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THE CONTRIBUTION OF RAYMOND DART TO THE DEVELOPMENT OF CAVE TAPHONOMY

by

C. K. Brain

Transvaal Museum, P. O. Box 413, Pretoria, 0001.

ABSTRACT

The basic principles of African cave taphonomy were formulated in 1976, but twenty years earlier, Raymond Dart embarked on a pioneering taphonomic investigation into a hominid-bearing fossil assemblage from the Makapansgat Limeworks cave. He asked the questions that are typically addressed in contemporary cave-taphonomic studies, such as: how did the bones find their way into the cave? From what animals were the bones derived? What parts of the skeleton are represented and what damage have the bones suffered? What can be said about the behaviour of the hominids and other animals whose remains are preserved in the cave?

Dart concluded that hominids had been responsible for collecting the very large number of bones preserved in the Member 3 grey breccia unit. He set up a theory of the "osteodontokeratic" culture of *Australopithecus* and drew some remarkable conclusions about the nature and behaviour of early hominids. These conclusions, presented in powerful prose, provoked a good deal of subsequent research that set the discipline of cave taphonomy on its course.

KEYWORDS: Taphonomy, Cave-taphonomy, Raymond Dart, Makapansgat.

INTRODUCTION

Any review of research activities at the Bernard Price Institute for Palaeontological Research, during the last 50 years, would be incomplete without mention of Raymond Dart's remarkable study of a large bone assemblage from the Makapansgat Limeworks, undertaken in the early days of the Institute's existence. This was a pioneering investigation that had far-reaching consequences and it served to bring the Institute into palaeo-anthropological prominence.

Dart's attention was drawn to the fossil potential of the Makapansgat Limeworks cave by a local school teacher, Wilfred Eitzman, during the early 1920s. Among the numerous fossils that Eitzman sent to Dart at that time were several blackened bones, enclosed in the calcified cave earth, that Dart suspected of having been burnt. He arranged for chemical analyses of the bones to be done and these showed the presence of free carbon, suggesting that the bones had indeed been in a fire. On the strength of this evidence, together with that of the broken bones from a wide variety of animals, Dart (1925) suggested that Makapansgat had been "a site of early human occupation". Subsequently, following a Witwatersrand University student expedition, led by Phillip Tobias in 1945, new fossils were found at the Limeworks that led Dart to visit there the following year (Tobias, this volume). Dart immediately recognised the importance of the cave as a potential early hominid locality and employed James Kitching, Alun Hughes and their helpers to sort the lime-miners' dumps. This resulted in the finding of the first Makapansgat hominid specimens (Dart, 1948), which Dart named *Australopithecus prometheus*, assuming that they had been responsible for the burning of blackened bones found in the deposit. Subsequent research on this topic by Kenneth Oakley (1956) failed to confirm the presence of free carbon in the bones and the conclusion was reached that the blackening was caused by the presence of manganese dioxide. It has been suggested that the carbon initially detected in the first samples may have come from the blasting activities of the lime-miners.

The long-term operation of sorting miners' dumps at Makapansgat also produced very numerous blocks of highly fossiliferous grey breccia that had been blasted from the lower levels of the cave. Dart arranged for many of these blocks to be transported back to the Bernard Price Institute, where the individual fossil bones were manually extracted from the breccia.

DART'S ANALYSIS AND INTERPRETATION OF THE MAKAPANSGAT FOSSIL ASSEMBLAGE

At the Third Pan-African Congress on Prehistory held at Livingstone in 1955, Dart (1957a) presented the results of his taphonomic investigation of the Makapansgat grey breccia (now termed Member 3) fossil assemblage. His sample consisted of 7159 pieces of fossil bone that had been laboriously prepared from the breccia blocks sorted from the lime-miners' dumps. Of these, 4560 were found to be sufficiently complete to allow allocation to skeletal part and taxon; the remaining specimens consisted of bone flakes and fragments. Dart found that 91,7% of the identifiable fossils were of bovid origin, 4,0% came from non-bovid ungulates and the rest were from non-ungulates, such as primates and carnivores. Among the 293 individual antelope represented, 39 were large such as kudu, 126

were medium-sized, 100 were from gazelle-sized antelope and 28 were from small species such as duiker. Non-bovid ungulates were represented by four equids, six chalicotheres, five rhinos, 20 pigs, one hippo and six giraffids. Among the primates, there were remains of 45 baboons and five australopithecines, together with a variety of other animals that included 17 hyaenas, a sabre-toothed cat, porcupines, as well as other small mammals and reptiles, including terrapins.

Non-ungulate mammals were typically represented by skull-parts only, but the antelope had contributed a wide variety of skeletal parts which, however, showed striking and unexpected disproportionate representations. Most common of all parts were skull pieces, particularly mandibles; neck vertebrae, particularly the atlas and axis, were well-represented, but thoracic vertebrae were scarce and those from the tail were absent. Among the limb-bones, disproportions were most striking of all: in the case of the humerus, for instance, the distal ends were ten times more common than the proximal ends.

