Earth Science

Lantian *Homo Erectus* Re-dated to 1.63 Ma

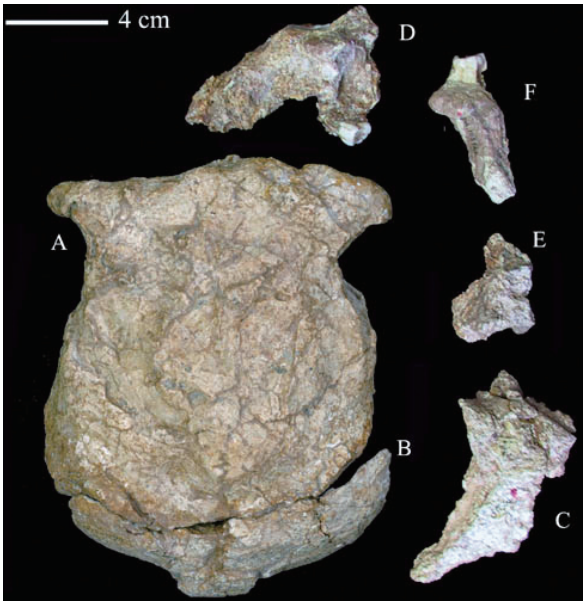
According to a paper published online on November 20 in the *Journal of Human Evolution*, the the Lantian *Homo erectus* cranium from Gongwangling, Lantian County, Shaanxi Province, China is likely half a million years older than previously thought. The new dating makes it the oldest fossil hominin cranium known in northeast Asia, and the second oldest outside Africa, only second to the 1.75-million-year old Dmanisi crania from Georgia, which, like Lantian, are relatively small-brained.

Earlier estimates dated the Lantian *Homo erectus*, which was first found in 1964, to 1.15 million years ago. While the authors provided compelling evidence in the paper to demonstrate that the cranium should be dated to 1.63 million years ago.

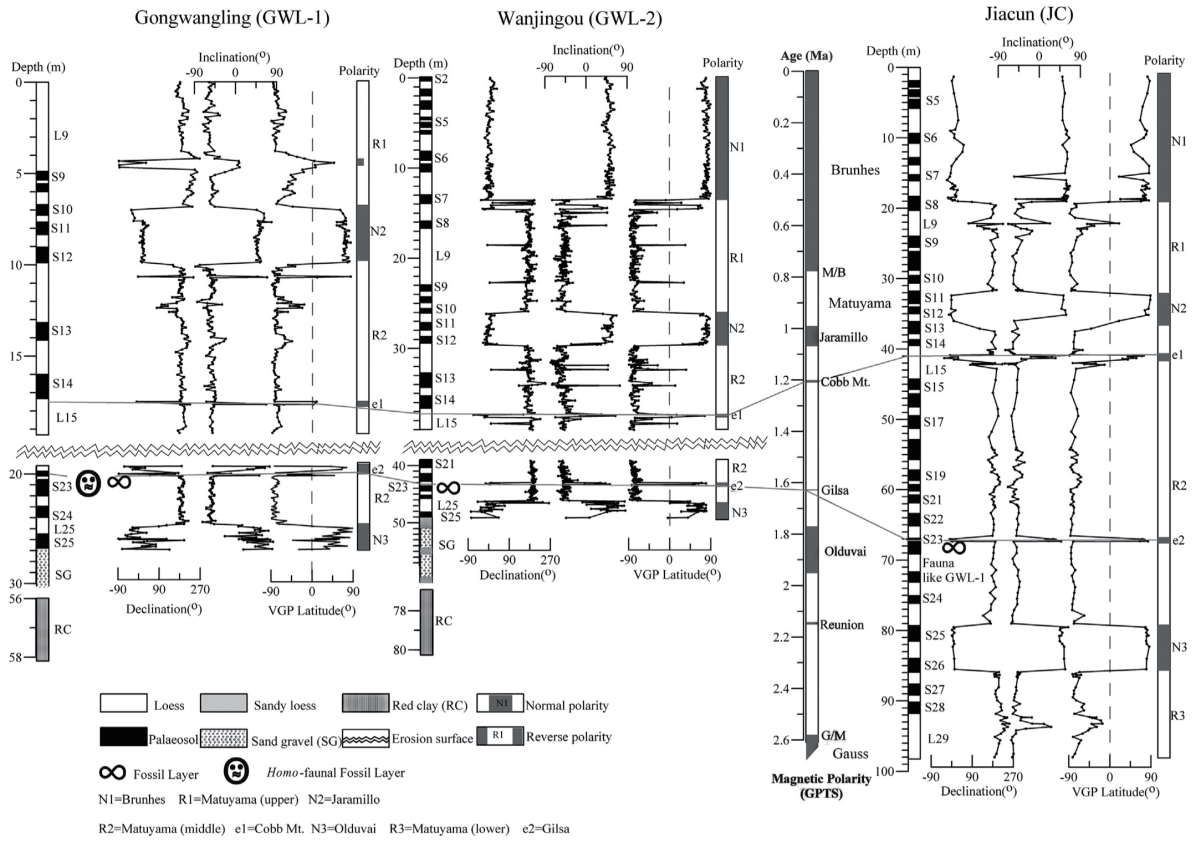
The new dating of the Lantian cranium provides strong evidence that small-brained hominins moved rapidly eastwards in a warm period shortly after 1.75 million years ago. The presence of fossils of slightly younger ages (c. 1.5–1.6 million years ago) in Indonesia, to the far south of the Lantian site, also suggests the possibility that hominins could have traveled from Africa into Asia following both northern and southern dispersal routes.

