New partial skeleton of *Homo habilis* from Olduvai Gorge, Tanzania

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A new partial skeleton of an adult hominid from lower Bed I (about 1.8 Myr ago), Olduvai Gorge, is described. This specimen's craniodental anatomy indicates attribution to *Homo habilis*, but its postcranial anatomy, including small body size and relatively long arms, is strikingly similar to that of some early Australopithecus individuals.

OLDUVAI Gorge in northern Tanzania has yielded important evidence bearing on human origins and evolution. Discoveries made from the 1950s to the 1970s have demonstrated the coexistence of two hominid taxa in late Pliocene and early Pleistocene strata at the site: *Australopithecus boisei* and *Homo habilis*. Palaeoanthropological research at Olduvai has been carried out since 1985 by a team from the National Museums of Tanzania, the Tanzanian Department of Antiquities, the Institute of Human Origins and the University of California, Berkeley. We report here the discovery of a new hominid specimen from lower Bed I at Olduvai Gorge.

**Recovery**

On 21 July 1986, the third day of surface survey of the 1986 field season, one of us (T.D.W.) discovered a fragment of hominid ulna on the surface of Bed I sediments at FLK, near Geological Locality 45c (ref. 4) and 25 m west of the road to FLK Zinj (Fig. 1a and b). A search and screening of the adjacent surface resulted in the recovery of maxillary, calvarial, mandibular, radial, humeral, femoral and tibial fragments of what appears to be a single hominid individual. This specimen is designated Olduvai Hominid (OH) 62.

**Stratigraphy and geological framework**

The site at which OH 62 was found lies roughly 250 m south-east of the FLK (Zinjanthropus) locality (Fig. 1a). Hominid fragments were found on the surface and in a thin colluvial soil (Fig. 1b and c), over an area of about 40 m² on the north side of a small knoll, Dik Dik Hill (DDH).

Roughly 16 m of deposits are exposed in the gneiss wall immediately south-west of the hominid discovery. These consist of Bed I and lower Bed II sediments unconformably capped by the Ndutu Beds. Lower Bed I lava forms the present-day valley floor. Roughly 2 m of beige tuffaceous silts and clays, which are subjacent to Tufts IC and 1D, overlie the lava.

The base of the section at the hominid site (Trench 2) consists of thinly laminated beige and brown clays (Unit 2-1), which are overlain by 30 cm of tuffaceous silts and silty clays containing large, altered pumice clasts (up to 3 cm) in the basal part (Unit 2-2) (Fig. 1b and c). This sequence is unconformably capped by a 0–50 cm colluvium containing large lithic clasts. All of the vertebrate (including hominid) fossils were on top of or within this colluvium.

The colluvium capping DDH (Unit 2-3, Fig. 1c) probably formed as a lag deposit after a section of the gneiss wall collapsed and deflated. Tuft ID forms a resistant ledge in the local topogra-

**Associations**

Screening and excavation recovered nearly 18,000 fragments of fossil bone and tooth. The hominid fossils are highly lithified and dark grey to black in colour, distinguishing them from specimens derived from higher in the section. Most of the nonhominid fossils associated with OH 62 are small fragments of small to medium sized mammals and reptiles. These include: *Kobus sigmodalis*, cf. Antelopini, cf. Alcelaphini, Giraffidae (cf. *Sivatherium*), Hippopotamidae, Suidae, Deinotheeriidae, Carnivora (cf. large lutrine mustelid or viverrid), Cercopithecidae, Hystricidae, Cricetidae, Aves (cf. *Struthio*), Reptilia (Varanidae, Crocodylus, Serpentes, Chelonia), Amphibia (cf. Anura) and Pisces (*Clarius*).

 Artefacts recovered on the surface and in the lag deposit are cores and flakes typical of the Oldowan industry, but whether they are contemporary with the hominid cannot be established. No stone tools were found in the outcrop of the laminated sand unit.

**Preliminary description of the skeleton**

After full conjoining of the recovered pieces it is evident that
parts of the skull, right arm and both legs are represented (Table 1). There is no duplication of elements, which suggests the presence of only one individual. Preservation and colour of all fragments correspond and all elements are fully adult.

All limb bone articular ends are missing except for a portion of the proximal ulna. The bones show no evidence of rodent- or carnivore-induced damage and display no cutmarks or evidence of peri-mortem fracture. The bone surfaces are slightly weathered and suggest limited exposure before deposition.

