A NEW SPECIES OF THE GENUS *HOMO* FROM OLDUVAI GORGE

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THE recent discoveries of fossil hominid remains at Olduvai Gorge have strengthened the conclusions—which each of us had reached independently through our respective investigations—that the fossil hominid remains found in 1960 at site *F.L.K.N.* I, Olduvai, did not represent a creature belonging to the sub-family Australopithecinae*.

We were preparing to publish the evidence for this conclusion and to give a scientific name to this new species of the genus *Homo*, when the new discoveries, which are described by L. S. B. and M. D. Leakey in the preceding article, were made.

An examination of these finds has enabled us to broaden the basis of our diagnosis of the proposed new species and has fully confirmed the presence of the genus *Homo* in the lower part of the Olduvai geological sequence, earlier than, contemporary with, as well as later than, the *Zinjanthropus* skull, which is certainly an australopithecine.

For the purpose of our description here, we have accepted the diagnosis of the family Hominidae, as it was proposed by Sir Wilfrid Le Gros Clark in his book *The Fossil Evidence for Human Evolution* (110; 1955). Within this family we accept the genus *Australopithecus* with, for the moment, three sub-genera (*Australopithecus*, *Paranthropus* and *Zinjanthropus*) and the genus *Homo*. We regard *Pithecanthropus* and possibly also *Atlanthropus* (if it is indeed distinct) as species of the genus *Homo*, although one of us (L. S. B. L.) would be prepared to accept sub-generic rank.

It has long been recognized that as more and more discoveries were made, it would become necessary to revise the diagnosis of the genus *Homo*. In particular, it has become clear that it is impossible to rely on only one or two characters, such as the cranial capacity or an erect posture, as the necessary criteria for membership of the genus. Instead, the total picture presented by the material available for investigation must be taken into account.

We have come to the conclusion that, apart from *Australopithecus* (*Zinjanthropus*), the specimens we are dealing with from Bed I and the lower part of Bed II at Olduvai represent a single species of the genus *Homo* and not an australopithecine. The species is, moreover, clearly distinct from the previously recognized species of the genus. But if we are to include the new material in the genus *Homo* (rather than set up a distinct genus for it, which we believe to be unwise), it becomes necessary to revise the diagnosis of this genus. Until now, the definition of *Homo* has usually centred about a 'cerebral Rubicon' variably set at 700 c.c. (Weidenreich), 750 c.c. (Keith) and 800 c.c. (Vallois). The proposed new definition follows:

Family HOMINIDAE (as defined by Le Gros Clark, 1955)

Genus *Homo* Linnæus.

Revised diagnosis of the genus Homo. A genus of the Hominidae with the following characters: the structure of the pelvic girdle and of the hind-limb skeleton is adapted to habitual erect posture and bipedal gait; the fore-limb is shorter than the hind-limb; the pollex is well developed and fully opposable and the hand is capable not only of a power grip but of, at the least, a simple and usually well developed precision grip †; the cranial capacity is very variable but is, on the average, larger than the range of capacities of members of the genus *Australopithecus*, although the lower part of the range of capacities in the genus *Homo* overlaps with the upper part of the range in *Australopithecus*; the capacity is (on the average) large relative to body-size and ranges from about 600 c.c. in earlier forms to more than 1,600 c.c.; the muscular ridges on the cranium range from very strongly marked to virtually imperceptible, but the temporal crests or lines never reach the midline; the frontal region of the cranium is without undue post-orbital constriction (such as is common in members of the genus *Australopithecus*); the supra-orbital region of the frontal bone is very variable, ranging from a massive and very salient supra-orbital torus to a complete lack of any supra-orbital projection and a smooth brow region; the facial skeleton varies from moderately prognathous to orthognathous, but it is not concave (or dished) as is common in members of the Australopithecinae; the anterior symphyseal contour varies from a marked retreat to a forward slope, while the bony chin may be entirely lacking, or may vary from a slight to a very strongly developed mental trigone; the dental arcade is evenly rounded with no diastema in most members of the genus; the first lower premolar is clearly bicuspid with a variably developed lingual cusp; the

* See also *Nature* of March 7, pp. 967, 969, and preceding articles in this issue.

