Behavioral modernity is considered one of the defining characteristics separating modern humans from earlier hominin lineages. Over the course of the past two decades, the nature and origins of modern human behavior have been among the most debated topics in paleoanthropology.\(^1\)–\(^7\) There are currently two primary competing hypotheses regarding how and when modern human behavior arose. The first one, which we shall term the saltational model, argues that between 50–40 kya modern human behavior appeared suddenly and as a “package”; that is, the entire range of traits appeared more or less simultaneously. The proposed reason most often cited for this sudden change in behavior is a genetic mutation, possibly related to communication,\(^7\) that occurred around 50 kya. The second major hypothesis, which we shall term the gradualistic model, argues that modern human behavior arose slowly and sporadically over the course of the past 150,000 years and may be related to increasing population pressure.\(^2\) In general, many European scholars subscribe to the saltational model, while many Africanists seem to prefer the gradualistic model. As McBrearty and Brooks\(^2\) noted, the disagreement may be related to different developmental histories underlying the research traditions in Europe and Africa.

Generally accepted evidence of modern human behaviors are art and ornamentation; burials; blade technology; worked biological implements such as bone and antler tools; long-distance exchange; standardized lithic technology; effective predation of large mammals; successful use of harsh environments; and fishing and fowling, among others (see Henshilwood and Marean,\(^4\) Table 1). All of these traits would involve effective communication skills, particularly the abilities to express abstract thought and/or teach how to produce composite and complex objects. We add to this list crossing large bodies of open water, because it requires the ability to produce some type of watercraft and successfully navigate to locations that are not necessarily visible to the naked eye, as Davidson and Noble\(^6\) originally noted.

Many paleoanthropologists agree that the one overarching trait that can truly be considered evidence of modern human behavior is “symbolically organized behavior,” further defined as “behavior that is mediated by socially constructed patterns of symbolic thinking, actions, and communication that allow for material and information exchange and cultural continuity between and across generations and contemporaneous communities.”\(^4\)–\(^6\)\(^3\) Although we agree with Henshilwood and Marean\(^4\) about the importance of “symbolically organized behavior,” we suggest that this type of behavior does not present itself until populations increase to the point of which different foraging groups find the need to distinguish themselves from each other. This may or may not be related to access constraints to valuable resources such as mates. Thus, it may be possible for other traces of modern human behavior to appear earlier than the evidence of symbolically organized behavior.

Behavioral modernity should not be confused with morphological modernity.\(^9\) Current evidence indicates that modern human behavior and morphology do not appear in the record simultaneously.\(^2\),\(^4\),\(^7\) For example, detailed studies in Africa indicate that modern humans appear about \(\sim 195\) kya\(^10\) and that modern human behavior appears by \(\sim 150\) kya.\(^2\),\(^11\) Although we wholeheartedly acknowledge the importance of the integrated approach to modern human origins research,\(^12\) we have chosen here, because of disparities in the data, particularly in East Asia, to focus on the behavioral record. Thus, in this paper we do not imply that the East Asian behavioral data support any of the major modern human origins models such as replacement,\(^13\) multiregionalism,\(^14\) or assimilation.\(^15\)

