

Taung stratigraphy and taphonomy: preliminary results based on the 1988–93 excavations

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The Palaeo-Anthropology Research Unit, began excavations of Pliocene fossil deposits in the Thabaseek tufa at Buxton, Taung, in 1988. Work on the top surface and southern face of the Hrdlička pinnacle revealed a series of closely related fossiliferous breccia deposits, the lower three of which appear to have accumulated in primary carapace tufa caves. The combined faunal assemblages from these deposits appear to be roughly contemporaneous with the fauna of Sterkfontein Member 4. Exposure of the quarry floor to the east of the Hrdlička deposits revealed *in situ* fossiliferous breccia, the Dart deposits, close to the probable area from which the type specimen of *Australopithecus africanus* was found in 1924. It is suggested that fossils in the Dart deposits, and probably the Taung hominid as well, accumulated in primary carapace caves that were filled and sealed prior to the formation of the Hrdlička caves, and therefore antedate the faunal assemblage of the Hrdlička deposits.

Fossils have been known from the Buxton Limeworks, now in the Taung district of Bophuthatswana, since 1919. The exact provenance of the caves that yielded these fossils, including the juvenile type specimen of *Australopithecus africanus* Dart, has long since been forgotten with the partial destruction of the caves by quarrying activity. Yet knowledge about the depositional context of the Taung hominid is crucial for the testing of hypotheses about the evolutionary role of *A. africanus*. Likewise, a sample of adult hominids from Taung would clarify the phylogenetic position of the species and allow for an assessment of its morphological variability. It was with the

goal of answering the questions surrounding the Taung hominid that we began a programme of excavation and research at the Buxton Limeworks in 1988.¹

The focus of our excavation was initially on the Hrdlička pinnacle, a remnant of the Thabaseek tufa, rich in fossils (Fig. 1). In 1925, Aleš Hrdlička found and excavated fossil remains of extinct cercopithecids from the southern face of this pinnacle.^{2,3} Excavations of these deposits in 1947–48 by Frank Peabody suggested the presence of three distinct fossiliferous deposits. Of these, there was a lower, sandy breccia deposit, inferred to be the older, which had yielded most of the cercopithecids. The subsequent deposition of a silty pink breccia with fewer fossils was postulated to represent a 'wet phase' which Peabody considered contemporaneous with the deposition of the Taung skull. Peabody³ saw the caves as being solution cavities that developed in the terminal stage in the formation of the Thabaseek tufa, whereas Butzer⁴ suggested that the solution cavities were produced somewhat later.

Peabody had reconstructed the locality of the original hominid discovery at a position to the west of the Hrdlička deposits, where the Taung monument, erected in 1985, now stands (Fig. 1). The cave that once existed there was inferred to be part of the same cave system as that preserved on the face of the Hrdlička pinnacle. In 1991, our team discovered a series of *in situ* fossiliferous deposits in the quarry floor immediately south of the Dart pinnacle, and just west of Peabody's reconstructed type locality. These have been dubbed the 'Dart deposits',⁵ and were the focus of the 1992–93 excavations.

Analyses of the Hrdlička and Dart deposits are leading to a new synthesis on the context of the Taung hominid. Here we summarize some preliminary results.

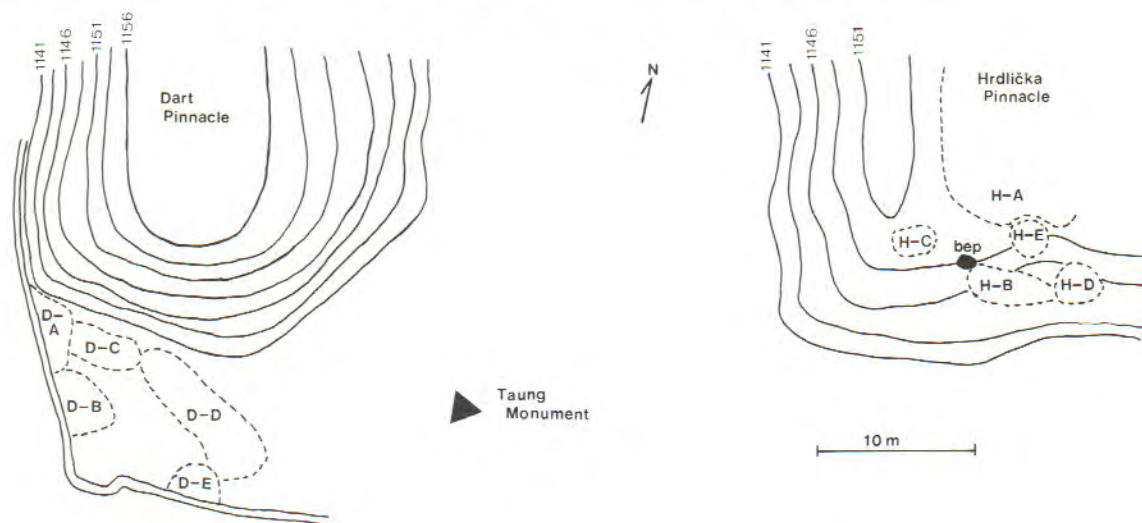


Fig. 1. Diagram of the fossil deposits in the Thabaseek tufa near the type locality of *Australopithecus africanus*. The Hrdlička deposits, denoted with an H prefix, are intersected by a more recent solution cavity called the 'Black Earth Pipe' (bep). The Taung Monument stands at the approximate spot which Peabody reconstructed as the locality from which the Taung skull was quarried in 1924. The Dart deposits, (D-A to D-E) were inferred to be part of the *Australopithecus* type site cave system. The dashed lines indicate the extent of each deposit as revealed by the end of the 1993 excavation.

