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Modern human origins backdated

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Here we report datings of a hominid cranium (specimen KNM-ER 3884) and femur (KNM-ER 999) from the Lake Turkana region, Kenya, that indicate ages of around 270,000 and 300,000 years, respectively. These hominids might represent the oldest near-modern human specimens from anywhere in the world. Our datings and other recent evidence indicate that the chronological framework of Homo sapiens evolution in Africa needs to be revised.

The cranium from Ileret, northeast of Lake Turkana, was first reported in 1992 [1]. It was found in deposits formerly attributed to the Guomde Formation [2], most of which has since been subsumed into the Chari Member of the Koobi Fora Formation. It was derived from undifferentiated later deposits, probably representing an age of 0.5 to 0.1 Myr [2]. However, the specimen came from very close to the base of the latest Pleistocene/Holocene Galana Boi Formation [1] and so the hominid could be much younger.

We have now dated two different fragments of the cranium and a part of the femur, which derived from the same deposits [3], by non-destructive gamma-ray spectrometry. The technique has been used successfully to date other fossil hominids [4]. Activities of234 U and230 Th are determined from the gamma-rays emitted at 53.3 KeV and 67.7 KeV, respectively [5], by a high-purity germanium gamma-ray detector (25% relative efficiency).

The two samples of the cranium yielded concordant U-Th ages of 272,000 years (minimum age 159,000; indeterminate maximum age) and 279,000 years (minimum 162,000; maximum indeterminate). The U-Th date of 301,000 years (minimum 205,000, maximum indeterminate) for the femur supports the date of the cranium and indicates that both fossil hominid specimens came from very closely related stratigraphic levels. The U-Th dates are further supported by U-Pa dates of over 180,000 years for all three samples. Finally, an age of about 270,000 years for the cranium and 300,000 years for the femur are in agreement with the previous

stratigraphic conclusions [1]. The infinite upper errors leave open the possibility that the two hominids spanned a longer timescale, but they are both probably older than 180,000 years.

The cranium belongs to an adult individual. It consists of a large posterior part of the cranial vault including most of the occipital, parietals and temporals, a nearly complete supraorbital region and a maxillary part with all teeth. Preliminary estimation of endocranial capacity points to around 1,400 cm3. The posterior vault has thin walls (5-6 mm) and a lack of clear archaic features, and so shows close affinity to modern anatomy. In contrast, the torus-like supraorbitals are different from those seen in modern humans and closer to late archaic specimens like Florisbad and Laetoli H.18. Our observations indicate that the hominid might represent an archaic Homo sapiens or a transitional specimen very closely related to modern humans.

Comparative analyses showed that, in spite of its rather robust shaft, the femur has some modern features common among the earliest modern humans from Qafzeh and Skhul, Israel [6]. In view of the uranium-series dates, the femur might indicate that a very robust but basically modern morphology already existed in eastern Africa more than 200,000 years ago and probably as early as 300,000 years ago.

Table 1 **Results of uranium-series dating**

	KNM-ER 999 (femur)	KNM-ER 3884 (cranium sample 1)	KNM-ER 3884 (sample 2)
Mass (g)	130.8	23.3	20.1
U p.p.m.	3.95	4.03	2.28
Ratio of nuclide activities			
$^{234}U/^{238}U$	2.253±0.256	3.773±0.760	4.343±0.757
$^{230}Th/^{234}U$	1.089±0.129	1.114±0.248	1.133±0.236
$^{230}Th/^{232}Th$	46	99	>200
$^{231}Pa/^{235}U$	1.083±0.060	1.185±0.178	1.309±0.210
Age (yr)			
U–Th (s.d.)	301,000 (+∞, −96,000)	272,000 (+∞, −113,000)	279,000 (+∞, −117,000)
U–Pa	>180,000	>180,000	>180,000

Such an early existence of near-modern transitional or late archaic Homo sapiens specimens, and the presence of early archaic Homo sapiens (Bodo, Ethiopia) at around 600,000 years ago [7], as well as other recent datings of African archaic and early modern fossils (Eyasi, Florisbad, Singa) [8-10] make a revision of the course of Middle Pleistocene evolution in Africa necessary (Figure 1). Early and late archaic Homo sapiens and also the earliest modern humans seem to have existed considerably earlier than has been assumed [11]. This revision further supports an early evolution towards modern humans in Africa and pushes the origin of archaic Homo sapiens back to the earliest Middle Pleistocene. This framework strongly affects the hypotheses of the emergency of archaic Homo sapiens outside Africa, for example the Ante-Neanderthals of Europe and archaic Homo sapiens of China.