Dart also made a detailed study of the damage that the fossil bones had suffered. He described how, in his opinion, broken cannon-bones of antelope had been pounded with a pointed object, perhaps a bovid calcaneus, converting them into scoop-like structures.

As would be the case in a contemporary taphonomic investigation, Dart speculated on the possible agents of accummulation for the collection of bones in the cave and the behaviour of the animals involved. Since the early conclusions of William Buckland (1822) about the role of hyaenas as bone collectors in the Kirkdale Cave of Yorkshire, it had been customary to implicate these scavengers in the accumulation of fossil assemblages elsewhere. Dart (1956a) however, dismissed this concept in his paper on "the myth of the bone-accumulating hyaena". He concluded instead that the entire accumulation of bones in the grey breccia, running to many hundreds of thousands, had been taken to the cave by hominids, who ate the meat and then used the bones as a variety of tools and weapons. The implication was that australopithecines were powerful hunters as Dart (1956b) made clear:

> "The fossil animals slain by the man-apes at Makapansgat were so big that in 1925 I was misled into believing that only human beings of advanced intelligence could be responsible for such manlike hunting work as the bones revealed ... These Makapansgat protomen, like Nimrod long after them, were mighty hunters".

In his 1957 monograph, Dart elaborated his theory of the "osteodontokeratic" (bone, tooth and horn) culture of *Australopithecus prometheus*. He explained the striking disproportions in skeletal parts apparent in the Makapansgat assemblage in terms of deliberate selection of certain bones in view of their potential as tools and weapons. Parts of antelope skeletons not suitable for tool-use were simply left at the kill-sites, hence their absence from the cave. Uses were suggested for virtually all the bones in the fossil assemblage: the tooth-rows of mandibles made good saws, for instance, while the distal ends of humeri served as convenient clubs. Early in the investigation, Dart (1949) had suggested that humeral clubs had been responsible for the depressed fractures he observed on the calvaria of baboons and hominids from the caves of Taung, Sterkfontein and Makapansgat. In the case of fossil animals, such as baboons and carnivores, where only skulls are found in the Limeworks assemblage, Dart suggested that the exclusive presence of these, too, represented deliberate selection, concluding that the hominids had been "head-hunters" and "professional decapitators".

In the course of the 20-year-long duration of his Makapansgat project, Dart published 39 papers, the text of which often contained powerful, provocative prose. For instance, in his paper "The predatory transition from ape to man" (1953), he wrote:

> "On this thesis man's predecessors differed from living apes in being confirmed killers: carnivorous creatures that siezed living quarries by violence, battered them to death, tore apart their broken bodies, dismembered them limb from limb, slaking their ravenous thirst with the hot blood of victims and greedily devouring livid writhing flesh".

Dart's conclusions on early human nature were obviously of interest to a wide variety of people and his concepts generated lively debate. They so impressed the American dramatist Robert Ardrey that he wrote a series of widely-read books, starting with *African Genesis* (1961). They also provoked a number of palaeontologists, including myself, into undertaking further taphonomic investigations that would confirm or disprove Dart's wide-ranging conclusions. One such investigation was my 21-year-long excavation of the Swartkrans cave and associated taphonomic studies. This work quickly showed that many of the observations made by Dart, such as the striking disproportions of skeletal parts in the fossil assemblage, had explanations different from those that Dart had proposed. For instance, my work (Brain 1981) showed that the disproportions were linked to the varied robusticity of skeletal parts: some bones are simply better able to survive destructive treatment than others. In fact, it is possible to predict which parts of a skeleton will survive any given destructive process and which will disappear. It is no longer necessary to invoke deliberate hominid selection of bones to account for disproportions in a fossil assemblage. Similarly, subsequent work on hyaenas (Maguire *et al.* 1980; Skinner *et al.* 1980), particularly the striped hyaena, *Hyaena hyaena* whose fossils are found in the Makapansgat assemblage, have shown that these scavengers do, in fact, accumulate large numbers of bones in their breeding lairs. It now seems highly probable that they were more important as bone-collectors at Makapansgat than hominids had been.

It can be said that African cave taphonomy crystallised as a discipline at a symposium, held under the auspices of the Wenner-Gren Foundation for Anthropological Research, at Burg Wartenstein, Austria, during July 1976. The conference proceedings

were published as a book, *"Fossils in the Making"* (Behrensmeyer & Hill 1980). However, it will always be to Raymond Dart's credit that he embarked on a pioneering taphonomic investigation years before the basic principles of cave taphonomy had been formulated. His generosity of spirit was shown by the fact that he enthusiastically welcomed new interpretations, even when these conflicted with his own published views.

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