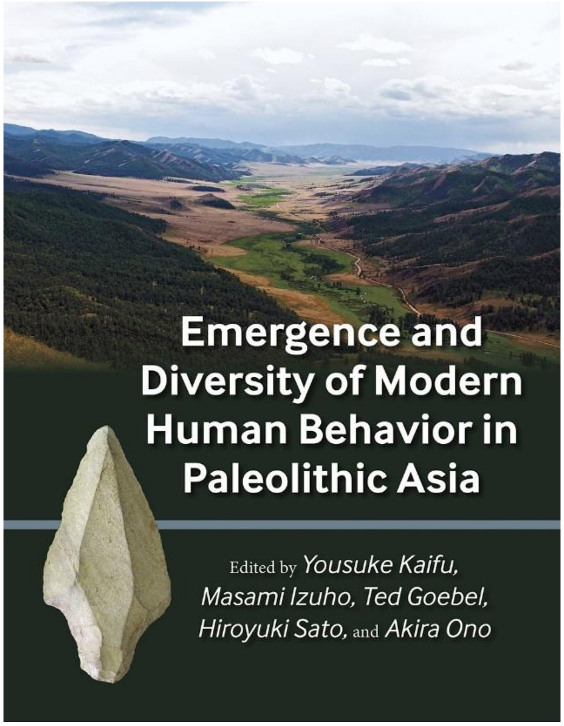

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Book Gathers Work of Archaeologists Worldwide to Address Emergence, Dispersal of Modern Humans in Asia

COLLEGE STATION— Despite the obvious geographic importance of eastern Asia in human migration, its discussion in the context of the emergence and dispersal of modern humans has been rare. Emergence and Diversity of Modern Human Behavior in Paleolithic Asia focuses long-overdue scholarly attention on this under-studied area of the world.

Arising from a 2011 symposium sponsored by the National Museum of Nature and Science in Tokyo, this book gathers the work of archaeologists from the Pacific Rim of Asia, Australia, and North America, to address the relative lack of attention given to the emergence of modern human behavior as manifested in Asia during the worldwide dispersal from Africa.

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Contents

Preface

This book arose from a symposium, "The Emergence and Diversity of Modern Human Behavior in Palaeolithic Asia," which was held at the National Museum of Nature and Science, Tokyo, November 29–December 1, 2011. The rise and general acceptance of the Recent African Origin theory for modern humans around the turn of the last century has sparked new studies on the process of global dispersal by *Homo sapiens,* as well as the origins, evolution, and nature of our behavioral modernity. In the framework provided by this theory, it is expected that fundamental aspects of modern behavioral capacity are rooted in the African Middle Stone Age, more than 100,000 years ago. With this capacity, *H. sapiens* dispersed across the world, in some areas replacing other archaic populations and in other areas expanding the hominin range far beyond the natural barriers that had restricted geographic ranges of archaic hominins, generating and developing diverse cultures in each region of the world. Reconstructing the processes of this global expansion and associated cultural developments and diversification are essential tasks for modern anthropologists and archaeologists. The need of worldwide surveys for such studies is widely acknowledged among scholars, but current arguments still rely heavily on evidence from Europe and Africa, and to a lesser extent, western Asia, Siberia, and Australia.

The aim of the Tokyo symposium was to gather and synthesize information from one region that has been a large black box in this field of research. Our focal region was eastern Asia, here defined to cover South Asia, Southeast Asia, East Asia, and Siberia. Australia, which holds an important key to interpreting the Asian Paleolithic, was also included. The vast terrain of Eastern Asia was a stepping stone for early modern humans as they continued to disperse to the Sahul, the Americas, and the Pacific islands. Despite its obvious geographic importance, discussion on the emergence of modern human behavior in eastern Asia has so far been rare, except for some pilot attempts. This is not necessarily because of a lack of studies and evidence from eastern Asia, but more because of obvious language barriers and a lack of attention to these global research issues. Under such circumstances, we designed the Tokyo symposium to be a place to discuss what is known and not known about modern human origins in eastern Asia and to plan effective strategies for future research in this region.