Hrdlička deposits

Excavations from the top of the Hrdlička pinnacle down the southern face have revealed at least five distinct deposits (Fig. 1). The lower of these, H-B and H-D, rest on a tufa floor sloping downwards to the north-east, with the former abutting on an ancient cave wall to the west. H-B has pockets of concentrations of *Papio antiquus* fossils, with less-frequent occurrences of bovids, mostly medium-sized alcelaphines, and microfauna. The breccia is pink with a heavy calcium carbonate component, interfingering with decalcified pockets of loose, sandy red breccia.⁶ The position of H-B corresponds to Peabody's locality 38-5b, which is his so-called 'wet-phase' deposit. Very little remained of H-D, which is in the position of Peabody's locality 38-5a; this corresponds to the 'dry-phase' deposit, from which many fossils, now in the University of California, Berkeley collection, were excavated in 1947-48.

Deposits H-B and H-D do not appear to be in solution cavities, as postulated by Peabody³ and Butzer,⁴ for there is no evidence of the depositories having cut across the bedding planes of the tufa. Rather, the deposits appear to have accumulated in primary carapace caves, as the tufa forming the western wall and floor, exposed by our excavations, shows the morphology characteristic of such caves.^{5,7} These deposits are near the easterly limit of the Thabaseek tufa, based on reconstructions from historical records. Therefore, we believe that the caverns containing deposits H-B and H-D probably formed and filled during the terminal stages in the deposition of the Thabaseek tufa. In both deposits the localized concentrations of bone are suggestive of a former lair of a carnivorous predator⁷ in a dry portion of the cave,⁵ but none of the bones prepared to date has any definitive carnivore tooth marks.

Deposit H-C, included by Peabody as part of the 'wet-phase' deposit, lies behind the currently exposed back wall of H-B. It yielded no fossils from our excavation and apparently very few from the 1947-48 excavation.

A layer of sandy breccia, devoid of fossils, overlies deposits H-B and H-D. It is intersected by a more recent solution cavity, Peabody's 'black earth pipe', containing Middle Stone Age artefacts.³ Part of the tufa roof of this cave system forms the floor of deposit H-E, which was discovered in 1989. H-E is a small remnant of a pink breccia deposit, containing about 2 m² rich in bone. Most of the fossils are referable to *Papio izodi*, but there are also juvenile alcelaphines. This densely packed bone assemblage, like the ones below it, was almost certainly collected by a predator specializing primarily in baboons and storing their remains in the narrow recesses of a primary cave.

On the roof of H-E were distinct erosional grooves, overlain by deposit H-A. Therefore the deposition of H-A, the uppermost and probably latest in the Hrdlička pinnacle sequence, followed an erosional phase that destroyed part of the roof of the H-B/H-D system and carved into the roof of H-E. The H-A breccia contains many large bone fragments with most of the cortical bone eroded away. There are a few fragmentary bovid teeth and isolated cercopithecoid teeth. The deposit slopes down to the north-east and the bone fragments get successively smaller along that slope. A plausible scenario is that the animals were caught in a cave or ravine upstream, and their bones washed down over this area.

Dart deposits

The Dart deposits were first defined as a series of five separate deposits.⁵ Excavations in 1993 further revealed the relationships among the deposits (Fig. 1). It is now apparent that D-A and D-B are parts of one continuous deposit; the former component is characterized by a uniform pink breccia, whereas

the latter has numerous decalcified pockets presumably from tree roots. The fossils in the breccia are very sparse, with only occasional bone fragments ranging up to the size of a class III bovid. More characteristic of the deposit are the crab claws, tortoise carapaces and yellow eggshells, similar to those noted by Hrdlička² as being associated with the Taung hominid deposit. A piece of tortoise carapace has indeed survived in the very fragment of breccia from which Dart extracted the child skull. Fossilized stems of reed plants were also recovered, especially in the area of D-B.

The Dart deposit richest in fossil bone is D-C, a small pocket of mottled pink breccia at the back of an apparent carapace cave. It is separated from D-A by a thin layer of tufa that forms the western back wall of the D-C cavity at the current level of exposure. Four well-preserved cercopithecoid crania have been recovered from D-C, but have not yet been prepared; they are in the medium-size range of *Parapapio*. In addition there are some post-cranial bones of cercopithecoids and of a large class III bovid, as well as a partial cranium of *Procavia antiqua* and fragments of tortoise carapace.