Although some such as Henshilwood and Marean\(^4\) question the trait-list approach, we suggest that
<table>
<thead>
<tr>
<th>Site</th>
<th>Location</th>
<th>Age (BP)</th>
<th>Dating Method</th>
<th>Cultural Assignment</th>
<th>Artifacts</th>
<th>Fauna</th>
<th>Hominin Fossils</th>
<th>Comments</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heimahe</td>
<td>Qinghai Province (China)</td>
<td>15-11 ka</td>
<td>AMS 14C</td>
<td>Late Paleolithic</td>
<td>Hearth &amp; stone tools</td>
<td>Mid-size ungulates &amp; small mammal bone fragments</td>
<td>None</td>
<td>None</td>
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<tr>
<td>Huanglongdong</td>
<td>Hubei Province (China)</td>
<td>~100-40 ka</td>
<td>U-series, ESR</td>
<td>Early Paleolithic</td>
<td>22 core &amp; flake tools; bone artifacts</td>
<td>Oriental faunas typical of tropical and subtropical environs</td>
<td>Modern H. sapiens: Teeth</td>
<td>Questions about context and age</td>
<td>82</td>
</tr>
<tr>
<td>Jiangxigou</td>
<td>Qinghai Province (China)</td>
<td>15-11 ka</td>
<td>AMS 14C</td>
<td>Late Paleolithic</td>
<td>Hearth, 107 stone artifacts</td>
<td>158 Artiodactyl specimens</td>
<td>None</td>
<td>None</td>
<td>46</td>
</tr>
<tr>
<td>Jingshuiwan</td>
<td>Three Gorges Region (China)</td>
<td>~70 ka</td>
<td>OSL</td>
<td>Early Paleolithic</td>
<td>910 core &amp; flake tools</td>
<td>Oriental faunas typical of tropical and subtropical environs</td>
<td>None</td>
<td>None</td>
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<td>Lijiang</td>
<td>Yunnan Province (China)</td>
<td>Late Pleistocene</td>
<td>Biostratigraphy?</td>
<td>?</td>
<td>Stone tools</td>
<td>Oriental faunas typical of tropical and subtropical environs</td>
<td>Modern H. sapiens: 1 cranium</td>
<td>Questions about context and age</td>
<td>15, 99</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;100, ~150 ka</td>
<td></td>
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<td></td>
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<tr>
<td>Site</td>
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<td>Dating Method</td>
<td>Cultural Assignment</td>
<td>Artifacts</td>
<td>Fauna</td>
<td>Hominin Fossils</td>
<td>Comments</td>
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<tr>
<td>Salawusu</td>
<td>Inner Mongolia (China)</td>
<td>~50–37 ka</td>
<td>$^{14}$C, U-series</td>
<td>Late Paleolithic</td>
<td>400 stone artifacts</td>
<td>Palearctic</td>
<td>Modern H. sapiens: crano-dental &amp; postcranial elements</td>
<td>Questions about context and age</td>
<td>15, 99, 100</td>
</tr>
<tr>
<td>Salawusu</td>
<td></td>
<td>&gt;1945 A.D.; ~200</td>
<td>AMS $^{14}$C</td>
<td>Late Paleolithic</td>
<td>Stone artifacts</td>
<td>Palearctic</td>
<td>None</td>
<td>None</td>
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<tr>
<td>Shuidonggou</td>
<td>Ningxia Hui Autonomous Region (China)</td>
<td>25.5 ka</td>
<td>AMS $^{14}$C</td>
<td>Late Paleolithic</td>
<td>Stone artifacts</td>
<td>Palearctic</td>
<td>None</td>
<td>None</td>
<td>15, 46, 100</td>
</tr>
<tr>
<td>Shuidonggou</td>
<td></td>
<td>38–16.7 ka</td>
<td>AMS $^{14}$C</td>
<td>Late Paleolithic</td>
<td>Stone artifacts</td>
<td>Palearctic</td>
<td>Modern H. sapiens: 34 cranial &amp; post-cranial elements</td>
<td>None</td>
<td>101</td>
</tr>
<tr>
<td>Shuidonggou</td>
<td></td>
<td>42–39 ka</td>
<td>AMS $^{14}$C</td>
<td>Late Paleolithic</td>
<td>Stone artifacts</td>
<td>Palearctic</td>
<td>Modern H. sapiens: 5 teeth, 1 juvenile femur</td>
<td>None</td>
<td>86</td>
</tr>
<tr>
<td>Xianggushan</td>
<td>Liaoning Province (China)</td>
<td>40 ka</td>
<td>$^{14}$C</td>
<td>Paleolithic</td>
<td>&gt;10,000 stone artifacts, perforated animal teeth, bone needles, &amp; harpoon</td>
<td>Palearctic</td>
<td>Modern H. sapiens: Homo sp.</td>
<td>Questions about context and age</td>
<td>15, 59, 60, 100</td>
</tr>
<tr>
<td>Xialongdong</td>
<td>Three Gorges Region (China)</td>
<td>~150–120 ka</td>
<td>U-series</td>
<td>Early Paleolithic</td>
<td>20 core &amp; flake tools</td>
<td>Oriental faunas typical of tropical &amp; subtropical environs</td>
<td>Homo sp.</td>
<td>Questions about context &amp; age</td>
<td>61</td>
</tr>
<tr>
<td>Xijiyao</td>
<td>Shanxi Province (China)</td>
<td>125–104 ka</td>
<td>U-series</td>
<td>Early Paleolithic</td>
<td>1,3650 stone artifacts</td>
<td>Palearctic</td>
<td>Archaic H. sapiens: 16 cranial fragments &amp; isolated tooth</td>
<td>Questions about age</td>
<td>15, 26, 99</td>
</tr>
<tr>
<td>Site</td>
<td>Location</td>
<td>Age (BP)</td>
<td>Dating Method</td>
<td>Cultural Assignment</td>
<td>Artifacts</td>
<td>Fauna</td>
<td>Hominin Fossils</td>
<td>Comments</td>
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<tr>
<td>Zhoukoudian Upper Cave</td>
<td>Beijing (China)</td>
<td>34–10 ka</td>
<td>14C, U-series, AMS 14C</td>
<td>Late Paleolithic</td>
<td>25 stone artifacts, perforated</td>
<td>Paleartic</td>
<td>Modern H. sapiens</td>
<td>Questions about age</td>
<td>15, 53</td>
</tr>
<tr>
<td>Kanedori</td>
<td>Iwate Prefecture (Japan)</td>
<td>115–84 ka)</td>
<td>Tephrochronology</td>
<td>Early Paleolithic</td>
<td>Stone tools?</td>
<td>?</td>
<td>None</td>
<td>Question about the nature of artifacts</td>
<td>34, 35</td>
</tr>
<tr>
<td>Musashidai Tategahana (Nagano Prefecture, Tokyo (Japan))</td>
<td>32–30 ka, 49–41 ka</td>
<td>14C AMS 14C</td>
<td>Late Paleolithic, Early/Late Paleolithic</td>
<td>? Assorted bone &amp; stone flake tools</td>
<td>? Palaeoloxodon, Sinomegaceros</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>33, 102, 35, 40</td>
</tr>
<tr>
<td>Dokso</td>
<td>Kyunggi-do (Korea)</td>
<td>37–36 ka</td>
<td>AMS 14C</td>
<td>Late Paleolithic</td>
<td>Blades</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>73</td>
</tr>
<tr>
<td>Hopyeong</td>
<td>Kyunggi-do (Korea)</td>
<td>31.2 ka ± 900</td>
<td>AMS 14C</td>
<td>Late Paleolithic</td>
<td>Blades</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>73</td>
</tr>
<tr>
<td>Turubong Cave (Hungsu Cave)</td>
<td>Chungcheongbuk-do (Korea)</td>
<td>40 ka</td>
<td>Biostratigraphy</td>
<td>Early Paleolithic</td>
<td>Scrapers, denticulates</td>
<td>Oriental faunas typical of tropical/subtropical environs</td>
<td>Modern Homo sapiens almost complete cranium &amp; postcranium of a 5-6 year old child</td>
<td>Questions about the nature of artifacts and age</td>
<td>57, 73</td>
</tr>
</tbody>
</table>
compiling a list of region-specific evidence of perceived modern human behaviors is still the necessary first step before we can move on to attempts to address broader questions. Regional reviews of the evidence of modern human behavior include coverage of Europe, Africa, South Asia, and Australasia. Although East Asia is important to the debate about the origin of modern human behavior, it is a region that has yet to be synthesized in this light. Indeed, in many of the major edited compilations on the topic, including those by Mellars and Stringer and Mellars and coworkers, the East Asian record is only briefly touched on or completely neglected. We argue that the primary reason for this discrepancy is that there has been a lack of synthesis of what is known and unknown in East Asia. This paper provides the necessary synopsis from which the East Asian record can now be considered in discussions of the evolution of modern human behavior.