The Tokyo symposium was organized alongside the fourth meeting of the Asia Palaeolithic Association (APA), which is co-organized by the Paleolithic research communities of Russia, China, South Korea, and Japan. This combination enabled us to share much information with a large number of researchers from these and other countries. A small exhibition of Japanese Paleolithic artifacts during the symposium was effective for non-Japanese participants to understand the presentations at the symposium and further discover characteristics of these assemblages. Conference attendees also participated in a one-day excursion near Mt. Fuji, a national symbol and world heritage site. Participants directly experienced the landscape where dense Upper Paleolithic site complexes have been discovered and excavated in well-stratified and well-dated tephra layers exceeding 5 m in thickness. These sites have yielded various stone artifact forms, some of which belong to the earliest phase of the Japanese Upper Paleolithic, obsidian from the Kozushima Island off the coast of the nearby Izu Peninsula, and numerous hunting pitfalls. Many of these findings were the subjects of presentations at either the symposium or the APA meeting.

Speakers at the Tokyo symposium included skeletal anthropologists and geneticists, of course, but more emphasis was put on archaeological evidence for detailed discussion about behavioral aspects of early Asian modern humans. These speakers were an interesting mixture of local and Western researchers, but we acknowledge that not all of eastern Asia and Australia could be represented. We regret not having been able to invite additional active researchers from the region to share their discoveries and thoughts. Despite such limitations, overall, we feel that the symposium was full of new and surprising information and was a great success.

This book starts with an introductory section (Part I), which provides a general background on the modern human question and an overview of the book. It includes an extensive pan-Old World review of the emergence of Paleolithic modern behavior (Mellars), a focused regional review of modern human dispersal outside eastern Asia (Svoboda), and a review of human genomic studies (Kimura). The section ends with a brief overview of the Tokyo symposium and a resultant essay about Pleistocene human migration in Asia by one of the most experienced archaeologists in our focal region (Bellwood). These are followed by chapters focusing on specific regions of eastern Asia and Sahul: South Asia (Part II), Southeast Asia (Part III), Wallacea and Australia (Part IV), mainland East Asia (Part V), Japanese Archipelago (Part VI), and Siberia (Part VII). The Japanese evidence was emphasized because much of its abundant archaeological record, which has come to light during the past half century, has remained unpublished in international books and journals. In the final section (Part VIII), the editors wrap up the book by summarizing, contextualizing, and highlighting the significance of each of the chapters. We hope that this book will provide a useful and up-to-date synthesis of current understanding of the emergence of modern humans in eastern Asia, and will stimulate new studies about early *H. sapiens* in Paleolithic Asia.

The Tokyo symposium was funded and supported by the National Museum of Nature and Science in Tokyo, as well as the Japanese Palaeolithic Research Association and the Commemorative Organization for the Japan World Exposition ('70). We are deeply grateful to many individuals who worked hard to make this conference possible and productive, including, but of course not limited to, Junko Nikkawa, Miho Suzuki, Seiji Kadowaki, Yuji Mizoguchi, Reiko, T. Kono, Kazuhiro Sakaue, many dedicated student volunteers, as well as Misato Nishimura, Osamu Kamei, Mika Morinaga, and other museum staffs. Takuya Yamaoka and Nobuyuki Ikeya planned the wonderful field excursion with assistance from the Numazu City Board of Education and the Numazu City Center for Cultural Property, and staff from these organizations. Atsushi Noguchi arranged the exhibition of Japanese Paleolithic artifacts with permissions from the Fuchu City Board of Education, the Chofu City Board of Education, the Mitaka City Board of Education, and the Itabashi Ward Board of Education. Our thanks also extend to the excellent hospitality of Miho Imoto and the Ueno Terminal Hotel. We owe special thanks to Thom Lemmons and the staff at the Texas A&M University Press for facilitating the rapid production and publication of this book, and to Heather Smith and Joshua Keene, PhD students at Texas A&M University, for assisting with the English-language corrections of some of the chapters. We also thank Mayu Nagata, Netsuko Takahashi, Kohei Hiromatsu, and Sohei Yoshidame, undergraduate students at the Tokyo Metropolitan University, for their hard work on part of the proofreading. Finally, we would like to thank again all of the symposium participants, the contributors to this book, and anonymous reviewers for the individual papers published here, for their contributions in making this event so successful.

35 Modern Human Dispersal and Behavior in Paleolithic Asia

Summary and Discussion

Yousuke Kaifu, Masami Izuho, and Ted Goebel

Introduction

As outlined in the preface, this book resulted from the symposium entitled "The Emergence and Diversity of Modern Human Behavior in Paleolithic Asia," which was held at the National Museum of Nature and Science, Tokyo, in 2011. Reconstructing the process of prehistoric worldwide dispersal of *Homo sapiens,* and studies on the origins, evolution, and nature of behavioral modernity during the later Pleistocene are central and hotly debated issues in current anthropology. However, much of Asia remains a vast black box in these regards.

