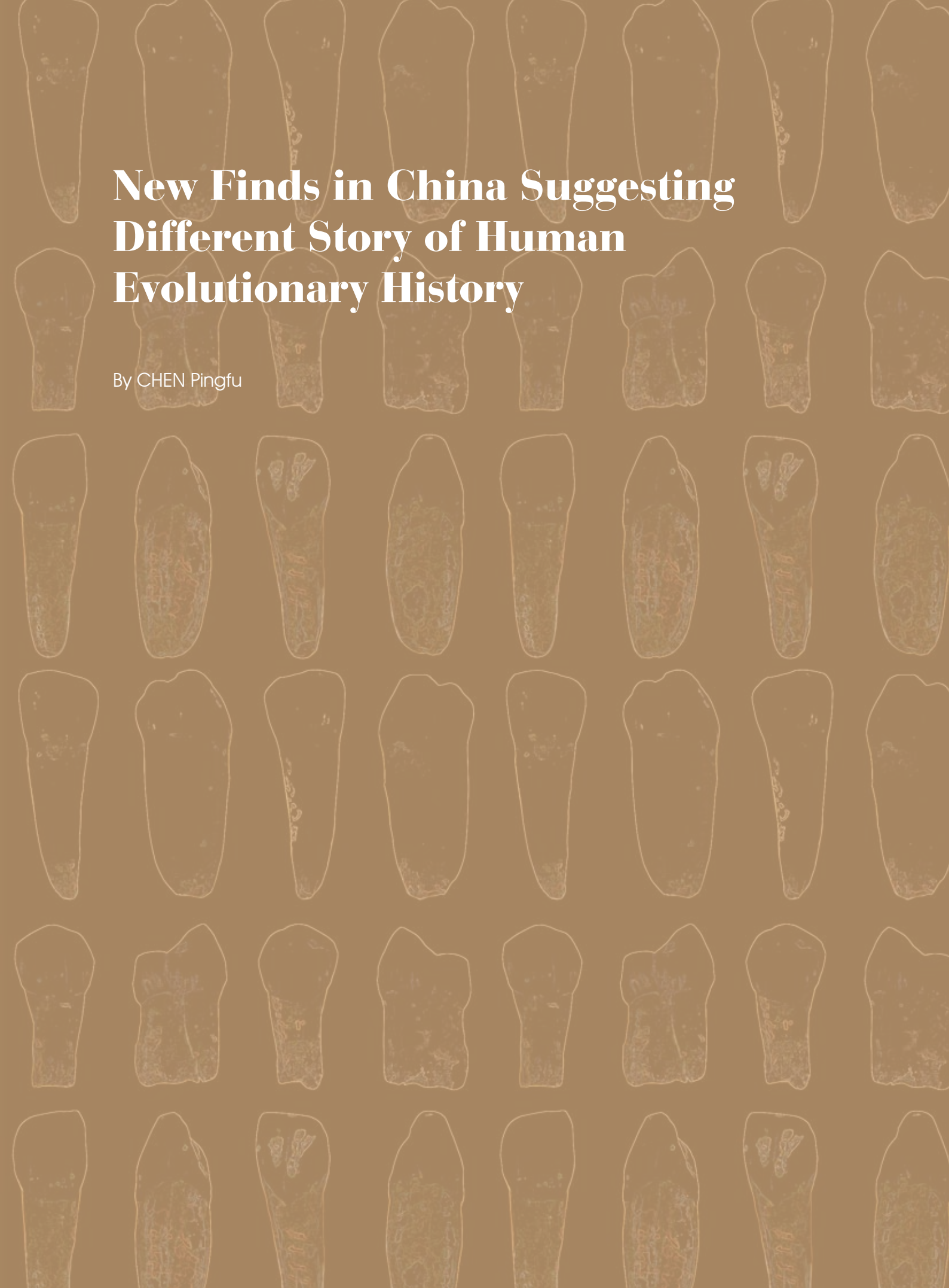
New Finds in China Suggesting Different Story of Human Evolutionary History

By CHEN Pingfu



Updated fossil evidence from Asia and more accurate analysis with aid from state-of-the-art methods are showing that a dazzling variety of *Homo* species once roamed the continent, posing challenges to conventional ideas about the evolutionary history of humanity. "But it's increasingly clear that many Asian materials cannot fit into the traditional narrative of human evolution," said WU Xinzhi, a senior professor of the Institute of Vertebrate Paleontology and Paleoanthropology (IVPP), Chinese Academy of Sciences, commenting on the implication of the confluence of new findings. "Asia has been a forgotten continent," agreed Chris Stringer, a palaeoanthropologist at the Natural History Museum in London: "Its role in human evolution may have been largely under-appreciated."