We offer here a review of the current early evidence of modern human behavior in East Asia and evaluate how this evidence contributes to the debates regarding modern human behavior. This review covers East Asia, which encompasses the modern-day political entities of China, Korea, and Japan. “East Asia” should not be confused with “eastern Asia” or “eastern Eurasia,” which would also include Siberia and mainland and island Southeast Asia. We are restricting our review to East Asia sensu stricto. East Asia encompasses roughly 12,000,000 km², an area approximately 15% larger than Europe. Topographically, to the west, the most notable geographical landmark is the Qinghai-Tibetan Plateau, which, beginning during the Miocene, would have formed a formidable dispersal barrier. Moving from west to east, the altitude decreases substantially, to the point where much of lowland eastern China is less than 200 meters above sea level (MASL). During extreme glacial periods, various land connections would have been present between eastern China, the Korean peninsula, and the Japanese archipelago. East Asia comprises two biogeographic zones, with the Palearctic in the north and Oriental in the south. Throughout the Quaternary, this biogeographic boundary was fairly fluid, moving southward during glacial periods and northward during interglacial periods.

BEHAVIORAL CORRELATES

Ideally, it would be constructive to evaluate every modern human behavioral trait listed by McBrearty and Brooks and Henshilwood and Marean. However, suitable data from East Asia for many of these traits are either lacking or absent. Therefore, from among the array of generally accepted modern human behaviors, we review the evidence of watercraft; use of harsh environments (in this case, adaptation to high altitudes); burials; art and symbolism; networks of long-distance exchange; and stone-tool specialization. The sites mentioned here are presented in Figure 1 and Table 1. Although “successful exploitation of large mammals” is usually included in this suite, we feel that, given the plethora of new taphonomic and isotopic data published in the last decade by, for example, Marean and Kim, Richards and coworkers, Norton and Gao, it may no longer be considered a defining characteristic of modern human behavior. Instead of “successful use of harsh environments,” we prefer to use “successful adaptation to high altitudes” because, as we will discuss, successful occupation of the Qinghai-Tibetan Plateau involved a wide range of physiological and behavioral adaptations.

Watercraft

Long-distance sea voyaging has often been cited as evidence of early modern behavior, usually in reference to the peopling of Australasia. Nevertheless, it has been suggested that the Middle Pleistocene Mente site on Flores could only have been occupied by sea voyaging *Homo erectus*. However, paleobathymetric reconstructions of the region (see, for example, Anton and Pettitt, Fig. 4.32) indicate that at least during several Middle Pleistocene glacial periods, Flores could have been connected to the Southeast Asian mainland. Thus, it is still not clear that *Homo erectus* had deep sea voyaging capabilities.

The best evidence of early sea voyages in East Asia is directly related to the earliest peopling of the Japanese archipelago. Modern-day Japan is comprised of four major islands, Hokkaido, Honshu, Shikoku, and Kyushu. Paleobathymetric and vertebrate paleontological studies indicate that only during major glacial periods was the Japanese archipelago connected to the Asian mainland. The last two accepted land bridges were during the Middle Pleistocene, when *Stegodon orientalis* arrived during marine isotope stage (MIS) 6 (~0.63 Ma) and MIS 12 (~0.43 Ma), when *Palaeoloxodon naumannii* arrived (see Fig. 2 for description of the MIS stages). The Korea/Tsushima Strait, which separates the southern part of the Korean Peninsula and southern Japan, is ~130 meters deep. It is unclear whether, during the LGM, the region was dry land forming a land bridge.

