

# Earliest known modern humans from Kibish, Ethiopia

IAN MCDUGALL<sup>1</sup>, F.H. Brown<sup>2</sup> AND J.G. FLEAGLE<sup>3</sup>

<sup>1</sup>Research School of Earth Sciences, The Australian National University; Ian.McDougall@anu.edu.au

<sup>2</sup>Geology and Geophysics, University of Utah, Salt Lake City, Utah; F.Brown@earth.utah.edu

<sup>3</sup>Anatomical Sciences, Stony Brook University, Stony Brook, New York; jfleagle@notes.cc.sunysb.edu

Two hominin skulls (calvaria), Omo I and Omo II, recovered from the Kibish Formation in southern Ethiopia, have been assigned to *Homo sapiens*. These specimens are regarded as representative of early anatomically modern humans. However, the provenance and age of the fossils have been much debated. We confirm that Omo I and the somewhat more primitive-looking Omo II calvaria are from similar stratigraphic levels in Member I of the Kibish Formation. Based on <sup>40</sup>Ar/<sup>39</sup>Ar age measurements on alkali feldspar crystals from pumice clasts within a tuffaceous horizon in Member I just below the hominin levels we place an older limit of  $198 \pm 14$  ka (weighted mean age =  $196 \pm 2$  ka) for the hominins. A younger limit of  $104 \pm 7$  ka (weighted mean age =  $104 \pm 1$  ka) is provided by feldspars separated from pumice clasts in the Aliyo Tuff in Member III. Geological evidence indicates rapid deposition of each member of the Kibish Formation, concurrent with deposition of sapropels in the Mediterranean Sea. The <sup>40</sup>Ar/<sup>39</sup>Ar age measurements, together with correlations with sapropels, indicate that the hominin fossils are close in age to the older limit. Our preferred estimate of the age of the hominins is  $195 \pm 5$  ka, making them the earliest well-dated anatomically modern humans yet described.

The four members comprising the Kibish Formation are separated by disconformities and have a cumulative thickness of about 100 m. Each member represents an interval of mainly deltaic deposition associated with the Omo River where it entered a much expanded Lake Turkana, about 100 km north of the present lake. In addition to the <sup>40</sup>Ar/<sup>39</sup>Ar ages on alkali feldspars from Members I and III, <sup>14</sup>C ages on Member IV show deposition occurred between about 10 and 3 ka ago. The numerical ages for the three dated members of the Kibish Formation are remarkably similar to ages derived via the astronomical time scale for several sapropels in the eastern Mediterranean Sea, 195 ka for sapropel S7, 102 ka for S4 and 8 ka for S1. The link between the two widely separated regions is paleoclimatic. The Omo River and the Nile River systems share a drainage divide and both the formation of the sapropels and the deposition of the members of the Kibish Formation reflect greatly increased precipitation in the Ethiopian highlands and high runoff during periods of intensification of the African monsoon when precession was at a minimum and solar insolation was at a maximum.