The most common story of Human evolution is that our species, *Homo sapiens*, first appeared in East Africa around 200,000 years ago, and then dispersed into Eurasia 60,000 years ago, where they replaced local hominins with a minuscule amount of interbreeding. In this "Out of Africa" model, *Homo heidelbergensis*, the oldest remains of which have been found in Ethiopia, was viewed as a transitional form between *H. erectus* and *H. sapiens*, and regarded as the potential common ancestor of Neanderthals, Denisovans and modern humans. It has a mixture of primitive and modern features.

However, within the human genus, many traits show overlapping ranges of variation in different species. Taking into account that intraspecific variation can be large and inter-specific differences can be subtle, large samples are necessary to provide robust statistical inferences able to detect significant dissimilarity. In many paleoanthropological cases, the scarce fossil record hampers a consistent quantitative approach, and obscured how they relate to other early hominins. While filling gaps with new evidence, recent findings from China have raised inspiring questions about how our ancestors have roamed from Africa to Asia and Europe and, the real role of Asia in human evolution.

The Neandertal or Its Ancestor Might Have Roamed to China

The Maba 1 specimen, a partial cranium found from a deep and narrow crevice in the Maba Village of Guangdong Province (Southern China) in 1958, can be approximately dated to the end of the Middle Pleistocene, tentatively between 300,000 and 130,000 years ago.

The Maba 1 specimen, in right lateral (a), frontal (b), and inferior (c) views. The areas reconstructed with plaster in 1959 are visible. (Image by WU Xiujie)

According to a re-study published online 12 March 2016 in *American Journal of Physical Anthropology*, the cranial capacity of the Maba 1 is estimated at around 1300 cc, and its cranial morphology combines upper facial features affined to Neandertals with a more archaic braincase. Should this be the result of demographic and genetic variation shared with the European Middle Pleistocene human groups, it would provide a further piece of evidence in support of an intercontinental evolutionary process, suggesting a revision of the biogeographic ranges associated with the Neandertal lineage.

"The Maba specimen was either an early Neanderthal, which means that species ranged all the way to eastern Asia, or it shared the same ancestor as Neanderthals," said Emiliano Bruner, co-author of the study at the National Research Center for Human Evolution in Spain. "Either theory would point to the possibility of an 'unknown Euro-Asian evolutionary process,' which is more likely than the possibility of a native species developing the same features in parallel evolution."

Some experts prefer tempering this interpretation with a touch of caution. "The endocranial anatomy appears to lack any evidence of derived features able to support more complete phylogenetic perspectives. A detailed analysis of its facial traits is therefore necessary to evaluate any further taxonomic inference," said WU Xiujie of IVPP.

The Mysterious Late Pleistocene Xujiayao Hominins

During the excavations occurred in 1976, 1977, and 1979, some hominin remains were unearthed from the Xujiayao site of Hebei Province in Northern China. The hominin sample comprises a maxilla, 12 parietal fragments, 2 pieces of occipital bones, 1 temporal bone, 1 mandibular fragment, and 3 isolated teeth, dated to 125,000–100,000 years ago. Earlier studies and recent analyses of the cranial and mandibular remains point to a complex mosaic of primitive and derived features, including traits that have been classically identified in Eurasian Neanderthals, Early and Middle Pleistocene hominins, and even Late Pleistocene modern humans from Asia. Thus, the Xujiayao sample represents an unknown and not well understood combination of features that could point to unknown hominin lineages and/or interactions, or greater regional variation through the Pleistocene in Asia.

A detailed morphometric study of the Xujiayao teeth published online 20 October 2014 in *American Journal of Physical Anthropology* also indicated the existence in China of a population of unclear taxonomic status with regard to other contemporary populations such as *H. sapiens* and *H. neanderthalensis*.

Compared with 13 teeth of early modern humans from late Middle Pleistocene (Panxian Dadong) and early Late Pleistocene deposits (Huanglong and Zhiren Cave) as well as to other early modern humans around the world, the Xujiayao teeth exhibit more primitive features, and are closer to the Early and Middle Pleistocene hominins from East Asia and different from *H. sapiens* and *H. neanderthalensis*.

