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Laetoli Hominid 18: an Early *Homo sapiens* Skull

Laetoli Hominid 18 (LH 18) was found by Dr M. D. Leakey's team in 1976. The Ngaloba beds at Laetoli, Tanzania from which it comes have been dated at approximately 120,000 ± 30,000 years B.P. The description of the skull is summarized here, and it is shown to incorporate a mixture of both archaic and modern features, and have a likely cranial capacity of about 1200 cc. Morphological comparisons with other early African *Homo sapiens* crania show that although there are some differences between them and LH 18, there are enough similarities to suggest that they all belong to a single species. LH 18 is shown to be quite unlike the *Homo erectus* and Neanderthal crania studied. Metrical analyses confirm the links between LH 18 and the other archaic *Homo sapiens* crania from Africa, especially Eyasi and Omo 1. The similarities between these crania provide a good example of mosaic evolution, incorporating a range of cranial variation within a single species.

1. Introduction

In 1976 Dr M. D. Leakey and her co-workers found a fossil human cranium *in situ* in the Ngaloba Beds at Laetoli, Northern Tanzania. The cranium, known as Laetoli Hominid 18 (LH 18), was found partially emerging from the deposits within an area of one square metre. Associated with a cranium were a number of artefacts and some faunal remains that included fossil reptilian, avian and mammalian bones.

2. The Site

The stratigraphy of the Laetoli area was first described by Kent (1941), but after more recent work by R. L. Hay (1974/5) a more detailed picture has emerged. Both Hay and Kent subdivided the Laetoli sequence into three main units: a Lower unit, the Laetolil Beds (dated by K/Ar to 3·6–3·75 m.y.B.P. and containing australopithecine fossils and hominid footprints), a Middle unit, the Ndolanya Beds (dated to 2·4–3·6 m.y.B.P.) and an Upper unit, the Ngaloba Beds. The Ngaloba Beds are stream deposits, principally sandstones and claystones that are separated from the underlying Ndolanya and Laetolil Beds by Vogesite lava (Leakey *et al.*, 1976; Leakey & Hay, 1979). Attempts to date the Ngaloba Beds by the radiocarbon method and by amino-acid racemization measurements were unsuccessful, but an estimate of 120,000 ± 30,000 was derived from correlations with the marker tuff in the lower unit of the Ndutu beds at Olduvai Gorge. Recent analyses of the faunal remains, together with an assessment of the stone artefacts as belonging to the Middle Stone Age cultural complex also found in the upper Ndutu beds, tend to confirm this initial assessment (M. D. Leakey, pers. comm.). The Ngaloba skull was found in 21 pieces, which were carefully cleaned and restored and formed the subject of detailed description and comparative analysis (Magori, 1981; Magori & Day, in press).

3. The Skull

The LH 18 cranium consists of an almost complete and intact cranial vault, much of the base together with both temporal bones and part of the sphenoid bone. The maxillo-facial

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fragment, including part of the upper dentition, is only partially preserved and is completely detached from the rest of the cranium. The mandible is missing. The cranium is large, long and oval-shaped with a low vault. The individual fossil bones are ivory in colour and heavily mineralized, as are other bones from the same site. The bone shows no signs of pathology but there are signs of some surface erosion, in particular of the temporal bones. The bone of the supraorbital region and the left temporal bone show signs of post-mortem plastic deformation that has resulted in torsion to the right of the supraorbital region and in some springing of the temporo-occipital suture of the left. All the principal sutures are still open and well preserved. Bregma, lambda and asterion are well defined. Internally, most of the endocranial features are well retained. The frontal region is twisted to the right side (Figure 1). It reveals a developed and divided supraorbital torus, a low vault, slight keeling of the frontal bone in the sagittal plane, mid-parietal bossing and a moderately developed glabella. The lateral view (Figure 2) shows the recession of the frontal region, a shallow ophryonic sulcus, a round occipital profile with a prominent occipital torus, small mastoid processes and the presence of a well-developed occipitomastoid crest on the right side. The occipital view (Figure 3) shows the skull to be symmetrical and rounded. The occipital torus is centrally situated and of uniform thickness, but fades away and does not become continuous with the supramastoid crest. The nuchal portion of the squamous part of the occipital bone is divided by a well marked external occipital crest that separates two shallow depressions for the attachments of the nuchal muscles. The vertical view reveals the long and low outline of the calvaria, the twist in the right supraorbital region, mid-parietal expansion and the prominence of the supraobital torus. Although much of the base of the cranium is missing, the basal view confirms the deformation in the frontal region and clearly shows the outline of the ethmoidal air cells and positions of the ethmoidal canals, as well as the interior grooves for the sinuses and meningeal vessels.