† For the definition of 'power grip' and 'precision grip', see Napier, J. R., *J. Bone and Joint Surg.*, 38, B, 902 (1956).

molar teeth are variable in size, but in general are small relative to the size of these teeth in the genus *Australopithecus*; the size of the last upper molar is highly variable, but it is generally smaller than the second upper molar and commonly also smaller than the first upper molar; the lower third molar is sometimes appreciably larger than the second; in relation to the position seen in the Hominoidea as a whole, the canines are small, with little or no overlapping after the initial stages of wear, but when compared with those of members of the genus *Australopithecus*, the incisors and canines are not very small relative to the molars and premolars; the teeth in general, and particularly the molars and premolars, are not enlarged bucco-lingually as they are in the genus *Australopithecus*; the first deciduous lower molar shows a variable degree of molarization.

Genus *Homo* Linnæus
Species *habilis* sp. nov.

(*Note:* The specific name is taken from the Latin, meaning 'able, handy, mentally skilful, vigorous'. We are indebted to Prof. Raymond Dart for the suggestion that *habilis* would be a suitable name for the new species.)

A species of the genus *Homo* characterized by the following features:

A mean cranial capacity greater than that of members of the genus *Australopithecus*, but smaller than that of *Homo erectus*; muscular ridges on the cranium ranging from slight to strongly marked; chin region retreating, with slight or no development of the mental trigone; maxillæ and mandibles smaller than those of *Australopithecus* and within the range for *Homo erectus* and *Homo sapiens*; dentition characterized by incisors which are relatively large in comparison with those of both *Australopithecus* and *Homo erectus*; canines which are proportionately large relative to the premolars; premolars which are narrower (in bucco-lingual breadth) than those of *Australopithecus*, but which fall within the range for *Homo erectus*; molars in which the absolute dimensions range between the lower part of the range in *Australopithecus* and the upper part of the range in *Homo erectus*; a marked tendency towards bucco-lingual narrowing and mesiodistal elongation of all the teeth, which is especially evident in the lower premolars (where it expresses itself as a marked elongation of the talonid) and in the lower molars (where it is accompanied by a rearrangement of the distal cusps); the sagittal curvature of the parietal bone varies from slight (within the hominine range) to moderate (within the australopithecine range); the external sagittal curvature of the occipital bone is slighter than in *Australopithecus* or in *Homo erectus*, and lies within the range of *Homo sapiens*; in curvature as well as in some other morphological traits, the clavicle resembles, but is not identical to, that of *Homo sapiens sapiens*; the hand bones differ from those of *Homo sapiens sapiens* in robustness, in the dorsal curvature of the shafts of the phalanges, in the distal attachment of *flexor digitorum superficialis*, in the strength of fibro-tendinous markings, in the orientation of trapezium in the carpus, in the form of the scaphoid and in the marked depth of the carpal tunnel; however, the hand bones resemble those of *Homo sapiens sapiens* in the presence of broad, stout, terminal phalanges on fingers and thumb, in the form of the distal articular surface of the capitate and the ellipsoidal form of the metacarpo-phalangeal joint surfaces; in many of their characters the foot bones lie within the range of variation of *Homo sapiens sapiens*; the hallux is stout, adducted and plantigrade; there are well-marked longitudinal and transverse arches; on the other hand, the 3rd metatarsal is relatively more robust than it is in modern man, and there is no marked difference in the radii of curvature of the medial and lateral profiles of the trochlea of the talus.

Geological horizon. Upper Villafranchian and Lower Middle Pleistocene.

Type. The mandible with dentition and the associated upper molar, parietals and hand bones, of a single juvenile individual from site *F.L.K.N.N.* I, Olduvai, Bed I.

This is catalogued as Olduvai Hominid 7.

Paratypes. (*a*) An incomplete cranium, comprising fragments of the frontal, parts of both parietals, the greater part of the occipital, and parts of both temporals, together with an associated mandible with canines, premolars and molars complete on either side but with the crowns of the incisors damaged, parts of both maxillæ, having all the cheek teeth except the upper left fourth premolar. The condition of the teeth suggests an adolescent. This specimen, from site *M.N.K.* II, Olduvai, Bed II, is catalogued as Olduvai Hominid 13.

(*b*) The associated hand bones, foot bones and probably the clavicle, of an adult individual from site *F.L.K.N.N.* I, Olduvai, Bed I. This is catalogued as Olduvai Hominid 8.

(*c*) A lower premolar, an upper molar and cranial fragments from site *F.L.K.* I, Olduvai, Bed I (the site that yielded also the *Australopithecus* (*Zinjanthropus*) skull). This is catalogued as Olduvai Hominid 6. (It is possible that the tibia and fibula found at this site belong with *Homo habilis* rather than with *Australopithecus* (*Zinjanthropus*). These limb bones have been reported on by Dr. P. R. Davis (*Nature*, March 7, 1964, p. 967).