Skull. The skull of OH 62 is represented by portions of the palate, face, calvaria, mandible and dentition. The following descriptions focus only on features of taxonomic importance. Palate (Fig. 2a). The palatal surface is preserved between the incisor alveoli and the M2/M3 level, but the alveolar processes
are broken at most tooth positions. The palate is moderately deep posteriorly, and shelves inferiorly anterior to the large incisive fossa. As judged by estimates of internal breadth (~35 mm) and length (~41 mm, measured to mid-M2 level), it is clear that the palate is relatively wide compared to Australopithecus (for example, A.L. 200-1a, Sts. 5, Sts. 52a, OH 5). In size and morphology, the OH 62 palate is similar to OH 24, and especially to Stw. 53, a Homo habilis skull from the Sterkfontein (Member 5) Extension Site breccia in South Africa.

**Face** (Fig. 2b). Most of the region around the nasal cavity, including the right zygomatic process of the maxilla, is preserved. The maxilla is moderately prognathic. It is evident that the nasoalveolar clivus is flat, short and minimally projecting relative to the bicanine line. The eroded remnant of a small, but distinct, anterior nasal spine is present at the entrance to the nasal cavity. The spine is separated from the nasal orifice of the incisive canals, and hence from the inferred anterior insertion of the vomer, by a 6.0 mm long, horizontal intranasal platform. Laterally, the inferior nasal margin demarcates a fairly distinct change in contour between the clivus and the nasal cavity floor. The anterolaterally facing nasal process of the maxilla shows that superiorly the lateral margin of the nasal aperture was sharp.
and everted. An 'anterior pillar' is not present, and there are no indications of a distinct canine fossa or 'maxillary furrow' intervening between the nasal and zygomatic processes. The zygomatic process arises low on the maxilla. Its root is positioned posteriorly, at the M1 level.

The isolated frontal process of the left zygomatic is slender and bears a well-developed marginal process on its temporal face. The facial plate of the process, separated from the orbital plate by a sharp lateral orbital margin, faces distinctly laterally.

In almost all these characters, the OH 62 facial skeleton closely resembles specimens attributed to Homo habilis or Homo sp. (for example OH 24, KNM-ER 1470, 1813, SK 847, and especially Stw. 53). Specializations defining Australopithecus africanus, A. robustus and A. boisei are notably absent in the new Olduvai face 7,10.

Caltaria. Very little of the cranial vault of OH 62 survives. Preserved fragments of the sphenoid, occipital, and other vault bones reveal no taxonomically valuable morphology. Mandible. The preserved right condylar neck is gracile and the condyle is small compared to 'robust' Australopithecus specimens. A basal fragment evinces a degree of eversion similar to that seen in H. habilis mandible KNM-ER 1802, although the OH 62 mandible base was obviously less robust. Dentition. Molar wear pattern and anterior/posterior dental proportions (as estimated from maxillary alveoli and preserved canine and molar crowns) indicate that OH 62 does not represent a 'robust' Australopithecus. Both P3 and P4 possess double buccal roots. These roots lack the massiveness of 'robust' Australopithecus homologues and are similar to the condition seen in Stw. 53.

The right C3 measures 9.9 mm buccolingually. The buccolingual breadths of the left M2 and M3 are estimated to be ~16.0 mm and ~15.5 mm, respectively. These molar dimensions approximate those of OH 16 and Stw. 53, and lie in the upper range of early Homo specimens. The canine/molar breadth ratio is therefore at the low end of the Homo range.

Other morphological features, such as a virtual lack of asymmetry in upper canine occlusal outline, a simple distal buccal groove on the lower canine lacking a 'V' configuration, and M3 with a relatively short mesiodistal dimension lingually, suggest that OH 62 represents Homo rather than A. africanus.

Postcranium. Description of the OH 62 postcranium will focus on comparisons with the A.L. 288-1 partial skeleton from Hadar ('Lucy'; ref. 11) because of the size and anatomical similarities between these two hominin individuals (Fig. 2c).

Humerus. The OH 62 humeral shaft is essentially intact, with most of the bicapital groove present. The proximal shaft circumference closely approximates that recorded for A.L. 288-1, whereas the distal shaft of OH 62 is slightly thinner. We conservatively estimate the OH 62 humeral length at ~27 mm longer than that of A.L. 288-1. The total OH 62 upper arm was almost certainly longer than that of 'Lucy'.