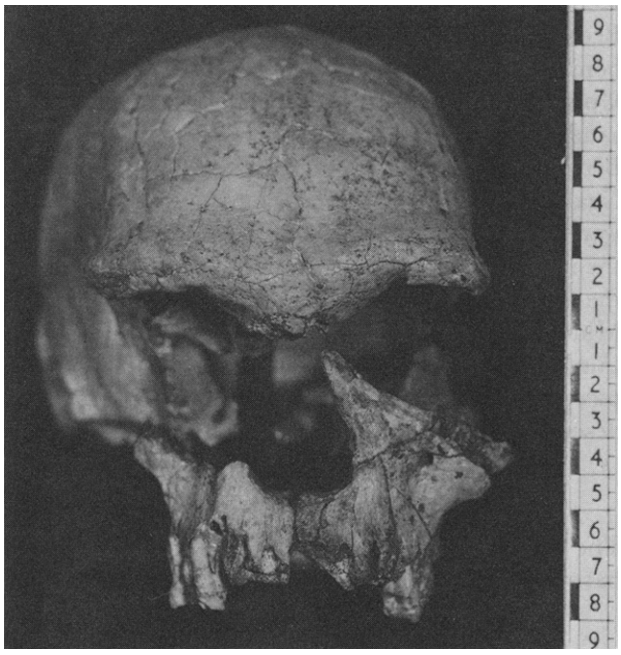
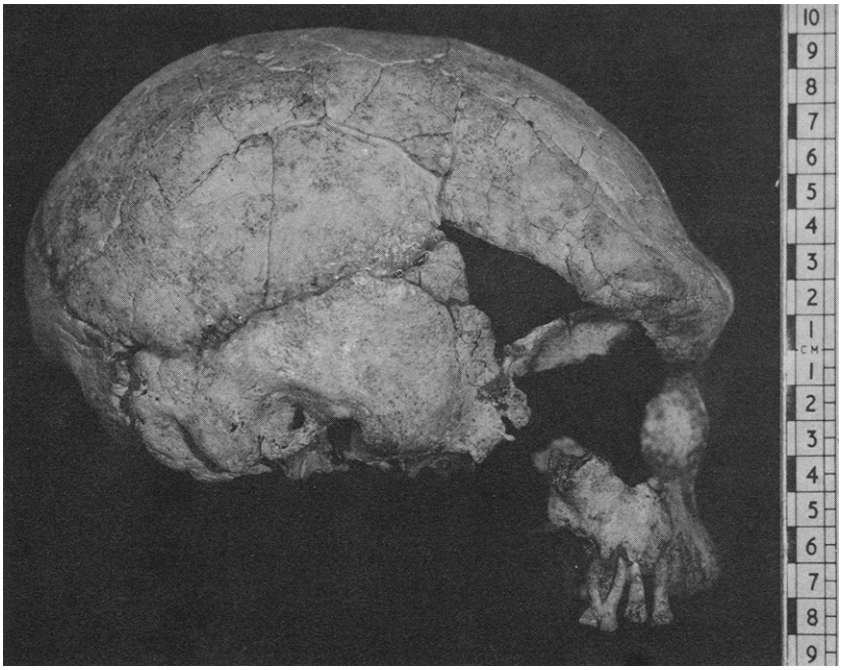


Figure 1. Laetoli Hominid 18—norma frontalis.