(*d*) A mandibular fragment with a molar in position and associated with a few fragments of other teeth from site *M.K.* I, Olduvai, Bed I. This specimen is catalogued as Olduvai Hominid 4.

Description of the type. Preliminary descriptions of the specimens which have now been designated the type of *Homo habilis*, for example, the parts of the juvenile found at site *F.L.K.N.N.* I in 1960, have already been published in *Nature* by one of us (189, 649; 191, 417; 1961). A further detailed description and report on the parietals, the mandible and the teeth are in active preparation by one of us (P. V. T.), while his report on the cranial capacity (preceding article) as well as a preliminary note on the hand by another of us (*Nature*, 196, 409; 1962) have been published. We do not propose, therefore, of give a more detailed description of the type here.

Description of the paratypes. A preliminary note on the clavicle and on the foot of the adult, which represents paratype (*b*), was published in *Nature* (188, 1050; 1961), and a further report on the foot by Dr. M. H. Day and Dr. J. R. Napier was published in *Nature* of March 7, 1964, p. 969.

The following additional preliminary notes on the other paratypes have been prepared by one of us (P. V. T.).

Description of Paratypes

(*a*) *Olduvai Hominid* 13 *from* M.N.K. *II*. An adolescent represented by a nearly complete mandible with complete, fully-erupted lower dentition, a right maxillary fragment including palate and all teeth from P^3 to M^3, the latter in process of erupting; the corresponding left maxillary fragment with M^1 to M^3, the latter likewise erupting, the isolated left P^3; parts of the vault of a small, adult cranium, comprising much of the occipital, including part of the posterior margin of *foramen magnum*, parts of both parietals, right and left temporosphenoid fragments, each including the mandibular fossa and foramen ovale. The distal half of a humeral shaft (excluding the distal extremity) may also belong to Olduvai Hominid 13. The *corpus mandibulae* is very small, both the height and thickness at M_1 falling below the australopithecine range and within the hominine range. All the teeth are small compared with those of Australopithecinae, most of the dimensions falling at or below the lower extreme of the australopithecine ranges. On the other hand, practically all the dental dimensions can be accommodated within the range of fossil Homininae. The Olduvai Hominid 13 teeth

show the characteristic mesiodistal elongation and labiolingual narrowing, in some teeth the *L/B* index exceeding even those of the type Olduvai Hominid 7, and paratype Olduvai Hominid 6. The occipital bone has a relatively slight sagittal curvature, the Occipital Sagittal Index being outside the range for australopithecines and for *Homo erectus pekinensis* and within the range for *Homo sapiens*. On the other hand, the parietal sagittal curvature is more marked than in all but one australopithecine and in all the Pekin fossils, the index falling at the top of the range of population means for modern man. Both parietal and occipital bones are very small in size, being exceeded in some dimensions by one or two australopithecine crania and falling short in all dimensions of the range for *Homo erectus pekinensis*. The form of the parietal—antero-posteriorly elongated and bilaterally narrow, with a fairly abrupt lateral descent in the plane of the parietal boss—reproduces closely these features in the somewhat larger parietal of the type specimen (Olduvai Hominid 7 from *F.L.K.N.N.* I).

(*b*) *Olduvai Hominid* 6 *from* F.L.K. *I*. An unworn lower left premolar, identified as P_3, an unworn, practically complete crown and partly developed roots of an upper molar, either M^1 or M^2, as well as a number of fragments of cranial vault. These remains were found at the *Zinjanthropus* site and level, some *in situ* and some on the surface. Both teeth are small for an australopithecine, especially in buccolingual breadth, but large for *Homo erectus*. The marked tendency to elongation and narrowing imparts to both teeth an *L/B* index outside the range for all known australopithecine homologues and even beyond the range for *Homo erectus pekinensis*. The elongating-narrowing tendency is more marked in this molar than in the upper molar belonging to the type specimen (Olduvai Hominid 7) from *F.L.K.N.N.* I.

(*c*) *Olduvai Hominid* 8 *from* F.L.K.N.N. *I*. Remains of an adult individual found on the same horizon as the type specimen, and represented by two complete proximal phalanges, a fragment of a rather heavily worn tooth (premolar or molar), and a set of foot-bones possessing most of the specializations associated with the plantigrade propulsive feet of modern man. Probably the clavicle found at this site belongs to this adult rather than to the juvenile type-specimen; it is characterized by clear overall similarities to the clavicle of *Homo sapiens sapiens*.