Anthropologists now almost unanimously accept that *H. sapiens,* or anatomically modern humans, evolved in Africa during the terminal Middle Pleistocene and later dispersed into Eurasia to largely replace or absorb indigenous archaic hominins (Kimura, chapter 3, this volume; Klein 2009; Stringer 2012). As reviewed by Mellars (chapter 1, this volume), the chronology of such migration events and the cultural and behavioral characteristics of early *H. sapiens* immigrants are relatively well documented for Europe, being highlighted by contrasts between Cro-Magnon and Neanderthal people and Upper versus Middle Paleolithic cultures, although the detailed process of modern human invasion into Europe is still a matter of debate (Svoboda, chapter 2, this volume). Chronologies of *H. sapiens* morphological and behavioral evolution in Africa are also becoming clear, although details are still debated (Bräuer 2008; McBrearty and Brooks 2000; Mellars et al. 2007). Scrutiny likewise continues regarding evidence from West Asia and Australia (Brantingham et al. 2004; Brumm and Moore 2005; Davidson 2013; Habgood and Franklin 2008), but all agree that the study of the origins of *H. sapiens* is a global issue.

In the eastern parts of Asia, however, efforts to understand the emergence of modern humans are far from complete, having developed only recently (Dennell and Porr 2014; Haidle and Pawlik, 2010; James and Petraglia 2005; Norton and Jin 2009; Rabett 2012; Trinkaus 2005). Researchers have not reached consensus on many fundamental issues in this vast terrain that was a stepping-stone to the Sahul, the Pacific islands, and the Americas. First, it is still unclear when the first dispersal of *H. sapiens* occurred and how they spread into these regions: Did the earliest *H. sapiens* appear in eastern Asia before or after 45,000–50,000 years ago? Was the entire eastern Asian continent colonized primarily by single or multiple waves of immigration? How did the region's varied environments—from the tropics of Indonesia to the steppes of Siberia—condition dispersal and the development of unique signals of modern behavior? Even the prevalent hypothesis that the earliest colonists of eastern Asia moved rapidly along the southern coastlines as "beachcombers" (Bulbeck 2007; Field and Lahr 2005; Oppenheimer 2009) still requires rigorous testing, because it is based on minimal field research and little empirical data (Boivin et al. 2013).

Furthermore, researchers have long been puzzled by apparently poor, scanty evidence for behavioral modernity in the Late Pleistocene archaeological records from, in particular, southern parts of Asia and Australia. For example, lithic artifacts from these regions typically lack standardized forms and are made by simple flaking technology, and material evidence for symbolic behavior (e.g., personal ornamentation) is rare or even absent in most areas. Many argue that this is partly because of the limited amount of research, but it is also possible that evidence for these signals just has not been announced to the international research community because of language barriers or local indifference to these global issues. It may be, too, that expressions of early modern humanity preserved in the archaeological records of eastern Asia are different from those in Africa and Europe, requiring us to think "outside the box" if we want to comprehensively understand modern human evolution.

The Tokyo symposium was a place to improve the above situation—present new evidence and explore new perspectives. Our focal area was eastern Asia, here defined as South Asia, Southeast Asia, East Asia, and Siberia. Australia, which holds an important key to interpreting Asian Paleolithic records, was also included. Local and Western researchers assembled to share information from each region, much of which was new and surprising for all.

Here, we discuss the significance of each paper contributed for this book. We then synthesize current evidence on: (1) the initial dispersal of *H. sapiens*, and (2) the emergence and diversity of modern human behaviors as expressed in the Paleolithic anthropological and archaeological records of eastern Asia. We focus on the issues raised in the Tokyo symposium; providing a comprehensive review of all the published information from eastern Asia is beyond our scope. Still, we hope this book will provide a useful summary of the current understanding of early *H. sapiens* in Paleolithic Asia.

Where possible, published radiocarbon dates were calibrated to calendar years based on the IncCal13, Marine13, or SHCal13 calibration curves (Hogg et al. 2013; Reimer et al. 2013), using the Calib Rev 7.0.2 software (Stuiver and Reimer 1993). All the ages are in calendar years except for a few uncalibrated radiocarbon dates, which are expressed as "^{14}C BP."