Figure 2. Laetoli Hominid 18—right norma lateralis.



The facial skeleton is only partially preserved and has been restored from seven separate bone fragments plus isolated teeth. The fragments make up the paired maxillary bones, the alveolar process bearing some teeth, the palatine process and the frontal process on the left side. The nasal opening is pear-shaped with a nasal spine, and subnasal prognathism is evident. Both maxillary sinuses are exposed through damage, and they are large and pyramidal in shape. Both zygomatic processes are partially preserved and spring laterally at an angle of just over 90° from the body of the maxillae. The palate is U-shaped. The

Figure 3. Laetoli hominid 18—norma occipitalis.

preserved teeth include P^3, P^4 and M^1 on the right side, and P^4, M^1, M^2 and M^3 on the left side. All the teeth are heavily worn with no trace of cusps or fissure pattern. X-ray photographs confirmed the thickened vault at the occipital torus and lambdoid region. The paired frontal sinuses were widely separated oval-shaped loculi, simple and not subdivided. No natural endocranial cast was found with the cranium, but due to the excellent state of preservation of the calvaria it was possible to obtain a reasonably complete mould of its interior. The cast presents an almost complete forebrain and part of the cerebellum. The surface has impressions of gyri and sulci of the cerebrum and complex meningeal vascular markings. The volume of the endocast was determined by the water displacement method. The mean of 15 assessments was 1200 cc and this is regarded as the likely cranial capacity for Laetoli Hominid 18.

4. Comparative Anatomy

The features of the cranium were compared with the corresponding parts of better preserved crania from a number of other localities. The anatomical comparison shows that it has a combination of both archaic and modern features. Thus, the cranium is closer to modern man in the shape of the maxillae, the depth of the palate, the shape of the nasal aperture, the posterior profile of the parietal bones, the profile of the occipital bone and in the general development of the cerebral vascular vessels; but it has archaic features that include flattening and recession of the frontal region, the development of the brow ridges and of the occipital torus, the small size of the mastoid processes and the development of the occipito-mastoid crest. The cranium shows resemblances to some of the early African *Homo sapiens* crania including Kabwe, Eyasi I, Omo I, Omo 2, Saldanha, Iwo Eleru, Florisbad and Singa. The morphological evidence suggests that, although there are some differences between the LH 18 cranium and early African *Homo sapiens* crania, the cranium still fits well within this range. This morphological relatedness of the early African *Homo sapiens* crania mentioned above seems to suggest that early African populations were basically similar yet show some diversity of skull form, demonstrating the mosaic type of evolution. Comparisons with the Peking *Homo erectus* skulls and Olduvai Hominid 9 show wide differences from LH 18 in the post-orbital constriction, very low vaults and low maximum breadths. The European Neanderthals are also unlike LH 18 in their expanded parietal regions and bun-shaped occiputs. Comparisons with Middle Eastern fossils such as Tabūn, Amud and Skhūl show that these have higher vaults, laterally expanded parietals and strongly developed supraorbital tori and glabellae.

5. Metrical Analysis

The metrical analysis of the LH 18 cranium was based on 27 measurements that were taken according to the landmarks and definitions laid down by Howells (1973). Comparative measurements were taken from groups of skulls, both fossil and recent, from Africa, the Middle East and the Far East/Australia (Table 1). The data obtained from these were subjected to univariate, bivariate and multivariate analyses. The metrical analyses of the frontal and parietal bones confirmed that the Laetoli Hominid 18 cranium closely resembles the Saldanha, Kabwe and Omo I skulls and differs from the Sub-Saharan modern skulls, the OH 9 skull and the Peking *Homo erectus* skulls. Canonical variate analysis was performed on the ten groups, using ten variables only, the others being

