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Reappraisal of the Taxonomic Status of the Cranium Stw 53 from the Plio/Pleistocene of Sterkfontein, in South Africa

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ABSTRACT. A fossil skull, Stw 53, from the Plio/Pleistocene of Sterkfontein, in South Africa, has been referred to *Homo habilis* LEAKEY, NAPIER, and TOBIAS, 1964. Reappraisal of its putative hominine affinity reveals a closer resemblance to *Australopithecus africanus* DART, 1925. The skull, as reconstructed, is too small for *H. habilis*; with no indication of brain expansion over *A. africanus*; has a facial angle outside the hominine range, but identical with that of *A. africanus*; and whose teeth are not elongated but display buccolingual expansion. Although it was found in the same strata (Member 5) as stone tools, there is no causal connection. It has been dated faunistically at 2–1.5 my BP, but due to an unconformity it is suggested that it could be older. In spite of its late date, Stw 53 shows no intermediate characters which could support a trend towards *H. habilis* or *A. robustus* BROOM, 1938. It may, therefore, represent a relict population of *A. africanus*.

Key Words: *Homo habilis*; *Australopithecus africanus*; Sterkfontein; Cranial capacity; Facial angle; Dentition.

INTRODUCTION

In 1976 much of a fossilized skull with postcanine upper teeth, Stw 53, was discovered at Sterkfontein, in the Transvaal of South Africa. It was found with stone tools *in situ* in Member 5 of the Sterkfontein Formation, and dated faunistically at 2–1.5 my BP. The skull was identified as *Homo* aff. *habilis* (TOBIAS, 1976; HUGHES & TOBIAS, 1977) and later referred to *H. habilis* by TOBIAS (WASHBURN & MOORE, 1980; TOBIAS, 1983b; KIMBEL et al., 1984; TOBIAS, 1987 in press).

It is stated that 'the features of the skull sharply distinguish it from *A. africanus*, and that its features have clear affinities with *H. habilis*, as do the hominid teeth found in Member 5 (at the Sterkfontein Extension site) in 1957–1958' (HUGHES & TOBIAS, 1977). These teeth and a jaw fragment were identified as australopithecine by ROBINSON (1957, 1962). TOBIAS (1965a, b) said they include elements that seemed to belong to *Homo*.

Since the determination of Stw 53 belonging to *H. habilis* did not include quantitative evidence, it is reasonable to ask if the non-metrical evidence is all that convincing.

The aim of this study is to determine whether the skull Stw 53 is indeed quite different from *A. africanus* and the same kind of skull as that of *H. habilis* in East Africa.

MATERIAL AND METHOD

The material consists of a partial fossil skull and teeth, Stw 53, which has been described anatomically and figured by HUGHES and TOBIAS (1977). The features of the skull and teeth

were not quantified. A photograph of the skull in *norma lateralis* with a scale, as provisionally reconstructed by A. R. HUGHES and R. J. CLARKE (TOBIAS, 1983b), makes it possible to analyze quantitatively the relative brain size and the facial angle; and a photograph of the maxillary postcanine dentition in occlusal aspect (HUGHES & TOBIAS, 1977) allows for comparison of the relative sizes and proportions of the teeth. Drawings for this study were made from these photographs of Stw 53, OH 13 teeth after TOBIAS and VON KOENIGSWALD in WILLIAMS (1979); Sts 5 and KNM-ER 1813 of casts by the author.

The method of identification by the use of photographs and the technique of superimposition may be challenged by some. It has frequently been demonstrated that access to original fossil material per se does not insure correct identification. The veracity of identification based on photographs is not due to the methodology, but in the quality of the photographs used and the competence of the worker. The major problem is "to establish reasonable probabilities for the existence of anatomical similarities" (ORTNER, in MEYER, 1987).

RESULTS AND DISCUSSION

The skull Stw 53 has been referred to *H. habilis* on the basis of the following features (HUGHES & TOBIAS, 1977). (1) The skull is very small, smaller than *H. erectus* SK 80. (2) The vault of the temporal fossa is well-filled. The temporal lines are well separated from the midline. (3) The brow is very thin, moderately protuberant, and reminiscent of both the male *H. habilis* OH 16 and the female OH 24. (4) The nasal bones are virtually identical with those of *H. erectus* SK 80. (5) The presence of a styloid process. (6) The lateral pterygoid plate has a nearly vertical, notched posterior margin. (7) The maxilla resembles that of *H. erectus* SK 80. (8) The Occlusal Plane is helicoidal. (9) Both third and fourth premolars have three roots each. (10) The mandibular ramus is slender and gracile, with a somewhat excavated mandibular notch. 'The part as a whole bespeaks a high, narrow, modern-looking ramus of the lower jaw': With the exception of the very small size of the skull, none of the above features are diagnostic characters for *H. habilis* as described by LEAKEY et al. (1964). There is no mention of a marked tendency towards buccolingual narrowing and mesiodistal elongation of the teeth.