Appearance of Modern Humans and the Process of Colonization in Eastern Asia

When, where, and how modern humans appeared and colonized various regions of Asia are challenging but fundamental questions. Many papers in this book contributed to or discussed this issue through the framework provided by the "Recent African Origin" theory of modern humans.

Genetic Evidence

The potential of human DNA analyses at the genomic level is neatly and effectively summarized in Kimura (chapter 3, this volume), together with some points to understand it. Now there is a hope that this rapidly growing field will contribute significantly to resolving questions regarding population divergence time, migration route, demographic structure, and admixture between populations, questions that are still difficult to answer solely using skeletal morphology or lithic artifacts. Furthermore, genomic studies can investigate new questions such as the mode of selection (positive or neutral) and biological adaptation as well as demographic history. In cases in which ancient DNA can be extracted and sequenced from fossilized bones, the potential for such studies expands exponentially, as some studies have shown (Green et al. 2010; Raghavan et al. 2014; Reich et al. 2010). Still, genomic research is not without limitations. Sampling bias is an obvious problem, and even after reliable sequence data are obtained, these data are analyzed under a chosen set of assumptions (Kimura, chapter 3, this volume). For example, how estimating a correct genetic mutation rate continues to be a matter of debate (Green and Shapiro 2013). Because of these uncertainties, as Kimura emphasizes, genomic studies still do not provide unequivocal answers to the above questions about Asia. For example, researchers disagree on the number of migration events into Asia: While Rasmussen et al. (2011) interpreted separate migration events for Australo–Melanesian and other eastern Asian populations, a study by the HUGO Pan-Asian SNP Consortium (2009) suggested single migration and later splitting into the two groups. Studies based on mitochondrial DNA (mtDNA) phylogenies tend to suggest that the modern human exodus from Africa occurred at some time during 80–50 ka (Macaulay et al. 2005; Mellars et al. 2013; Oppenheimer 2012), but mtDNA acts as a single genetic locus and may overestimate population splits to an unknown degree (the problem of "incomplete lineage sorting"; see Kimura, chapter 3, this volume). In contrast, population divergence time between Africans and Eurasians is estimated as ~50 ka in one study of whole-genome sequence data (Gronau et al. 2011), although this approach is based on some unwarranted assumptions, such as an average generation time of 25 years.

Some of the limitations of the current genetic studies hopefully will be mitigated by future improvements in data and analytical methods, but one thing for certain is that we will always require multiple lines of independent evidence to construct solid scientific models. Archaeological and skeletal morphological evidence will continue to be essential to solving the problem; in effect, these approaches, backed up by various sophisticated radiometric dating techniques that are much more precise than the molecular clock, provide the empirical evidence needed to explain the initial migration history of *H. sapiens*. It is to these lines of research that we now turn.

Archaeological and Skeletal Evidence

Before summarizing the relevant chapters in this book, we first review published information about the First Appearance Datum (FAD) of *H. sapiens* in each region of eastern Asia. The Asian mainland had been long occupied by archaic hominin populations before the arrival of modern humans. Archaeological remains left by these hominins and early *H. sapiens* are often difficult to distinguish unambiguously (e.g., Moore et al. 2009; Petraglia et al. 2007), and this has been a major obstacle in tracing the earliest record of *H. sapiens* in the continental regions of South, Southeast, and East Asia. In this context, Sahul can provide an anchor or "reliable datum point" for identifying the spread of *H. sapiens*, as Hiscock (chapter 16, this volume) argues, because it was first colonized by our species, and any archaeological signatures can be regarded as the products of *H. sapiens*. The earliest, uncontested evidence for the oldest occupation in Sahul falls within a narrow time range of ca. 44,000–46,000 years ago, according to a critical review of published evidence from Australia and New Guinea (O'Connell and Allen 2004, 2012). Some other researchers believe that the oldest artifacts and a small pit found from northern Australia (Nauwalabila, Malakunanja II) and southwestern Australia (Lake Mungo) are slightly older than the above age range (Bowler et al. 2003; Hiscock 2008), but at present, claims supporting human occupation prior to 50 ka in Australia are very weak and partly depend on the expectation that the actual FAD must be significantly older than the sporadic, archaeologically recognizable signs (Hiscock 2008; Hiscock, chapter 16, this volume).