The research team, led by Profs. ZHU Zhaoyu, Robin Dennell and HUANG Weiwen and comprised of scientists from the the CAS Guangzhou Institute of Geochemistry (GIG), the CAS Institute of Vertebrate Paleontology and Paleoanthropology (IVPP), the University of Exeter in United Kingdom and the CAS Institute of Earth Environment (IEE), used a range of methods including loess-palaeosol stratigraphy, tectonic-geomorphology, sedimentology and mineralogy, geochemistry, palaeontology, paleomagnetism and rock magnetic methods to re-date the skull. From 2001 to 2013, the team conducted high-resolution sampling on some important geological sections, including the Gongwangling and Jiacun sections in the Lantian Basin to the immediate north of the Qinling Mountains in north China, and measured thousands of samples.

Integrating data from previous literature and the new round of research, the authors established four lines of new evidence to support the re-dating of the Gongwangling hominin. First, they demonstrated that the fossiliferous horizon cannot be attributed, as previously thought, to the 15th loess unit (L15). Instead, it was proven to lie below L15 beneath an erosional surface, and a stratigraphic break was revealed by stratigraphic correlation between L15 and the hominin horizon. Second, geomagnetic analysis demonstrated that the fossil horizon is situated between the Gilsa Event (average age c. 1.62 million years ago) and the Olduvai Subchron (top age 1.77 million years ago), and thus should correspond to the 22nd–23rd palaeosol units (S22–S23). Thirdly, the same type of subtropical faunal assemblage was found at the same stratigraphic position in both the Gongwangling and Jiacun sections, *i.e.*, S22–S23, between the Gilsa Event and the Olduvai Subchron. Finally, in line with palaeomagnetic and astronomical timescale of the Chinese loess-paleosol sequence, the age of the horizon of the Gongwangling fossil cranium should be about 1.63 million years ago, which was also a warm climatic period.



The cranium of Lantian *Homo erectus*. (Image by LIU Wu)



New data and a more careful stratigraphic correlation reveal that the stratum containing the cranium is actually located beneath an erosion surface. Due to the erosion some strata are lost in the section and the stratum of interest should correspond to the S22–S23 on the loess sequence, rather than the L15 as believed earlier. (Image by courtesy of Profs. ZHU Zhaoyu and HUANG Weiwen)

"This new age is not only consistent with the geological context as well as the subtropical fossil fauna found at Gongwangling, but also the small brain size of the Gongwangling *Homo erectus* cranium, similar to what's seen in Georgia and Indonesia," said HUANG Weiwen, professor of IVPP and guest professor of IEE.

"The revised date extends its age by about half a million years and makes the Gongwangling site a crucial benchmark in establishing the framework of the origin, migration and dispersal of early man in the Old World," said Robin Dennell of University of Exeter in United Kingdom: "It also provides reasonable evidence for re-evaluating the status of other early and controversial human fossils in China and Java. In addition, this new research rewrites the history of the Lantian hominin and provides additional knowledge of human evolution for the public."

"The new dating of the Gongwangling cranium is a multi-disciplinary research based on the fine correlation between the Chinese loess strata (the loess-palaeosol sequence over a period of 2.5 million years) and marine oxygen isotope stages. The results hint once again that the Chinese loess-palaeosol sequence should and will play an important role in studies of Quaternary global change and early human evolution over the last two million years," said ZHU Zhaoyu, professor of GIG and guest professor of IEE.

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