Table 1 **Groups of fossil hominids and modern crania employed in the study**

Group	No. of individuals	Specimens
(1) Sub-Saharan early Upper Pleistocene	7	Kabwe
		Omo 1
		Omo 2
		Singa
		Florisbad
		Saldanha
		Eyasi 1
(2) Sub-Saharan later Upper Pleistocene	3	Iwo Eleru
		Fish Hoek
		Matjes River
(3) Middle East early Upper Pleistocene	2	Tabūn 1
		Amud
(4) Middle East later Upper Pleistocene	2	Skhūl 5
		Kafzeh 9
(5) Peking *Homo erectus*	4	Peking Locus E2
		Peking Locus L1
		Peking Locus L2
		Peking Locus L3
(6) Far East/Australia Upper Pleistocene	3	Wadjak 1
		Solo 1
		Keilor 1
(7) European early Upper Pleistocene	8	La Chapelle-aux-Saints
		La Quina
		Le Moustier
		La Ferrassie
		Spy 1
		Spy 2
		Gibraltar 1
		Swanscombe
(8) Laetoli Hominid 18 cranium	1	LH 18
(9) Sub-Saharan modern	24	Ngoni
	53	Ashanti
	39	Kaffir
(10) North African Upper Pleistocene	1	Djebel Irhoud
(11) Sub-Saharan *Homo erectus*	1	Olduvai Hominid 9

omitted because of the high number of missing values. This analysis derived six variates, the first three of which accounted for 97% of the total variability.

The canonical plot of Axis I against Axis II showed a good separation between the groups (Figure 4). Axis I reveals a continuous spread along the axis with the Peking *Homo erectus* group at the positive limit and Sub-Saharan later Upper Pleistocene group at the negative limit. Axis I places LH 18 in an intermediate position closer to the archaic *Homo sapiens* groups and significantly separates it from the Peking *Homo erectus* group, the Sub-Saharan modern and later Upper Pleistocene groups. Examination of the vector loadings of the original characters reveals that high loadings on Axis I are those describing the overall size and shape of the cranial vault, the size and shape of the frontal and parietal bones and the degree of development of the supraorbital region. Axis II shows a more compact positioning of the groups along this axis. Maximum separation along this axis is between LH 18 at the positive limit and the European early Upper Pleistocene group at the negative limit. Axis II, unlike I, separates LH 18 from the more archaic *Homo sapiens* and the Peking *Homo erectus* groups and places it closer to the Sub-Saharan moderns. Axis II appears to be discriminating almost entirely on the basis of the shape and size of the frontal and parietal bones. Inspection of the matrix of (D) distances (Table 2) reflects more clearly the separation of the LH 18 skull from the Sub-Saharan moderns and the Peking *Homo erectus* group. By considering the Sub-Saharan moderns as a reference group, the following order of groups is formed in relation to it: the Middle East later Upper Pleistocene group followed by the Far East/Australia Upper Pleistocene group, the Sub-Saharan later Upper

Figure 4. Plot of canonical variate analysis, Axes I and II: Laetoli Hominid 18 cranium (8) compared with other hominid groups, as numbered in brackets in Table I.