The timing of the earliest peopling of the Japanese archipelago is still a subject of open debate. For instance, Matsufuji has suggested that the earliest peopling of Japan occurred sometime during MIS 6 (~186–127 kya). In support of this hypothesis, Matsufuji proposes that the artifacts from stratum IV of the Kanedori site located in northeastern Honshu were found in deposits (for example, Aso-4, K-Tž) containing tephra that dated between 115 and 84 kya (within MIS 5). Because MIS 5 is considered to be an interglacial period and a time interval that would have relatively high sea levels, Matsufuji suggests that it would have been easier for hominins to have arrived in Japan during MIS 6, a glacial period with substantially lower paleobathymetry. Questions do exist, however, concerning the artifactual nature of the Kanedori fractured stones from stratum IV. Kanedori aside, there is no current evidence of hominin occupation of the Japanese archipelago before the advent of MIS 3 (~54–25 kya). The earliest
site in Japan that is widely accepted is the Tategahana, Nojiriko site located in western Honshu, with accelerator mass spectrometry (AMS) $^{14}$C dates from the lowest stratum ranging between $\sim 49$ and $41$ kya.\textsuperscript{40}

Irrespective of which is the earliest site in Japan, Kanedori (MIS 5) or Tategahana (MIS 3) both represent periods when there were no land connections between the Asian mainland and the Japanese archipelago. This indirectly implies that some type of watercraft was used in order to colonize the archipelago.\textsuperscript{35}

Additional indirect evidence of early use of watercraft derives from obsidian sourcing studies from Kozushima, a small island off the east coast of Honshu, Japan.\textsuperscript{33} Kozushima is currently 54 km from the coast of Honshu. During the LGM, it is estimated to still have been some 40 km distant.\textsuperscript{41} Obsidian excavated from late MIS 3 Late Paleolithic sites in the Kanto Plain in and around Tokyo has been sourced to Kozushima.\textsuperscript{33,42} For instance, obsidian that originated from Kozushima was excavated from the Musashidai site stratum X, which has been $^{14}$C dated to 32–30 kya and has been identified from at least six other sites from eastern Honshu, all older than 28 kya, and may be coeval with Musashidai stratum X (see Ikawa-Smith,\textsuperscript{33} Table 1).

### Adaptation to High Altitudes (Use of Harsh Environments)

Hominin movement into higher elevations occurred sometime during the latter half of the Late Pleistocene,\textsuperscript{43} suggesting that cultural and physiological requirements for successful exploitation of such environments were relatively severe. In East Asia, human dispersal into the Qinghai-Tibetan Plateau (average 5,000 MASL) did not occur until the latter half of the Late Pleistocene and probably not until the latter stage of MIS 3 (<30 kya).\textsuperscript{43–46} It is likely that the primary reason for the late dispersal of hominins into higher altitudes was the decreasing amount of oxygen with the shift toward higher elevations, so that hypoxia became a problem.\textsuperscript{43,47,48} High-altitude hypoxia has been defined as a "severe physiological stress caused by lowered barometric pressure."\textsuperscript{48:423}

Studies comparing low- and high-altitude populations from the Andes and Tibet\textsuperscript{47,48} indicate a range of variation between these different populations. For instance, compared with indigenous low-altitude groups, populations assimilated to life in high altitudes have lower birth rates and birth weights, reduced exercise ability, and shorter stature, though variation exists even between these
groups.\textsuperscript{47,48} Humans dispersing into higher altitudes for the first time thus would have faced diverse challenges in order to overcome these initial physiological stresses. Accordingly, the ability not only to disperse into, but to survive successfully in this novel environment would have involved a wide range of behaviors including the ability to track and hunt game successfully, manage controlled use of fire, and some form of clothing.\textsuperscript{49} Indeed, evidence of at least footwear in East Asia dates to at least 40 kya, as studies of the Tianyuanlong modern \textit{Homo sapiens} skeleton suggest.\textsuperscript{50} As a consequence, humans probably were not physiologically adapted to move into a hostile environment like the Qinghai-Tibetan Plateau before late in MIS 3.

Recent studies\textsuperscript{44–46} have divided the Qinghai-Tibetan Plateau into areas of low elevation (<3,000 MASL), middle elevation (3,000–4,000 MASL), and high elevation (>4,000 MASL). Analysis of an array of optically stimulated luminescence (OSL) and AMS $^{14}$C dates derived from diverse sites from the region indicate that human occupation of the low-elevation areas began during MIS 3 during high-water stands, when wild ungulates would have been abundant.\textsuperscript{46} Occupation appears in the middle elevation region during MIS 2, but only ephemerally. Small test excavations at the middle elevation sites of Heimahe and Jiangxiugou (~15–11 kya) revealed evidence of hearths and small concentrations of artifacts (for example, microblades, bifacial thinning flakes, and cores).\textsuperscript{46} The small artifact and bone concentrations suggest that these sites were short-term, possibly single-visit foraging camps for small hunter-gatherer groups.\textsuperscript{45,46} It was not until after 6,000 cal. yr BP when permanent occupations were established at elevations above 3,000 MASL.\textsuperscript{43,45,46} Before this, foraging groups would have been restricted to below the 3,000 MASL boundary. Only short-term visits above that boundary would have been feasible. It has been suggested that this coincided with or was facilitated by the advent of animal domestication,\textsuperscript{43,45,46} which would have resulted in a reliable food and clothing source. In part, at least, increasing population pressure at the lower elevations likely forced hunting and gathering groups into the higher-elevation regions.\textsuperscript{44–46}

**Burials**

Ritualized treatment of the dead, often in the form of burials, has long been considered to be evidence of modern human behavior.\textsuperscript{2,4} Two sites in East Asia, Zhoukoudian Upper Cave, China, and Hungsu Cave, Korea, have been proposed as Paleolithic human interments.

