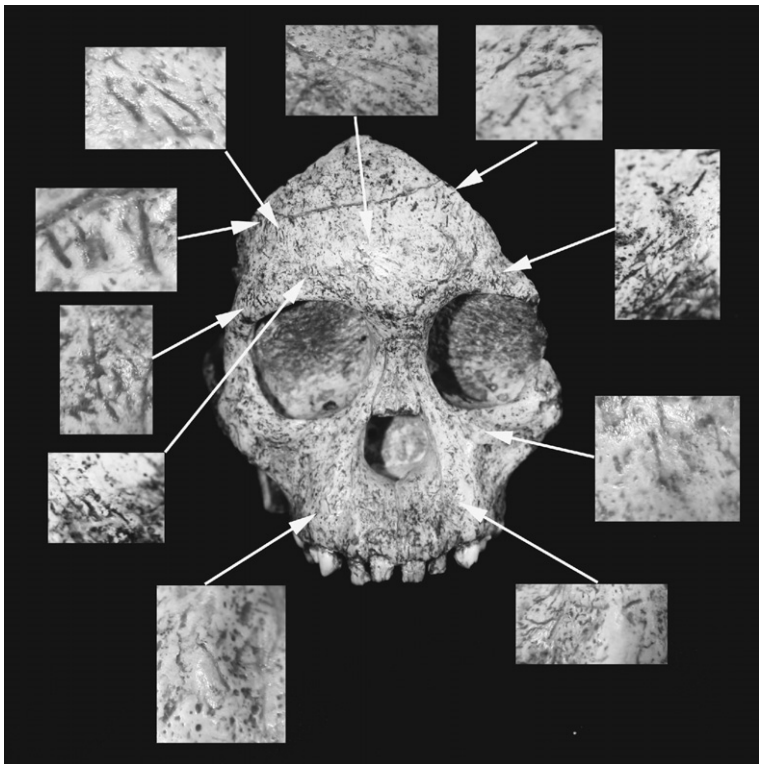


Fig. 6. The distribution and form of scratch marks around the face of the Taung child. Note that scratch marks are found on both sides of the face and both superiorly and inferiorly.

Discussion

Taken together, the presence of scratch marks very similar to those associated with eagle processing activities on extant monkeys bolsters the argument that a large bird of prey killed and collected not only large parts of the fossil assemblage associated with the famous hominin, but the Taung child itself. While we cannot, at this stage, completely discount the possibility that some of the scratches were made by Dart during its extraction from the breccia, we believe that the evidence for many if not most of the scratches being made by a raptor is strong. There is a striking similarity in form and position, particularly of those scratches situated above the orbits, on the maxillae and on the frontal area of the Taung fossil, to those observed on extant monkeys killed and consumed by crowned eagles. The fact that most of the Taung fossil baboons bear similar scratches to those found on the Taung child, while primates from other South African sites do not, supports our hypothesis that a raptor was at least partially responsible for the Taung primate assemblage, including its young australopithecine. Furthermore, the similarity between scratch marks on extant monkeys killed and eaten by crowned eagles in the Ivory Coast, and markings on the fossil baboons associated with the Taung discovery (Fig. H online) and on the face of the Taung child itself, provide additional support for the hypothesis.

We therefore propose that consideration should be given to the possibility that large birds of prey have had a potentially significant effect on the evolution of predator avoidance behaviour of early hominins. The extent to which juvenile australopithecines were exposed to raptor predation is unknown, but further studies of Miocene–Pleistocene primate assemblages may shed light on the prevalence of large raptors in the palaeo-African environment and their prey collecting capabilities and preferences.[18,19] The coincidence that the first African early hominin discovered (and represented by one of the very few intact juvenile crania) presents strongly suggestive evidence of predation by a bird of prey, may indicate that these juveniles were hunted by raptors. Testing this hypothesis will require the recovery of additional highly intact juvenile australopithecine crania.

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Supplementary material to:

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Fig. A. View of the face and right brain endocast of the Taung child skull.