The skull Stw 53, as figured (TOBIAS, 1983a, b), is oriented incorrectly for comparison with other skulls. The standard orientation of a primate skull is made in accord with the Frankfurt Horizontal Plane. Since the points orbitale and porion are unknown in Stw 53, it cannot be oriented according to the FHP. The postcanine dentition is present, however, so that the Occlusal Plane can be drawn. While the FHP of *A. africanus* is parallel with the Occlusal Plane of the molars (TOBIAS, 1967), the skull Stw 53 supposedly represents *Homo*. By superimposing an outline of Stw 53 on that of *H. sapiens* oriented according to the FHP, so that the Occlusal Planes of both are coincident, the correct orientation of Stw 53 can be established.

CRANIAL CAPACITY

The predominant change marking the inception of early *Homo* is cerebral development (TOBIAS, 1983a). The brain of *H. habilis* is almost 50% greater than the average for *A. africanus* (TOBIAS, 1980). Although the brain size of Stw 53 has not yet been estimated, the vault of the temporal fossa and temporal lines suggest a moderately large brain for so small a skull (HUGHES & TOBIAS, 1977).

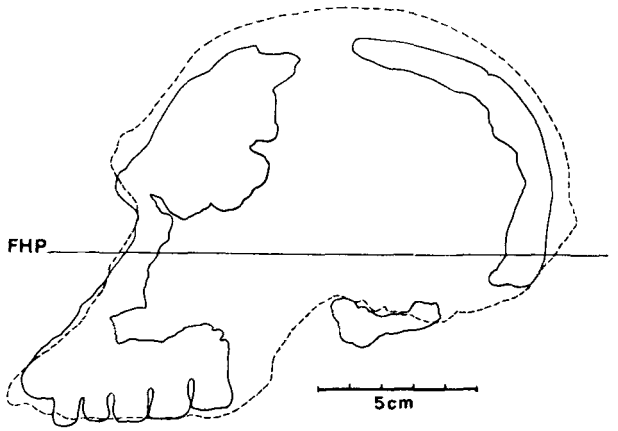

Fig. 1. Outline of Stw 53 (solid line) superimposed on an outline of *A. africanus* Sts 5 (broken line). The Frankfurt Horizontal Plane belongs to Sts 5. Note that the contour of the nasocanine and naso-alveolar is straight in both specimens. The difference between them is not greater than that due to intraspecific variation.

An outline of the skull Stw 53 is superimposed on that of *A. africanus* Sts 5, a small skull whose brain size is known (480 cm^3) (Fig. 1).

The results indicate that the brain of Stw 53 is less than 480 cm^3, much smaller than the minimum for *H. habilis*. The brain of *H. habilis* is 1/2 the average size of the brain of modern man. The brain of Stw 53 is only about 1/3 of the average size in modern man.

Facial Angle

The facial angle is made by the intersection of the axis of the face with the axis of the skull. It is determined by a line tangent to nasion or sellion and prosthion or pogonion and the Frankfurt Horizontal Plane. As already mentioned, the FHP of Stw 53 is unknown. A line corresponding to it, however, can be determined by superimposing an outline of Stw 53 on one of *Homo* so that the Occlusal Planes are coincident. A horizontal line parallel to the FHP of *Homo* can then be drawn, and the facial angle of Stw 53 measured. The reading of the facial angle of Stw 53 is nearly identical with that of *A. africanus* Sts 5, within the pongid and australopithecine ranges, but outside the hominine range (Table 1).

In the genus *Homo*, the facial angle varies from moderately prognathous to orthognathous (Le Gros Clark, 1955). The facial angle of *A. africanus* is defined as varying from moderate-

Table 1. Facial angle and cranial capacity of Stw 53 compared with those of other hominoids.

Hominoid species	Facial angle (in degrees)	Brain size (cm^3)	Mean (cm^3)
Pan troglodytes	49–63	350–400	393.8
A. africanus	(50) 53–65	428–562[1)]	498
Sts 5	53	480	
Stw 53	ca. 53	ca. 460–470	
H. antiquus			
KNM-ER 1813	67.5	510	
H. habilis	—	597–775+	660.
H. sapiens	(70)–(99)	1000–2000	1345

Facial angle made by sellion-prosthion line except for that in parentheses which are made by nasion-prosthion line. 1) Taung adult.