Zhoukoudian, a limestone hill located 50 km southwest from Beijing, China, contains a series of cave localities. The best-known site is the Middle Pleistocene Locality 1, which yielded abundant remains of \textit{Homo erectus} and is commonly known as the “cave home of Peking Man.”\textsuperscript{51} The second most publicized locality at Zhoukoudian is Upper Cave, which is best known for the presence of numerous modern human fossils, at least some of which are thought to
have been purposely interred.\textsuperscript{52,53} Multiple lines of evidence support the claim for human burials at Upper Cave. In particular, the human fossils were found partially articulated, suggesting minimal taphonomic disturbance after deposition, and were covered with ochre. Composite necklaces, consisting of perforated stone, shells, and bone were purportedly found near the neck of at least one individual.\textsuperscript{52,53} Although the wider scientific community generally accepts that Upper Cave represents Late Paleolithic burials (\textasciitilde34–20 kya), the age of deposition and cultural affiliation are still in question. For example, some scientists, among them Kamminga and Wright,\textsuperscript{54,55} argue that the burials are Early Holocene (~10 kya). We suggest that the case for Zhoukoudian Upper Cave dating to the Late Paleolithic is fairly strong, particularly given the number of extinct faunas found in association with the human skeletons.\textsuperscript{53}

A nearly complete skeleton of a modern human child thought to have been interred in Late Pleistocene sediment was discovered in the Hungsu Cave site in the Turubong Cave Complex in the central region of modern-day South Korea.\textsuperscript{56–58} Based on tooth eruption, the Hungsu child is estimated to have been between 5 and 6 years old at the time of death.\textsuperscript{59} Based on the associated paleontological remains, the excavators suggested a ~40 kya age for the burial.\textsuperscript{56} Nevertheless, it has been suggested that the burial may be intrusive from overlying Holocene layers.

Art and Symbolism

Since the 1930s, the best-known evidence of Paleolithic art and symbolism in East Asia has come from Zhoukoudian Upper Cave.\textsuperscript{52,53} The artifacts include seven perforated white calcareous stone beads, which were found near the Zhoukoudian Upper Cave 102 cranium. One hundred and twenty-five perforated animal teeth and three \textit{Arca} shells were excavated from the deposits. Many of these artifacts were dyed in red ochre. The majority of these ornaments were excavated from Layer 4, the source of the human burials.\textsuperscript{52,53}

In 1983, five teeth and one juvenile femur of modern \textit{Homo sapiens}, as well as lithic and bone artifacts, were excavated from the Xiaogushan site in Liaoning Province, Northeast China.\textsuperscript{59,60} The perforated carnivore and cervid teeth and three bone needles from Xiaogushan are similar to the osseous implements from Zhoukoudian Upper Cave. One of the most interesting aspects of the Xiaogushan materials is a finely crafted composite bone harpoon that displays similarities to those from the European Magdalenian cultures (Fig. 3). The bone harpoon may have been used in fishing and/or hunting activities, though fish remains were not identified in the faunal assemblage. The presence of extinct open-steppe taxa (such as \textit{Crocuta ultima}, \textit{Mammuthus primigenius}, \textit{Coelodonta antiquitatis}, \textit{Dicerorhinus mercki}, and \textit{Megaloceros ordosianus}) indicates a Late Pleistocene age for the deposits.\textsuperscript{59,60} The only reported \textsuperscript{14}C date is ~40 kya,\textsuperscript{15} though more research is currently being done to clarify the age. The excavators have also suggested Xiaogushan is similar in age to Zhoukoudian Upper Cave.\textsuperscript{59} Xiaogushan is a site complex that warrants more detailed multidisciplinary studies, particularly taphonomic reconstructions of the site formation processes. Because both Paleolithic and Neolithic artifacts are present at the site, it is crucial to evaluate the possibility that the bone harpoon derives from the overlying Neolithic layer and not from the Paleolithic level.

In 2001, a \textit{Stegodon} tusk with markings interpreted as being hominin-made was excavated from Xinglongdong, a cave site in the Three Gorges Region in southern China.\textsuperscript{61} This tusk is one of two representing separate individuals that were excavated \textit{in situ} about 50 meters inside Xinglongdong. The site also yielded a worn hominin tooth (\textit{Homo} sp.) from an aged individual, twenty stone artifacts, and diverse faunal materials. The size of the \textit{Stegodon} tusks precludes them from having naturally washed into the cave, their transport by nonhuman animals seems unlikely. Thus, the marked tusk is spatially associated with indubitable artifacts and a human tooth. The stratigraphic level from which the tusks were excavated is bracketed by two separate travertine layers. However, because the travertine has insufficient amounts of calcite, U-series dating could not be performed. Instead, U-series dating was done on a \textit{Stegodon} molar found in association with the tusks, resulting in an age range between ~150 and 120 kya.\textsuperscript{61} If it is confirmed that the markings on the tusk were made by hominins, the Xinglongdong specimen may be the earliest evidence of symbolic behavior in East Asia.