(*d*) *Olduvai Hominid* 4 *from* M.K. *I*. A fragment of the posterior part of the left *corpus mandibulae*, containing a well-preserved, fully erupted molar, either M_2 or M_3. The width of the mandible is 19·2 m level with the mesial half of the molar, but the maximum width must have been somewhat greater. The molar is 15·1 mm in mesiodistal length and 13·0 mm in buccolingual breadth; it is thus a small and narrow tooth by australopithecine standards, but large in comparison with *Homo erectus* molars. There are several other isolated dental fragments, including a moderately worn molar fragment. These are stratigraphically the oldest hominid remains yet discovered at Olduvai.

Referred Material

Olduvai Hominid 14 *from* M.W.K. *II*. (1) A juvenile represented by a fragment of the right parietal with clear, unfused sutural margins; two smaller vault fragments with sutural margins; a left and a right temporal fragment, each including the mandibular fossa.

(2) A fragmentary skull with parts of the upper and lower dentition of a young adult from site *F.L.K.* II, Maiko Gully, Olduvai, Bed II, is also provisionally referred to *Homo habilis*. This specimen is catalogued as Olduvai Hominid 16. It is represented by the complete upper right dentition, as well as some of the left maxillary teeth, together with some of the mandibular teeth. The skull fragments include parts of the frontal, with both the external orbital angles preserved, as well as the supra-orbital region, except for the glabella; parts of both parietals and the occipital are also represented.

Implications for Hominid Phylogeny

In preparing our diagnosis of *Homo habilis*, we have not overlooked the fact that there are several other African (and perhaps Asian) fossil hominids whose status may now require re-examination in the light of the new discoveries and of the setting up of this new species. The specimens originally described by Broom and Robinson as *Telanthropus capensis* and which were later transferred by Robinson to *Homo erectus* may well prove, on closer comparative investigation, to belong to *Homo habilis*. The Kanam mandibular fragment, discovered by the expedition in 1932 by one of us (L. S. B. L.), and which has been shown to possess archaic features (Tobias, *Nature*, **185**, 946; 1960), may well justify further investigation along these lines. The Lake Chad craniofacial fragment, provisionally described by M. Yves Coppens in 1962, as an australopithecine, is not, we are convinced, a member of this sub-family. We understand that the discoverer himself, following his investigation of the australopithecine originals from South Africa and Tanganyika, now shares our view in this respect. We believe that it is very probably a northern representative of *Homo habilis*.

Outside Africa, the possibility will have to be considered that the teeth and cranial fragments found at Ubeidiyah on the Jordan River in Israel may also belong to *Homo habilis* rather than to *Australopithecus*.

Cultural Association

When the skull of *Australopithecus* (*Zinjanthropus*) *boisei* was found on a living floor at *F.L.K.* I, no remains of any other type of hominid were known from the early part of the Olduvai sequence. It seemed reasonable, therefore, to assume that this skull represented the makers of the Oldowan culture. The subsequent discovery of remains of *Homo habilis* in association with the Oldowan culture at three other sites has considerably altered the position. While it is possible that *Zinjanthropus* and *Homo habilis* both made stone tools, it is probable that the latter was the more advanced tool maker and that the *Zinjanthropus* skull represents an intruder (or a victim) on a *Homo habilis* living site.

The recent discovery of a rough circle of loosely piled stones on the living floor at site *D.K.* I, in the lower part of Bed I, is noteworthy. This site is geologically contemporary with *M.K.* I, less than one mile distant, where remains of *Homo habilis* have been found. It seems that the early hominids of this period were capable of making rough shelters or windbreaks and it is likely that *Homo habilis* may have been responsible.

Relationship to *Australopithecus* (*Zinjanthropus*)

The fossil human remains representing the new species *Homo habilis* have been found in Bed I and in the lower and middle part of Bed II. Two of the sites, *M.K.* I and *F.L.K.N.N.* I, are geologically older than that which yielded the skull of the australopithecine *Zinjanthropus*. One site, *F.L.K.* I, has yielded both *Australopithecus* (*Zinjanthropus*) and remains of *Homo habilis*, while two sites are later, namely *M.N.K.* II and *F.L.K.* II Maiko gully. The new mandible of *Australopithecus* (*Zinjanthropus*) type from Lake Natron, reported in the preceding article by Dr. and Mrs. Leakey, was associated with a fauna of Bed II affinities.

It thus seems clear that two different branches of the Hominidae were evolving side by side in the Olduvai region during the Upper Villafranchian and the lower part of the Middle Pleistocene.