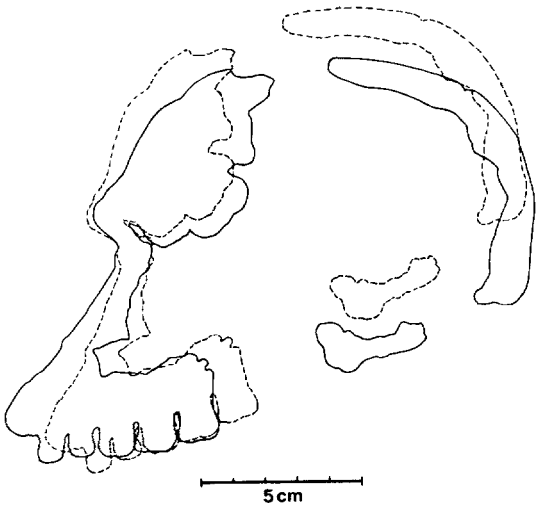

Fig. 2. Outline of Stw 53 (solid line) oriented according to the Occlusal Plane of *Homo*, and superimposed on an outline of Stw 53 (broken line) as originally oriented in the reconstruction by HUGHES and CLARKE (TOBIAS, 1983).

ly orthognathous (a subjective judgement) to markedly prognathous (by actual measurement) (TOBIAS, 1967). If a facial angle of 70 degrees in *Homo* is considered moderately prognathous, then *A. africanus* Sts 5, which does not represent the mean, and falls well within the range of *Pan troglodytes*, is markedly prognathous or hyperprognathous. In the original orientation of the skull Stw 53, the frontal bone is high as in modern man, and the facial angle is similar to that of KNM-ER 1813, which for *Homo* would be hyperprognathous. When reoriented according to the Occlusal Plane of *Homo*, the frontal bone is low, and the facial angle is indeed hyperprognathous (Fig. 2).

In the hominization of the human face there has been a trend in the facial angle from low, as in an anthropoid ape, to high in modern man. This angle is now understood to be primarily related to the development of the frontal part of the brain and secondarily to mesiodistal dental size and maxillary protrusion. As the brain grew bigger, frontal protrusion increased to accomodate it. Maxillary protrusion decreased with the diminution in mesiodistal dental size. Although the facial angle of *H. habilis* has not been published, except for KNM-ER 1813 (KIMBEL et al., 1984) which is not *H. habilis* (FERGUSON, 1987), the facial angle of *H. habilis* can be inferred from its brain size and dentition. The mesiodistal diameters of the dentition of *H. habilis* and *A. africanus* are about the same, and so the maxillary protrusion is also similar. The brain of *H. habilis*, however, is much larger with greater frontal protrusion than in *A. africanus*. It stands to reason that the facial angle of *H. habilis* will be higher than in *A. africanus*. In *H. habilis* 1470 the facial angle is described as 'steep' (DAY et al., 1975). It is safe to say that the facial angle of *H. habilis* lies above 67 degrees, distinctly higher than in Stw 53.

FACIAL PROFILE

Early *Homo* can be distinguished from *A. africanus* by the shape of the anterior facial profile in norma lateralis. In *H. habilis* the nasocanine and nasoalveolar contours are dis-

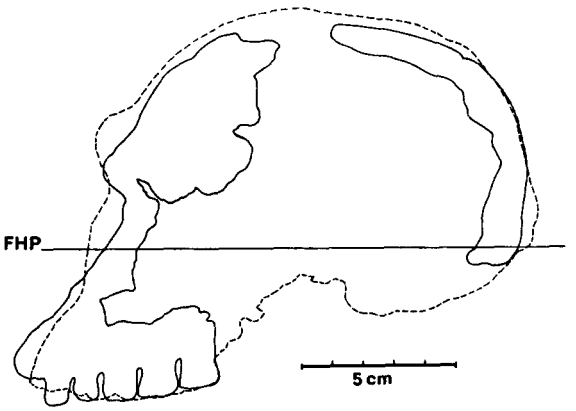

Fig. 3. Outline of Stw 53 (solid line) superimposed on that of *H. antiquus* FERGUSON, 1984 (not *H. antiquus*, ADLOFF, 1908 of CAMPBELL, 1965) KNM-ER 1813 (broken line). The Frankfurt Horizontal Plane belongs to KNM-ER 1813. Both skulls are about the same geologic age. Note the contour of the nasocanine and nasoalveolar of *H. antiquus* is angulated and not straight as in Stw 53.

tinct, while in *A. africanus* they merge (KIMBEL et al., 1984). In the facial profile of Stw 53 the contours merge (Figs. 1 & 3).