Some discoveries from mainland southern Asia are consistent with this conservative chronology. One is a modern human cranium excavated from well-stratified cave deposits at Tam Pà Ling, Laos. Although Demeter et al. (2012) reported that the specimen dates to 46–63 ka based on multiple geochronological techniques, the older estimates should be considered with caution. According to these authors, the most reliable "true" burial age for a sediment sample taken from the same vertical level as the fossil is an optically stimulated luminescence (OSL) date of ~46 ka. A direct uranium-series (U-series) date on the cranium itself (~63.6 ka) may not be reliable because of the open-system behavior of bone and its obvious inconsistency with the OSL sequence for the site's deposits. A radiocarbon age of 51,400 ^{14}C BP on a single charcoal sample recovered from slightly above the cranium may also be problematic, given its obvious proximity to the temporal limit of this technique. Another case involves the microliths of India, which survived until the Holocene and are generally considered to be products of *H. sapiens*. Mishra et al. (2013) have reported that a "microblade" assemblage from Mehtakheri, India, dates back to around 45 ka and possibly even 48 ka. This argument is based on OSL dates from one of their excavation sections and a single radiocarbon date on a mollusk shell that returned an infinite age (>46,500 cal BP). Another radiocarbon age from a different section also suggests that this assemblage is older than 34,000 cal BP. Although we still worry about the limited geoarchaeological study and radiocarbon dates at Mehtakheri, this early date is equivalent to the tentative OSL age (~45 ka) reported for the blades (and bladelets?) from Site 55 in Pakistan (Dennell et al. 1992).

In addition, a modern human basal cranium discovered in 1956 from Laibin, South China, has been reported to date to between 37.5 ka and 44.8 ka by U-series dating of flowstones assumed to have sandwiched the fossil-bearing layer (Shen et al. 2007); however, more detailed accounts need to be published to verify this.

Several sites in southern Asia (here defined as being south of the Qinling Mountains in central China) are claimed to have records of a considerably earlier presence of modern humans in this area. These include lithic assemblages from Jwalapuram, India (Petraglia et al. 2007), and Kota Tampan, Malaysia (Storey et al. 2012), as well as human remains from Punung, Java (Westaway et al. 2007), Zhirendong (Liu et al. 2010), Liujiang (Shen et al. 2002) and Huanglong caves, South China (Shen et al. 2013), and Callao Cave, Luzon (Mijares et al. 2010; Mijares, chapter 12, this volume). However, all of these leave room for doubt in terms of either stratigraphic derivation and dating (Liujiang, Zhirendong) or attribution to *H. sapiens* (Jwalapuram, Kota Tampan, Punung, Huanglong Cave, Callao) (Bacon et al. 2008; Dennell and Petraglia 2012; Kaifu and Fujita 2012; Mellars et al. 2013; Mijares et al. 2010; Mijares, chapter 12, this volume; Shen et al. 2007). Another possible case is Tabon Cave, Palawan, where three modern human fossilized bones excavated in 1962 and 2000 were directly dated to 14.5–18.5, 24–39, and even 37–58 ka (Détroit et al. 2004), but these dates are based on U-series methods applied to samples of bone, an open system for uranium (Grün 2006), and therefore should be considered unreliable, especially without corroborating evidence gained from another geochronological method.

In northeastern Asia (i.e., north of the Qinling Mountains), the reliable FAD for *H. sapiens* is 39,000 cal BP, a direct AMS radiocarbon age on a morphologically indisputable modern human partial skeleton excavated from Tianyuan Cave, northern China. Although future analyses of possible postdepositional contamination (Maroma et al. 2012) or more detailed documentation of the cave's stratigraphy may or may not slightly alter this figure, it is consistent with AMS ages for other faunal remains from the same layer (Shang et al. 2007).

Further north, in Siberia and Mongolia, the oldest clear fossil evidence for *H. sapiens* comes from Pokrovka and Mal'ta near Lake Baikal, ca. 32,000 and 24,000 cal BP, respectively (Akimova et al. 2010; Raghavan et al. 2014). Who left archaeological assemblages older than this date is a question currently difficult to answer in a strict sense. However, many of the late marine isotope stage (MIS) 3 sites found throughout southern Siberia yield ornaments, figurative arts, and structured hearths and dwellings and are associated with osseous tools and developed blade technology perhaps dating as early as 46,000 cal BP. These strongly signal the presence of modern humans much earlier than Pokrovka and Mal'ta, but whether these changes in material culture relate to the appearance of modern humans in Siberia remains to be seen, although we acknowledge the first reports of a human femur from Ust'-Ishim in northwestern Siberia directly dated to 45 ka and containing a modern human genome (Gibbons 2014).