The Xinglongdong material warrants further discussion. The markings on the tusk are comprised of linear striations on the natural external end of a tusk (Fig. 4). Trampling experiments conducted by the excavators did not produce similar
marks, leading the excavators to suggest that the marks were produced by human activity. Nevertheless, the Xinglongdong markings do not show a repetitive pattern like the incised ochre from Blombos Cave and Pinnacle Point in South Africa and they are not recognizably figurative. Furthermore, there is no evidence to suggest that the marks could not have occurred while still attached to the living elephant. Elephants normally use their tusks to carry out a variety of daily functions such as moving food and digging. More research is needed to verify the age and the evidence of “symbolic” behavior at Xinglongdong before it can be confidently accepted. In addition, most would argue that evidence of symbolic behavior needs to be repetitive. In other words, similar additional evidence needs to be found either at Xinglongdong or nearby pencontemporaneous sites.

Since the 1930s, the best evidence of Paleolithic art and symbolism in East Asia has been the material from Zhoukoudian Upper Cave. When the material from Xiaogushan and Xinglongdong are better studied and dated, further revisions of the evidence for Paleolithic art and symbolism in East Asia may be in store.

Long Distance Exchange Networks

The appearance of “exotic” materials (ones that are not perceived as indigenous to the site or region) is often used as evidence of long-distance transport and possibly is indicative of exchange interactions between different foraging groups. One of the best archeological indicators of long-distance transport in East Asia involves obsidian.

Hokkaido, the northernmost island of the Japanese archipelago, and Sakhalin, located just north, are separated by the Soya Strait, which is 55 meters in depth. This indicates that during major glacial periods (such as the LGM) these two islands would have been landlocked. Paleontological studies support the close relationship between the fauna from these two regions. Sourcing studies of obsidian from the southern part of Sakhalin date it to the Late Paleolithic (c. 23 kya) and indicate that the raw material originated from Shirataki, located in central Hokkaido, a distance of approximately 300 km. Kuzmin, Glascock, and Sato suggest that this is evidence of long-distance exchange between different foraging groups during the LGM and that there was likely some type of interaction.

Although the chronometric age of Zhoukoudian Upper Cave is still in question, biological materials in the form of three perforated seashells (Arca sp.) were recovered during excavations. Depending on which date one uses for the Zhoukoudian Upper Cave deposits, the seashells could have been moved as little as 150 km, which is where the paleo-coastline is estimated to have been during the Early Holocene. Alternatively, if the Zhoukoudian Upper Cave deposits date to the Last Glacial Maximum, the paleocoastline could have been some 500–600 km from the site. Regardless of which paleocoastline one uses, it has long been argued by Chinese scientists that the appearance of the seashells in the deposits was most likely the result of exchange with coastal hunter-gatherer groups.

Stone-Tool Specialization

Two stone tool types that are often associated with modern human behavior are blades and microblades. The East Asian Paleolithic is well known for the paucity of major technological innovations over long periods of time (see Gao and Norton, Norton, and coworkers, and references in Lycett and Norton). The advent of blade and microblade technologies is not an indigenous development in East Asia. Blade technology appears first at Kara Bom (~43 kya) in the Siberian Altai, then disperses southward into Inner Mongolia, northern China, Korea, and Japan. The type site for early evidence of blade technology in East Asia is Shuidonggou, in Ningxia Hui Autonomous Region in
northern China, with AMS and OSL dates ranging between 29 and 24 kya.\textsuperscript{46,68,71,72} However, blades with earlier AMS dates have been identified in Korea in, for example, Hopyeong (~31 kya) and Dokso (~37–36 kya).\textsuperscript{73}

At no time during the Pleistocene does blade technology appear in southern China or mainland Southeast Asia.\textsuperscript{74} Blade technology was moved southward either by foraging groups expanding southward in the face of increasing glacial conditions or through some type of exchange interaction sphere; that is, technology diffuses, foraging groups do not. We admit that trying to track such movements by anisochronous (time-transgressive) distributions of blade industries is unlikely to be as informative as are studies of variation in blade production methods (that is, chaine opéraire analysis). However, there is a relative paucity of such detailed analyses of lithic technologies in East Asia (but see Brantingham and coworkers.\textsuperscript{68} See Box 1).

**DISCUSSION**

Most of the archeological evidence evaluated here indicates a post-50kya appearance in East Asia (Fig. 5). Before we discuss the implications of these findings, it is important to understand the behavioral record in light of related fields of study. How do the hominin fossil record and chronological studies influence our interpretations of the advent of modern human behavior in East Asia?