"The molar teeth are massive, with very robust roots and complex grooves, reminiscent of those from Denisovans", said study co-author María Martinón-Torres, a

Molar teeth from the Early Late Pleistocene Site of Xujiayao (from left to right: occlusal, buccal, mesial, lingual, and distal) (Image by LIU Wu)

The Xujiayao 15, late archaic human temporal bone with the extracted temporal labyrinth superimposed on a view of the Xujiayao site in the Nihewan Basin of northern China. (Image by WU Xiujie)

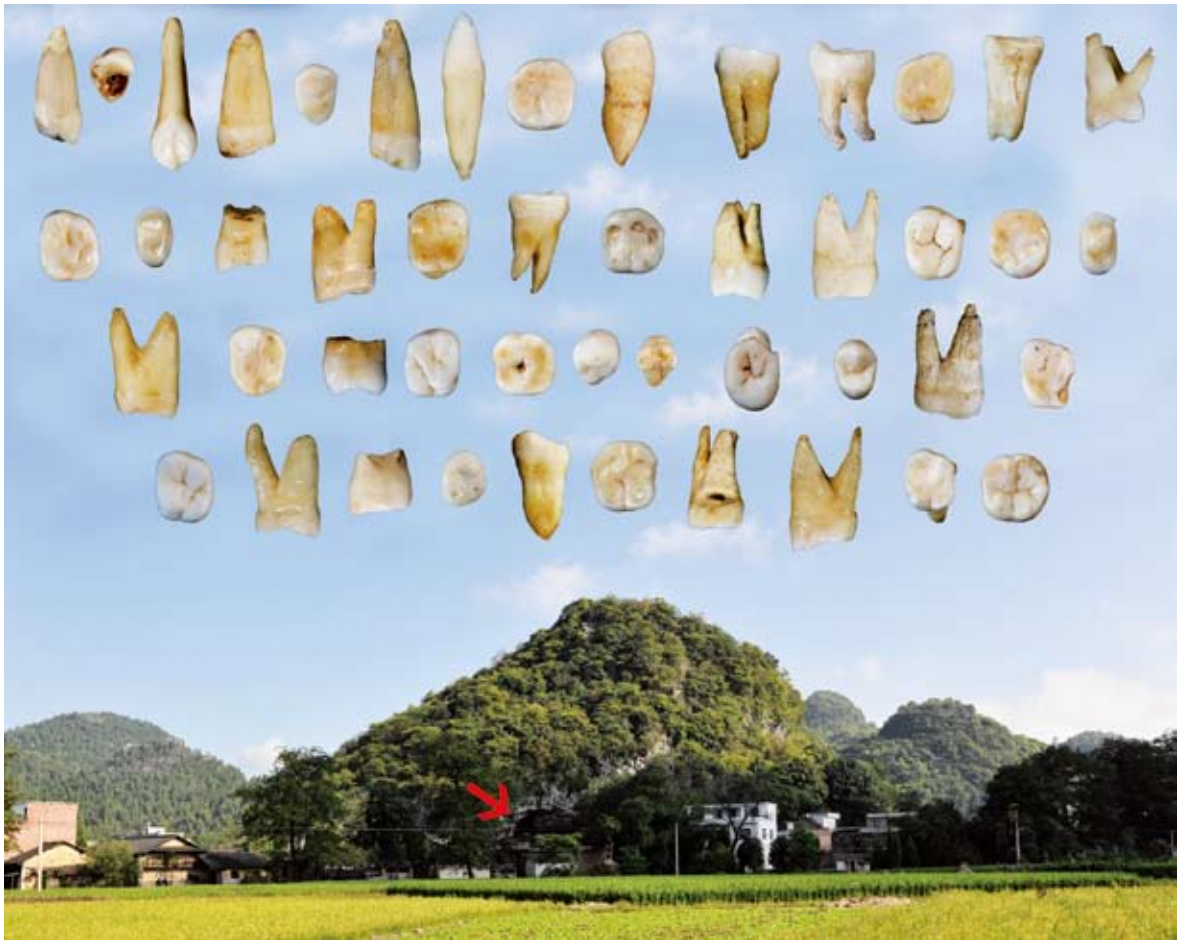
palaeoanthropologist at University College London, one of those who proposed that some of the Chinese hominins were Denisovans — a group first discovered in Siberia in 2010.