Thus, the conservative FADs for modern humans in southern Asia and Sahul are 45 ka (or slightly earlier) and 39 ka in East Asia. However, most recent models of modern human dispersals in these regions adopt substantially older dates than these (see below). Siberian evidence is definitely older than 32 ka and may rival that of Australia. Although the Tokyo symposium could not resolve the difference of opinion among various participants, discussions obviously raised some important points to rethink about this issue, as described below.

South Asia

As reviewed by Athreya (chapter 6, this volume), the oldest, secure fossil evidence for *H. sapiens* in South Asia is from the Sri Lankan sites of Fahien-lena, where anatomically modern human skeletal remains, apparently associated with red ocher and cremation practice, were excavated from cultural layers dated to as old as 36,250–38,380 cal BP (2σ range). Similar findings also come from the nearby site of Batadomba-lena, the lowest layer of which is dated to ~34,500 cal BP. Archaeologists claim that clear signs of behavioral modernity sporadically appear around this time or slightly earlier. Radiocarbon chronologies, though based on a relatively small number of samples, indicate that microliths, personal ornaments, and other possible signs of symbolism appeared ca. 30,000–39,000 cal BP at multiple places, such as the two Sri Lankan sites mentioned above (Perera et al. 2011), and the Indian sites of Jwalapuram Locality 9 (Clarkson et al. 2009), and Pante and Chandrasal (Chauhan et al., chapter 7, this volume). Thus, there remains some chronological gap between the documented secure FADs of modern humans in Australia (~45 ka) and South Asia (37–39 ka). Promising candidates to fill this gap are a microlithic assemblage that is claimed to date back to 45 ka in India (Mishra et al. 2013) and a similarly dated blade industry from Pakistan (Dennell et al. 1992).

Despite this limited "hard" evidence, two major hypotheses regarding the modern human origins in South Asia both suppose earlier arrival of *H. sapiens*, either >74,000 or 50,000–60,000 years ago. The first hypothesis is represented by Korisettar (chapter 6, this volume), who insists that early modern humans in India developed microlithic technology from the local late Middle Paleolithic culture (Blinkhorn et al. 2013; Haslam et al. 2010; Petraglia et al. 2007). The second view is put forward by Mellars et al. (2013), who claim, based on a combination of genetic and archaeological evidence, that the first *H. sapiens* brought microliths from Africa 50–60 ka along the now-submerged coastal regions of the Indian subcontinent before they occupied inland South Asia. In addition to these, we must consider the third possibility that *H. sapiens* appeared 45–50 ka in South Asia, regardless of whether they possessed microliths from the beginning. This hypothesis is based on a conservative reading of the available hard evidence from South Asia, Southeast Asia, and Sahul. Association between early microliths and *H. sapiens* is documented in Sri Lanka, but many researchers are unconvinced about the makers of the South Asian Middle Paleolithic industries in the absence of fossil evidence (Athreya, chapter 5, this volume; Chauhan et al., chapter 7, this volume). Mellars and colleagues' assumption that *H. sapiens* first settled coastal India >50 ka is based partly on genetic evidence (Mellars et al. 2013, table S2-3), but the reported large error ranges for the coalescence ages of key mitochondrial DNA haplogroups do not preclude the above third hypothesis.

What we need at this stage of research is critical rethinking of the available evidence. Chauhan et al. (chapter 7, this volume) provide a useful summary of the current problems and limitations in South Asian Paleolithic archaeology and other related fields. The South Asian Middle and Upper Paleolithic are ill-defined, and a lithic technological transition between the two is in fact more complex than usually supposed, with substantial intersite variation within each category and possible chronological overlap between them (also see James and Petraglia 2005). According to Chauhan et al., the available data are still not enough to provide a conclusive picture about modern human origins in South Asia. More fieldwork coupled with further elaborate chronometric dating and laboratory analyses are needed to understand the real nature of the Paleolithic transition and to track early modern human dispersals in the region. Our cautionary tone should not be taken simply as a negative proposal. Eventual detailing and classification of the South Asian Middle and Upper Paleolithic records will provide the best source of information to explain the material culture brought by the earliest *H. sapiens* migrants, and its difference from earlier MIS 5 Levantine industries, as well as these humans' behavioral adaptation to local environments and interaction with indigenous archaic hominin populations.