DENTITION

Criteria for distinguishing the maxillary postcanine teeth of *H. habilis* and that of *A. africanus* are after ROBINSON (1956), LEAKEY et al. (1964), and TOBIAS (1967).

Australopithecus africanus	*Homo habilis*
1. Postcanine teeth relatively large: marked by buccolingual expansion of the crown.	1. Postcanine teeth marked by tendency towards buccolingual narrowing and mesiodistal elongation.
2. Fourth premolar larger than third premolar.	2. Fourth premolar about equal to or smaller than third premolar.
3. First molar smaller than second molar.	3. First molar equal to or greater than second molar.
4. Third molar slightly smaller than second molar in mesiodistal diameters, but equal in buccolingual diameters.	4. Third molar smaller than second molar and narrower in buccolingual diameter.

According to the above criteria, the dentition of Stw 53 does not show clear affinities with that of *H. habilis*. The teeth of Stw 53 in general indicate buccolingual enlargement. The third premolar is not narrow and shows no tendency towards mesiodistal elongation. On the contrary, it is unusually short and broad. The premolars are not about the same size. The fourth premolar is larger than the third. The mesiodistal space for the first molar is smaller than the mesiodistal diameter of the second molar with no indication of mesiodistal elongation. The second and third molars are about the same in buccolingual diameters.

Moreover, TOBIAS (1981) noted that there is a general reduction in the size of the cheek teeth in *Homo*. The cheek teeth of Stw 53, however, show no sign of reduction compared with *H. habilis* OH 13 (Fig. 4).

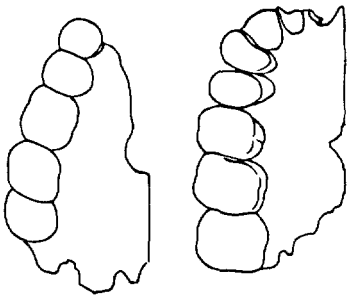

Fig. 4. Maxillary right postcanine dentition of *H. habilis* OH 13 (left) compared with that of Stw 53 (right). Occlusal aspect. Drawn approximately to the same scale.

GEOLOGIC AGE

The skull Stw 53 has been dated faunistically. It was found in Member 5 of the Sterkfontein Formation, above Member 4 which yielded fossils of *A. africanus* dated at 3.0–2.5 my BP. The fauna of Member 5 is younger than that of Member 4, and comparable to Member 1 of Swartkrans, which is dated at 2.0–1.5 my BP (TOBIAS, 1980). There is, however, a marked unconformity or interruption in the sedementation between Members 4 and 5 that has eroded away, so that the fauna between 2.5–2.0 my BP is unknown. The fauna of Member 5 could have extended back in time up to half a million years more. It is suggested, therefore, that Stw 53 is associated with fauna that could be several hundred thousand years older than *H. habilis* of Olduvai in East Africa.

SUMMARY AND CONCLUSION

A partial skull with maxillary postcanine dentition, Stw 53, was found in Member 5 of the Sterkfontein Formation, and referred to the taxon *H. habilis*. Although it was found in the same strata as stone tools, there is no causal connection. It has been dated faunistically at 2–1.5 my BP, but due to an unconformity it is suggested that it could be older.

As TOBIAS (1983b) rightly stated, "the final judgement on the classificatory designation of a sample of fossils must remain morphological appraisal, irrespective of the time dimension." While Stw 53 appears to belong to a higher geologic level than *A. africanus* of Member 4, the morphological pattern of the skull and teeth do not conform with the diagnosis for *H. habilis*. The neurocranium is not moderately large for a small skull, but is similar in proportions to those of *A. africanus*. It does not indicate cerebral enlargement over *A. africanus*; the facial angle and profile shape are unlike those of *H. habilis*; and together with the dental proportions are more like those of *A. africanus* than of *H. habilis*. The morphological difference between Stw 53 and Sts 5 is not greater than that seen in intraspecific variation.

In spite of its late geologic age, Stw 53 shows no intermediate characters that could indicate evidence of a morphological trend towards the more generalized *H. habilis* or more specialized *A. robustus*. TOBIAS (1983a) recognizes a possible temporary continuation of the *A. africanus* line after the earlier *A. africanus* gave rise to *A. robustus* in South Africa. The skull Stw 53 may, therefore, represent a relict population of *A. africanus* and helps fill the hiatus between *A. africanus* of Sterkfontein and Taung.

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