Analysis of East Asian labyrinths, as published 07 July 2014 in the journal *Proceedings of the National Academy of Sciences*, however revealed that the Xujiayao 15 temporal bone had an inner ear formation that was thought only to have occurred in Neanderthals. In comparison, none of the three other archaic human skulls analyzed from different parts of China had this type of inner ear. It not only raises questions regarding possible biological correlates of labyrinthine morphology and distinctive Neandertal features, but also the nature of late archaic human variation across Eurasia.

Modern Humans Trekked into Asia Far Earlier than Previously Known

Since the discovery of the modern human fossils dated to about 40,000 years ago at the Tianyuan Cave near Zhoukoudian in 2002, early modern human fossils have been found from several other sites in China including Huanglong Cave in Yunxi, Hubei Province and Zhiren Cave in Chongzuo, Guangxi. The findings of these human fossils indicate that early modern humans emerged about 100,000 years ago in southern China. In a paper published October 15, 2015 in *Nature*, Dr. LIU Wu of IVPP and his international team announced the discovery of human teeth between 80,000 and 120,000 years old from the newly excavated Fuyan Cave in Daoxian, southern China, and provided the earliest evidence of fully modern humans outside Africa. This discovery indicated that *Homo sapiens* trekked into Asia far earlier than previously known and much earlier than into Europe, providing important evidence for the study of dispersal routes of modern humans.

The Fuyan Cave, located in Tangbei Village, Daoxian County, Hunan Province, southern China, is part of a large multi-genesis pipeline-type karst system that contains several connected and stacked caves, and covers an area



The 47 fully modern human teeth and the Fuyan Cave in Daoxian, southern China. (Image by LIU Wu)

of more than 3,000m^2. From 2011 to 2013, systematic excavations yielded 47 human teeth and an abundant fossil mammalian assemblage.

The hominin and most of the faunal elements consist exclusively of teeth, and many of them present root alterations mostly due to the effects of calcium dissolution and some rodent gnawing. The mammalian fossil assemblage from the Daoxian site is typical of Late Pleistocene in southern China, and is composed of 38 species including 5 extinct large mammals such as *Ailuropoda baconi*, *Crocuta ultima*, *Stegodon orientalis*, *Megatapirus augustus* and *Sus* sp.

The Daoxian teeth are small and they consistently fall within *H. sapiens* variability, sad LIU Wu. They are generally smaller than other Late Pleistocene specimens from Africa and Asia, and closer to European Late Pleistocene samples and contemporary modern humans. Both the crown and the root of Daoxian teeth show typical morphologies for *H. sapiens*. The presence of moderate basal bulging as well as longitudinal grooves in the buccal surface of canines, premolars and molars from other Late Pleistocene samples such as Xujiayao, Huanglong Cave, Qafzeh or Dolni Vestonice make Daoxian teeth morphologically closer to middle-to-late Late Pleistocene and even contemporary human samples.

"Our data fill a chronological and geographical gap that is relevant for understanding when *H. sapiens* first appeared in southern Asia. The Daoxian teeth also support the hypothesis that during the same period, southern China was inhabited by more derived populations than central and northern China. This evidence is important for the study of dispersal routes of modern humans", said LIU Wu.

Some studies have investigated how the competition with *H. sapiens* may have caused Neanderthals' extinction. Notably, although fully modern humans were already present in southern China at least as early as 80,000 years ago, there is no evidence that they entered Europe before 45,000 years ago.

"Our species made it to southern China tens of thousands of years before colonizing Europe perhaps because of the entrenched presence of our hardy cousins, the Neanderthals, in Europe and the harsh, cold European climate," said Martinón-Torres, a paleoanthropologist of University College London, "In addition, it is logical to think that dispersals toward the east were likely environmentally easier than moving toward the north, given the cold winters of Europe." It may have been hard to take over land Neanderthals had occupied for hundreds of thousands of years.

"The Daoxian teeth place our species in southern China 30,000 to 70,000 years earlier than in the eastern Mediterranean or Europe", said LIU Wu. "We hope our Daoxian human fossil discovery will make people understand that East Asia is one of the key areas for the study of the origin and evolution of modern humans," LIU added.