Another perspective on South Asian modern human origins is offered by Athreya (chapter 5, this volume), who reviewed paleoanthropological evidence from the region, pointing out that the existing Pleistocene hominin fossil sample is still small, but that, interestingly, reports of the early *H. sapiens* skeletal remains from Afghanistan, India, and Sri Lanka frequently note some archaic morphology in these materials. Combined with some genetic studies, Athreya suggests that this morphological variation cannot be explained simply by the "southern dispersal hypothesis" of early *H. sapiens* from Africa via India to Australia, and instead suggests a much more complex population history, including admixture with local archaic hominins as well as reverse migrations of early *H. sapiens* populations from other Asian regions to the Indian subcontinent (cf. Dennell and Petraglia 2012; Mishra et al. 2013).

Southeast Asia

In this region, one of the most important developments has been refinement of the geochronology of the famous Niah Cave site in western Borneo, which was revised by a team led by Graeme Barker and is summarized in this book (Reynolds and Barker, chapter 10, this volume). According to these authors, the earliest evidence for human activity at Niah Cave is recognized by habitation features containing charcoal, ash, butchered animal bones, and a small number of artifacts, one of them dating back to ca. 47,000–50,000 cal BP, when the local climate was slightly cooler and drier than it is today. On the grounds of the presence of a modern human skeleton at the site (the "Deep Skull," now directly dated to ~37.5 ka by the direct U-series technique using LA-ICP-MS), the authors cautiously conclude that this earliest occupation was created by modern humans. They further argue that pollen and other records outside the cave suggest frequent forest fires since 52,000 cal BP, which may have resulted from deliberate burning by humans to maintain desirable open areas in the forest (Hunt et al. 2012).

What was the morphological affinity of the earliest *H. sapiens* in Southeast Asia? Although well-preserved human skeletal remains from MIS 3 contexts are few in number (Matsumura and Pookajorn 2005; Storm et al. 2013), terminal Pleistocene and early Holocene materials are relatively abundant and may serve as a useful window to infer details about the remote past. Matsumura et al. (chapter 8, this volume) take this approach, reporting a large-scale craniometric analysis particularly emphasizing male individuals from Hoabinhian sites. They calculated sample means of fourteen cranial measurements to represent each group. While some of the measurement data for each group were based on relatively large numbers of individuals, others were not. This bias is a potential source of significant error, making the study's results tentative, but still, compared to previous studies of this sort, Matsumura et al.'s analysis has a definite advantage in that it included quite a number of earlier prehistoric materials. The results were straightforward: the populations from eastern Asia and Sahul were classified into two major morphological groups, with pre-Neolithic Southeast Asians exhibiting closer affinities with present-day Australo–Melanesian people than with recent Southeast Asians and East Asians. This strongly suggests that the earliest modern human colonizers of Southeast Asia and Sahul were closely related.

East Asia

Although not widely acknowledged, as is the case for Sahul, the Japanese Archipelago can serve as another useful datum point in the discussion surrounding the timing of modern human arrivals in East Asia (Kaifu 2005). Archaeological sites older than 40 ka are very few in number, and they may not occur at all in Japan. This invites continuing debate concerning whether archaic hominins were once present on the archipelago. In sharp contrast to this, the number of indisputable Paleolithic sites increases dramatically after 38,000 cal BP on Honshu and Kyushu, two of the main islands that were connected to each other to form Paleo-Honshu Island during episodes of low sea level, as in the Late Glacial (Izuho and Kaifu, chapter 21, this volume). This unique chronological pattern of site density is known thanks to exceptionally intensive archaeological studies throughout the archipelago, which have so far recorded about 14,000 Paleolithic sites (Japanese Paleolithic Research Association 2010). Many of these sites are securely dated by well-developed tephrochronology and radiocarbon dates. Although no human fossil remains are known from earlier Japanese Upper Paleolithic sites except for Okinawa Island (Yamashita-cho Cave I), they are often associated with various signs of behavioral modernity—for instance, formal lithic tools such as trapezoids (Yamaoka 2012) or edge-ground stone axes (Tsutsumi 2012) and organized structures such as hunting pitfalls (Sato, chapter 27, this volume) or "circular aggregations" with dense concentrations of stone artifacts aligned in a circle reaching diameters of up to 80 m (typically 20–30 m) (Izuho and Kaifu, chapter 21, this volume). Evidence of long-distance transport of obsidian is also known, including interisland marine transport (Ikeya, chapter 25, this volume; Tsutsumi 2010). In our view, these features strongly signal the arrival of modern humans on Paleo-Honshu Island by 38,000 cal BP (Izuho and Kaifu, chapter 21, this volume). The Ryukyu Islands, southwestern Japan, provide additional evidence—human fossils and archaeological sites indicating that *H. sapiens* were widespread there 30,000–36,000 cal BP (Kaifu et al., chapter 24, this volume).