**The Hominin Fossils**

Most of the currently reported modern *H. sapiens* fossils in East Asia are from northern China, Korea, and Japan, with far fewer from southern China.\textsuperscript{15,34,57} Taken at face value, the paucity of modern *H. sapiens* in southern China apparently conflicts with the genetic argument that modern humans initially arrived in southern China and then dispersed northward (Jin and Su;\textsuperscript{75} Shi and coworkers;\textsuperscript{76} but see Karafet and coworkers\textsuperscript{77}). Some geneticists\textsuperscript{75,76} have argued that the higher frequency of genetic polymorphisms in the southern samples indicates an older occupation. However, it has also been noted that this genetic patterning may reflect greater population densities.\textsuperscript{78} All things being equal, if humans lived in higher population densities in southern China than in northern China during the Late Pleistocene, then we might expect to find more human fossils in

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**Box 1: The Legacy of the Movius Line**

Because of the presumed absence of bifacially worked heavy-duty tools such as handaxes, cleavers and picks, Hallam Movius\textsuperscript{91} made the famous comment that East and Southeast Asia constituted a “cultural backwater” for much of the Pleistocene. Movius’ comments prompted many Paleo-lithic archeologists working in East Asia to try and disprove what came to be known as the “Movius Line.”\textsuperscript{92} However, after more than 60 years of research, we suggest that many of Movius’ original observations (not interpretations) still stand.\textsuperscript{65,66} Accordingly, rather than dedicating more time to searching for handaxes, we believe it is time to move forward and take a closer look at what the East Asian lithics may tell us about early hominin behavioral variability. In particular, more detailed studies of variation in the core and flake implements that dominate all East Asian lithic assemblages is critical to understanding the behavioral variability that may or may not be present in the East Asian Paleo-lithic. In other words, rather than describing the East Asian Paleolithic as a stagnant, nondeveloping Mode 1 technology with little innovation over the course of more than one million years, it would be worthwhile to apply more modern analytical methodologies to these lithic datasets. Indeed, recent vertebrate paleontological research by Wang and coworkers\textsuperscript{93} indicated that the amorphous “Aiupodap-Stegodon” faunal complex, which often characterizes the Oriental biogeographic zone during the Quaternary, actually contains a great deal of temporal variation. There is little reason to believe that, upon closer examination, the stone toolkits from East Asia, particularly southern China and Southeast Asia, the nature of behavioral variability during the Early Paleolithic cannot be better understood.

We recommend two avenues of research that analyses of East Asian lithic assemblages could move toward. First, rather than basing analyses of bifacial implements on univariate length, width, and thickness measurements, more detailed multivariate data should be collected. In this regard, the recent multivariate morphometric investigations of Lycett,\textsuperscript{94,95} which were based on 60 different quantitative metrics taken from core nuclei, is more robust than the types of lithic analyses currently being done on East Asian stone toolkits (but see Brantingham and colleagues\textsuperscript{68}). Second, we suggest that methodologies being developed and used for analyses of the African Oldowan, which are designed to more closely examine behavioral variability, could also be readily employed in East Asia. For example, Braun and coworkers\textsuperscript{96,97} have been studying lithic sourcing (geochemical ED-XRF) and core reduction sequences from Early Pleistocene sites in Kanjera and Koobi Fora with very illuminating results. These studies are particularly relevant to the East Asian record because it is a well-known fact that Oldowan-type industries dominate the Early Paleolithic record.

Ultimately, as Shea\textsuperscript{98,226} has noted “recognizing the role that variability may have played in Early Paleo-lithic stone-tool design is a significant step toward more realistic models of early hominin subsistence.” More detailed analyses of the East Asian lithic toolkits would more readily facilitate a deeper understanding of early hominin lifeways, such as subsistence and mobility patterning, particularly because the paleoecology appears to have been so different from that in Europe and Africa throughout much of the Quaternary.
the former region. A hominin presence can be manifested by the presence or absence of archeological materials, as well as by hominin fossils. If southern China did indeed have higher population densities than did northern China between MIS 5 and 2, then this should be reflected in the archeological record in the form of higher site and artifact densities. Further systematic field work in southern China will likely clarify the density of hominin occupations during the Late Pleistocene and earlier periods.74,79

Though previous workers argued that hominins did not occupy China between 100 and 50 kya,75,76 recent studies indicate a hominin presence in this spatio-temporal point. For instance, the recent discovery of a modern H. sapiens cranium associated with vertebrate fossils and artifacts in Xuchang, Henan Province, China, places modern humans in East Asia between 100 and 80 kya, based on initial OSL dates. The excavation report and analysis of the fossils and artifacts have yet to be formally published, though news media disseminated the story in early 2008 (see Table 1 for links). Other examples include the open-air site Jingshuiwan, located in the Three Gorges Region in central China, where excavations revealed in-situ archeological materials with the lowest stratigraphic level OSL-dated to ~70 kya.80 Guanyindong, a cave site in Guizhou Province with more than 2,300 lithic artifacts and a diversity of Oriental faunas has an age range, based on U-series dating analysis, between 115 and 57 kya.81 Recent excavations at Huanglongdong in Hubei Province revealed modern H. sapiens teeth in association with archeological materials. Although U-series dates suggest an age of ~100 kya,82 the association between the speleothem samples used for the U-series dating analysis and the modern human teeth is not clear.