Deposit D-C is continuous with D-D, a long stretch of horizontally stratified pink breccia averaging about 25 cm in thickness, abutting on a floor of limestone nodules; these features are again characteristic of a carapace cave with a horizontal entrance.⁵ D-D has yielded only one identifiable fossil, the mandible of a female *Parapapio* cf. *broomi*. D-E has now been revealed to be a part of D-D, with a localized concentration of unidentifiable bone fragments.

The relatively low density of fossils in D-C is in stark contrast to the densely packed nature of deposits H-B, H-D, and H-E of the Hrdlička pinnacle. Taphonomic experiments in a nearby carapace cave show that bone can remain packed together in place, as in the Hrdlička deposits, in dry areas of a cave. The backflow of waters, washing animals into a cave, would lead to a wider scatter of bone near the back of a cave. It is postulated that D-C formed in such a manner, and that the animals deposited there may have drowned or been killed near the water's edge. This notion is consistent with the horizontally layered breccia of D-D representing water-laid sands in the outer portion of the cave.

Locality of the Taung hominid discovery

It has recently been posited that the Dart deposits may be remnants of the cave system from which the Taung child was quarried in 1924.^{5,8,9} Further evidence from the excavations and historical records, as well as recently acquired photographs from 1927, serve to support this hypothesis.

Peabody's reconstructed locality of the hominid discovery was based on interviews in 1947 with workers who had been present in 1924. Peabody recorded in his field notes, but not in his 1954 publication, that he had excavated breccia in the area of what are now known as the Dart deposits but had found no fossils. He nevertheless speculated that these breccias represented the floor of the *A. africanus* cave system.

Through the initiative and kindness of Dr J. Moggi-Cecchi, we recently acquired photographs of the Buxton Limeworks, taken in September 1927 by his great-uncle, the well-known Italian anthropologist, Lidio Cipriani. Cipriani was the second foreign scientist (after Hrdlička) to visit the site of the Taung hominid discovery. One photograph (Fig. 2) shows a quarry remnant which is undoubtedly the Dart pinnacle. On it is a man (at the arrow), suspended by a cable at the level from which the Taung skull was thought to have emanated. Cipriani did not publish the photograph, but stated that a small distance from the hominid locality was a spot where conditions were very similar in all respects to that in which the Taung skull had been found.¹⁰ The man is suspended on the south-west corner of the



Fig. 2. Photograph taken by Cipriani in September 1927, of the Buxton quarry, with the Dart pinnacle on the right. The arrow points to a man suspended on cable on the south-west corner of the pinnacle.

Dart pinnacle, approximately 4 m (a small distance indeed) from deposit D-C.

The presence of large, yellowish eggshells in deposit D-A in a sparsely littered deposit of pink breccia is also a significant clue. Hrdlička² (p. 384) noted the discovery of similar eggshells in the vicinity of the Taung skull, 'of yellowish uniform color and of about the size of a goose egg' together with the 'turtle' and some other bones. The presence of such eggshells, not found in the Hrdlička deposits, had been noted by the quarry workers for some time before the discovery of the Taung hominid.^{2,10}

It is therefore plausible and perhaps likely that quarrying occurred along the axis of D-A/D-B, reaching either D-C or a comparable cave nearby, late in 1924 when the Taung skull was found. De Bruyn, a lime miner at the site, 'believed he remembered that at the time the larger specimen was discovered there appeared in the broken rocks also what looked like a mixture of baboon and other bones'² (p. 386). The fossils from D-C, with preservation comparable to that of the Taung skull and in the immediate vicinity, are therefore those most closely associated with *A. africanus*.

On the hypothesis that the deposition of the Thabaseek tufa spread from west to east, the more-westerly primary caves housing the Dart deposits must have formed before those of the more-easterly Hrdlička pinnacle. This interpretation is strongly supported by the successive layers of steeply dipping tufa that intervene between these two cave systems, building up to the western wall of deposit H-B. At the eastern edge of the Dart deposits, at least 10 m (measured horizontally) of nearly vertically striking tufa is evident in the quarry floor; they are interrupted by a sand-filled fissure under the Taung monument. The vertical layers, in slightly curved seams running north-south,

are continuous with the tufa of the Dart pinnacle, where they slope steeply upwards for 5-7 m before levelling back towards the escarpment (above the level of the man in Fig. 2). It is therefore likely that, after the filling of the Dart caverns with deposits D-A to D-E, these layers of carapace sealed the easterly entrances to the Dart cavities, in all probability including that of the *Australopithecus* cave. Thereafter, the Thabaseek tufa built out for at least a further 40 m to the east, forming the roof, wall and floor of the Hrdlička caverns developing along the eastern edge.

The mammalian assemblage of the Hrdlička deposits, exclusive of *A. africanus*, shares more of its identified species, and indeed more extinct species, with Sterkfontein Member 4 and Makapansgat Member 3 than with any other southern African site units. Faunal assemblage seriations place the Hrdlička assemblage as being comparable in age to the fauna of Sterkfontein Member 4,¹¹ and therefore it has been estimated to date to ca. 2.6-2.4 Myr.⁸ On the hypothesis that the age of deposition of the Taung hominid antedates the age of the fauna of the Hrdlička deposits, it may be dated tentatively to ca. 2.8-2.6 Myr.⁸

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