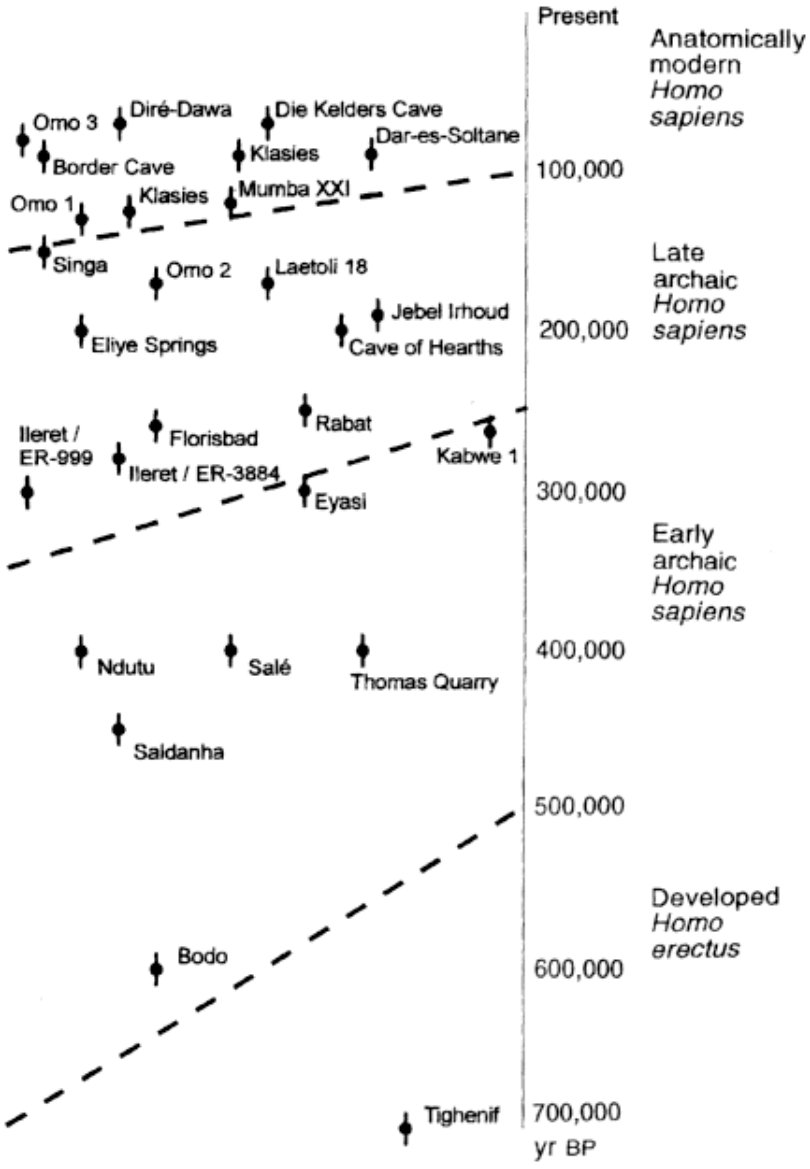

Figure1: Revised scheme *of Homo sapiens* evolution in Africa. The transitional *Homo erectus*/*archaic Homo sapiens* period can now be dated to at least 700,000- 500,000 years ago and the transition from early to late *archaic Homo sapiens* to around 350,000- 250,000 years. The origin of modern *Homo sapiens* might go back to at least 150,000 years ago. The most likely ages of the specimens are given, but they have different qualities and errors.

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