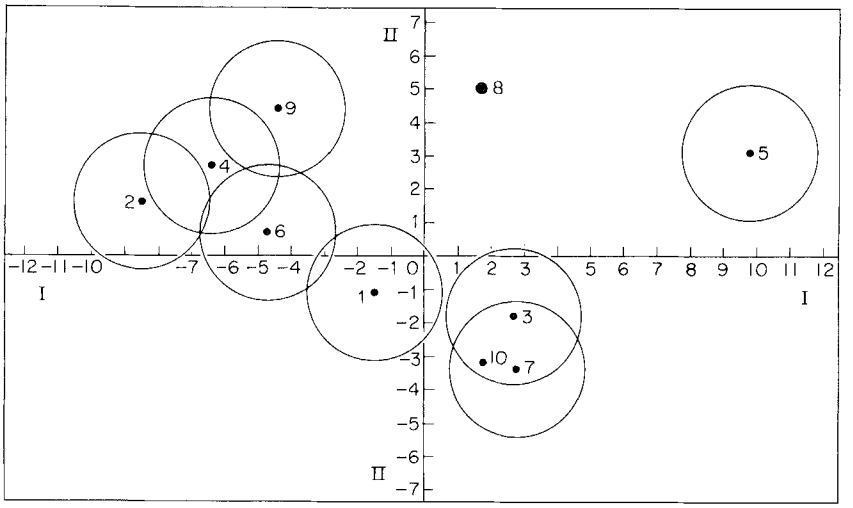


Table 2 **Matrix of (D) distance: Sub-Saharan modern and fossil hominid groups**

Sub-Saharan Modern	(9)	0·00									
Middle East Later Upper Pleistocene	(4)	4·26	0·00								
Far East/Australia Upper Pleistocene	(6)	4·61	5·68	0·00							
Sub-Saharan later Upper Pleistocene	(2)	5·58	5·54	4·74	0·00						
Sub-Saharan early Upper Pleistocene	(1)	7.16	6.82	5.99	8.72	0.00					
Lactoli Hominid 18 cranium	(8)	7·28	10·53	8.31	11·44	8·78	0·00				
Middle East early Upper Pleistocene	(3)	10·15	11·11	8·05	11·77	5·65	8·16	0·00			
North African Upper Pleistocene	(10)	11·05	12·00	8·14	11·48	6·93	9·31	2·86	0·00		
European early Upper Pleistocene	(7)	11·28	11·55	8·92	12·51	5·93	9·47	2·50	3·35	0·00	
Peking *Homo erectus*	(5)	14·68	16·53	14·89	18·42	12·17	9·18	8·78	10·71	9·58	0·00
		(9)	(4)	(6)	(2)	(1)	(8)	(3)	(10)	(7)	(5)

Pleistocene, the Sub-Saharan early Upper Pleistocene, LH 18, the Middle East early Upper Pleistocene, the North African Upper Pleistocene, the European early Upper Pleistocene and the Peking *Homo erectus* groups. Thus, the matrix of (D) distances shows that the LH 18 skull and the Sub-Saharan early Upper Pleistocene group are equidistant from the Sub-Saharan modern skulls.

6. Conclusion

Detailed description and study of the LH 18 cranium (Magori 1981; Magori & Day, in press) has resulted in confirmation of the view initially expressed (Day *et al.*, 1980) as to the

taxonomic category to which it should be attributed, that is to *Homo sapiens* but of an archaic variety. The resemblances of this skull to *Homo erectus* skulls is limited to frontal recession, the smallness of the mastoid processes, the overall length and the occipito-mastoid crests. More modern features include the thinner vault bones, enlargement of the vault, parietal bossing, maximum breadth above the mastoids in the biparietal region, lack of frontal keeling, a rounded occipital profile with inion well shifted to opisthion, a reduced facial skeleton, a nasal spine, moderate and divided brow ridges and an endocast of approximately 1200 cc showing a modern *Homo sapiens* meningeal and venous pattern.

Combining the anatomical and statistical data shows firmer links between LH 18 and other archaic *Homo sapiens* crania from Africa such as Kabwe, Eyasi I, Omo 1, Omo 2, Singa, Florisbad and Saldanha, perhaps being closest to Eyasi I and Omo I. The LH 18 cranium differs very much from classic Neanderthal crania from Europe and the Middle East, from Middle Eastern archaic *Homo sapiens* crania and from Far East/Australian archaic *Homo sapiens* crania.

It therefore appears from the available fossil record from the later part of the Upper Pleistocene that the African continent was once inhabited by populations of early sapiens that were widely spread and perhaps represented by LH 18, Ndutu, Kanjera, Eyasi, Omo 1 and 2 in the east, and by Kabwe, Saldanha, Florisbad and Cave of Hearths in the south. The similarities between these crania are sufficient to place them within the same species, yet providing a good example of the mosaic evolutionary process operating to produce an African Upper Pleistocene "spectrum of varieties" to parallel that described by Weiner & Campbell (1964).

We wish to acknowledge the opportunity to study this skull that was granted by its finder Dr M. D. Leakey and to thank the Department of Antiquities of the Government of Tanzania who allowed the skull to be taken to London for cleaning, reconstruction and analysis.

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