The Role of Asian Middle Pleistocene Hominins in the Origins of Modern Humans

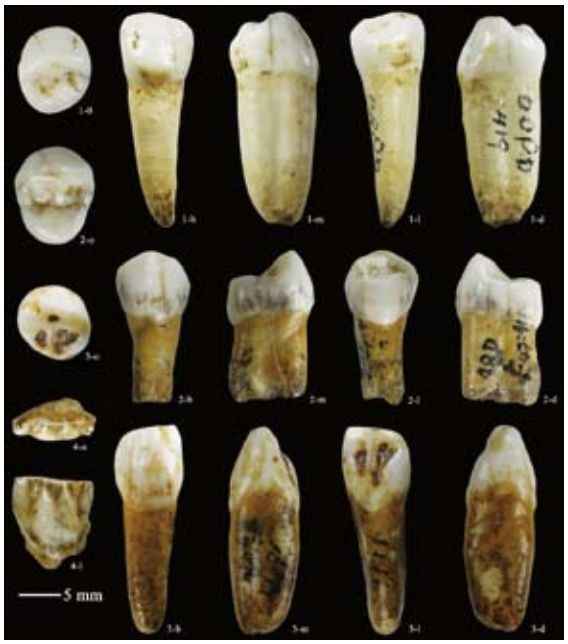
For two decades, research and debates on modern human origins have focused on the emergence of anatomically modern humans (AMHS) around the world. Although a relatively large number of late Middle Pleistocene hominins have been found in East Asia, these fossils have not been consistently included in current debates about the origin of AMHS, and little is known about their phylogenetic place in relation to contemporary hominins from Africa and Europe as well as to Upper Pleistocene hominins.

According to a paper published online 04 March 2013 in Journal of *Human Evolution*, Dr. LIU Wu of the IVPP and his international collaborators reported a detailed description and comparative analysis of four hominin teeth recovered from the late Middle Pleistocene cave site of Panxian Dadong, Guizhou Province in southwestern China. The Panxian Dadong teeth combine archaic and derived features that align them with Middle and Upper Pleistocene fossils from East and West Asia and Europe. These teeth do not display any typical Neanderthal features and they are generally more derived than other contemporaneous populations from Asia and Africa. However, the derived traits are not diagnostic enough to specifically link the Panxian Dadong teeth to *Homo sapiens*.

Faunal comparisons, Uranium-series dates of speleothems, and electron spin resonance dates on tooth enamel indicate that most of the excavated levels at the Panxian Dadong were deposited between MIS 8 and MIS 6 (roughly 300,000–130,000 years ago).

"This mosaic of primitive and derived traits gives a glimpse of the high morphological diversity of the prehistoric populations that inhabited the vast geographical region of East Asia and raises the possibility of new evolutionary trends that have yet to be fully understood. Upper Pleistocene fossils from Africa and Europe have been generally classified as *H. sapiens* or

View of the entrance to Panxian Dadong, southwestern China.



Four hominin teeth recovered from the late Middle Pleistocene cave site of Panxian Dadong. (Image by LIU Wu)

Homo neanderthalensis. However, comparatively little is known about the evolution of human populations in Asia and the question remains how to relate late Middle Pleistocene and Upper Pleistocene fossils from Asia to either *H. sapiens*, Neanderthals, or to something else unique to Asia," said LIU Wu of IVPP.

"The phylogenetic position of the Middle Pleistocene fossils of Africa is less clear, and this is partially due to the scarcity of the fossil record for this period and region", said Dr. Lynne A. Schepartz, School of Anatomical Sciences, University of the Witwatersrand Medical School, Johannesburg, South Africa: "Differences between the African and Asian Middle Pleistocene human assemblages may be pointing to different evolutionary trends for the populations of both continents and raise a number of unsolved questions about the evolutionary story of humans during the Middle Pleistocene. Current data and research have not yet confirmed or disproved whether late Middle Pleistocene and Upper Pleistocene hominins from Asia can fit within the variability of *H. sapiens* or Neanderthals, whether they are the result of the evolution in isolation of *H. erectus*, or whether they may even represent a fourth hominin lineage distinctive to Asia."

"We believe that the key to understanding the evolutionary fate of the Middle Pleistocene populations from Africa and Asia will derive from future fossil discoveries and more precise chronologies that help build a comparable fossil record and chronological framework between the continents," said Dr. Erik Trinkaus, Department of Anthropology, Washington University, Saint Louis: "The Panxian Dadong teeth provide new data for the discussion about the evolutionary course of the Middle Pleistocene of Asia, highlighting the necessity of incorporating this new Asian evidence into the scientific debate about human evolution and the development of dental diversity in Homo lineages."