**Dating Issues**

Dating is a persistent problem in East Asian paleoanthropology. As Trinkaus83 suggested, more attempts at direct dating of hominin fossils is needed because such studies in East Asia can either reinforce current scientific thinking or raise questions about how we currently interpret certain paleoanthropological sites and associated materials. For instance, direct dating of samples from Salawusui, which is thought to be Late Pleistocene,84 indicates that some of the human skeletal materials may only be a few hundred years old.85 However, in another recent study of Chinese materials, direct dating of the Tianyandong human fossils found support for the argument that the fossils date to the Late Pleistocene.86

The best known site in East Asia where direct dating of the human fossils would serve to clarify a diversity of paleoanthropological questions is Zhokoudian Upper Cave. Standard 14C, thermoluminescence (TL), U-series, and AMS 14C methods were applied to derive a general chronological framework for occupation (Norton and Gao,53 Table 1). Chrono-
metric dates vary widely, between 34 kya and 10 kya, for the primary cultural level (Layer 4) where the burials originate. Most paleoanthropologists agree that the burials from Zhoukoudian are from the Late Pleistocene and likely date to the latter part of MIS 3. However, noting that the integrity of the stratigraphic context of some of the faunal remains is questionable and that postdepositional disturbance more likely affected the smaller bones that were used in deriving the AMS 14C dates, Kamminga argued that the original 14C dates suggesting that Layer 4 was from c. 10 kya and the Lower Recess c. 18 kya were more viable. More detailed chronometric studies are critically needed to better understand the role of Zhoukoudian Upper Cave in Late Pleistocene human evolution in East Asia.

Other sites for which direct chronometric dates would be extremely useful are Laishui and Liujiang. Laishui is best known for the nearly complete skeleton of a hominin that initial observations suggest is modern H. sapiens with a date of 28 kya or 60–30 kya. It is unclear what dating method was applied to the Laishui site. However, observations of the casts of the hominin fossils that are on display in the Sackler Museum in Beijing indicate that the skeleton is very robust, with pronounced supraorbitals, (CJN, personal observation). Thus, it is possible that the Laishui hominin may actually be a late-appearing archaic H. sapiens, rather than a modern human. We await formal publication of the Laishui materials and dates. The Liujiang modern human cranium is one of the most important Late Pleistocene fossils from southern China. However, because of questions related to the context and three-dimensional positioning of the skull, questions will persist about the age of the deposits. Other important modern human fossils from southern China, such as Lijiang and Chuandong, have no reported chronometric dates.

Overall, the East Asian Late Pleistocene hominin fossil record presents a complex picture. More modern H. sapiens fossils have been discovered in northern China, Korea, and Japan, which may suggest that modern humans possibly arrived initially in Northeast Asia rather than Southeast Asia, or were in higher population densities in the former region. Although more research needs to be done regarding understanding the Late Pleistocene hominin fossil record, particularly in light of the variation in chronometric dating and morphology, growing evidence suggests that modern humans may have been present in East Asia before ~50 kya.

**Although more research needs to be done... growing evidence suggests that modern humans may have been present in East Asia before ~50 kya.**

**Future Directions**

Traditionally, publication and accessibility have been two major hurdles in efforts to decipher the East Asian record. In some cases, major paleoanthropological finds have been preliminarily reported in newspapers or difficult-to-access scientific journals. A good example of this is the Chinese Laishui hominin fossil materials, which were discovered in the 1980s but still have not been fully reported. Detailed and timely publication of paleoanthropological materials is important to fully understand what role the new data play in paleoanthropological debates.

Every year, as the world gets smaller and smaller and scientists from across the globe engage increasingly in cross-comparative studies between different regions, accessibility is becoming a less difficult barrier to overcome. East Asian scholars are usually keen in engaging in collaborative research with their Western counterparts, while at the same time offering Western scientists and student-scientists access to their sites and materials for detailed studies.

**CONCLUSIONS**

The apparent and substantial qualitative and quantitative differences among the African, European, and East Asian Late Pleistocene records leads us to draw two primary conclusions from this review. First, based on the current state of the evidence from East Asia, we suggest that it is premature to argue for or against the saltational or gradualistic models. Second, evidence of watercraft and adaptation to higher altitudes should receive greater consideration for reconstructions of modern human behavior, particularly in East Asia. Interestingly, the evidence from northern China, Korea, and Japan lends more support for the saltational model, while the evidence for southern China appears to corroborate the gradualistic model. We postulate that this may in part be related to ecological differences between the two regions, though more detailed studies of the sites and materials mentioned here should clarify this.

If this review raises questions about the nature of the East Asian Paleolithic record and reinforces the call for more detailed testing of hypotheses in the future, then it has served its purpose. The East Asian record has much to offer major debates in paleoanthropological research. Only when full accessibility and timely publication of research results become the norm will the full impact of what the East Asian record has to offer be fully understood, facilitating a deeper understanding of the role East Asia plays in the debate regarding modern human origins.

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REFERENCES


33 Ikawa-Smith F. 2008. Living on the edge of the continent: the Japanese archipelago 30,000– 8,000 cal. B.C. North Pacific Prehist 2:45–64.


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