Radius. Most of the radial tuberosity is intact and about two-thirds of the shaft below this point is preserved. The shaft exhibits moderate mediolateral bowing and a weak interosseous crest. The radial tuberosity is larger, more rounded and less divided than that of the A.L. 288-1 radius. Shaft circumference is greater than that measured for A.L. 288-1 and the radius of OH 62 is slightly more robust in comparable parts.

Ulna. The proximal ulna segment retains the inferior extension of the trochlear notch and a bit of eroded radial notch. The entire anatomy of the OH 62 proximal ulna is very similar to that recorded for A.L. 288-1. Mediolateral and anteroposterior measures of OH 62 and A.L. 288-1 at the level of the radial notch differ by less than 1 mm and shaft circumferences at the base of the brachialis insertion are the same. The distal OH 62 shaft hexagon shows part of a pronator quadratus insertion. Shaft circumference at the distal end of this line (minimum shaft circumference) is 2 mm less than that measured on A.L. 288-1.

Femur. A visible obturator externus groove marks the posterior surface of the femur neck. The estimated neck/shaft angle of OH 62 is roughly the same as that documented for A.L. 288-1 (123°). The inferior half of the neck suggests the shaft was flattened anteroposteriorly and was at least as long as that of A.L. 288-1. Anteroposterior and mediolateral shaft diameters at the base of the OH 62 lesser trochanter are both 21 mm, whereas homologous measures for the more anteroposteriorly compressed A.L. 288-1 shaft are 27 mm and 18 mm, respectively. Shaft circumference of the OH 62 specimen near midshaft is 9 mm less than that measured on A.L. 288-1. Even allowing for slight exfoliation of the OH 62 femur, visual comparison makes it obvious that this individual's femur was smaller and less robust than the A.L. 288-1 femur.

Tibia. Only the tibial tuberosity and the shaft immediately distal to it are preserved. The tuberosity is large and the surface lateral to it is deeply excavated as in A.L. 288-1. The tuberosity is well demarcated from the intracapsular area above by a marked transverse groove similar to that seen on the A.L. 288-1 and A.L. 129-1b proximal tibiae. Unlike these and other Hadar tibiae, however, OH 62 lacks any pit associated with the tibialis anterior muscle.

Discussion

The new OH 62 partial skeleton from Bed I represents a significant addition to the hominid fossil record because of its bearing on several key issues concerning Homo habilis, a taxon originally created on the basis of fragmentary cranial and questionably associated postcranial elements from Olduvai Gorge 5.

Several important conclusions about the OH 62 partial skeleton emerge from the first round of analysis. First, body size for this fully adult individual is estimated to be as small or smaller than that of any known fossil hominid. Second, in addition to size, there are striking anatomical and proportional similarities between the OH 62 postcranial skeleton and small Australopithecus individuals (especially A.L. 288-1). Third, the strong morphological similarities of the OH 62 face, palate and dentition to Homo habilis (especially Stw. 53) warrant attribution of the Olduvai individual to this taxon. This represents the
anatomy in early Homo erectus (KNM-WT 15000; ref. 30) emphasize the mosaic pattern of evolution in the early hominid postcranial skeleton. However, the juxtaposition of an otherwise relatively derived H. erectus postcranium at ~1.6 Myr (KNM-WT 15000) and a postcranially primitive H. habilis at ~1.8 Myr (OH 62) may imply an abrupt transition between these taxa in eastern Africa.

We estimate the OH 62 humerus length at 264 mm, 27 mm longer than the A.L. 288–1 humerus11. If the length of the less robust OH 62 femur was no greater than that of A.L. 288–1 (280 mm), the Olduvai individual would have a humerofemoral index of close to 95%. Further work on this intriguing issue is in progress.

The new partial skeleton OH 62 offers additional evidence regarding the relative size of the postcanine dentition. McHenry has concluded that postcanine megadontia (relative to body size estimates) was reduced in Homo habilis compared to the Australopithecus condition31. Our measurements indicate that the length of the postcanine tooth row relative to body size in OH 62 was at least as great as that of the comparably small A.L. 288–1 specimen of Australopithecus afarensis. Thus, the degree of megadontia in Homo habilis may, in fact, be little changed from the Australopithecus condition.

The very small body size of the OH 62 individual suggests that views of human evolution positing incremental body size increase through time are rooted in gradualistic preconceptions rather than fact32. It is not possible to estimate cranial capacity for OH 62, but this skeleton and other available data on cranial capacity suggest the possibility that small individuals of Australopithecus and Homo habilis were differentiated by cranial capacity but not by body size. This reinforces the view that encéphalization in the terminal Pliocene played a key role in hominid evolution16,33.

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