Of course, the time of the colonization of Japan may not be equal to that for other regions in East Asia, because the archipelago is located at the eastern edge of the region, and migrating *H. sapiens* populations needed to cross a natural barrier, the ocean, to reach there (see below). Still, the observations in Japan serve as a yardstick for reconstructing the initial migration history of *H. sapiens*. In this sense, the role of Japan is similar to that of Sahul, which helps define the timing of modern human dispersal to South and Southeast Asia.

Yi (chapter 19, this volume) offers an interesting observation in this respect. Because of the paucity of well-dated human fossil remains from the Korean Peninsula, we must rely on archaeological evidence to reconstruct modern human dispersal there (Bae and Bae 2012; Park 2006). According to Yi, an archaic-looking lithic industry including "Acheulian-like" hand axes survived until recently in the Korean Peninsula, before it was replaced rather suddenly by blade-based assemblages with Upper Paleolithic affinities around 35,000 years ago or a little earlier. He cautiously suggests that this transition signals the arrival of *H. sapiens* in this region of East Asia. Yi also highlights the possibility that premodern populations may have competed with dispersing *H. sapiens* during that transition. There appears to be general agreement that, albeit based on limited data, blades (and possibly peculiar tanged points) often produced from high-quality raw materials emerged around 35,000–40,000 years ago, marking the commencement of the Korean Upper Paleolithic (Bae 2010; Bae and Bae 2012; Lee, chapter 20, this volume; Yi, chapter 19, this volume). This chronological framework is consistent with the Japanese "datum point" of 38,000 years ago and points to a relatively smooth dispersal of *H. sapiens* from the mainland to Paleo-Honshu Island without a substantial time lag. However, the exact definition of the Korean Upper Paleolithic and its dating are still open questions (Bae 2010; Yi, chapter 19, this volume), and more data are needed to determine the timing, tempo and mode of its appearance.

Further west, in inland China, four late Pleistocene sites in Henan Province reported by Wang (chapter 18, this volume) provide additional archaeological hints about the FADs of *H. sapiens* in East Asia. Large-blade technology appearing sometime between 41,000–34,000 cal BP or slightly earlier at Shuidonggou, northern China, is classified as initial Upper Paleolithic or often taken as a signature of behavioral modernity (Brantingham et al. 2001; Gao and Norton 2002; Li et al. 2013; Nian et al., in press), but the situation in central China (and other regions) is different and less straightforward. Although detailed numerical analyses are still awaited, Wang's team found a stratigraphically ordered record of two different lithic industries at one of these sites, Zhijidong cave. The older assemblage is characterized by a higher frequency of core tools such as choppers, whereas the younger assemblage includes numerous retouched flakes of simple but diverse morphotypes. An increased frequency of nonlocal high-quality raw materials also characterizes the younger assemblage. Wang et al. hypothesize that the earlier core-tool industry and later flake-tool industry were products of archaic hominins and modern humans, respectively. Preliminary OSL and AMS radiocarbon dating suggests that this transition occurred 40–50 ka, although these remain very tentative at present. Similar or other evidence of "modern-looking" behaviors are also reported from two other open-air sites, Laonainaimiao and Zhaozhuang, preliminarily dated by single AMS ages to ca. 44,000 cal BP and ca. 37,000 cal BP, respectively. They include simple flake tools of various morphotypes, bone fragments modified by humans, a number of hearths, stone-knapping areas, and a possible stone structure associated with an elephant skull. Although more data are needed to confirm the above taxonomic hypotheses and chronology, Wang's suggestion does not contradict the above evidence for FADs of *H. sapiens* in Japan and Korea. In addition, blades and blade cores appeared around 26,000 cal BP at another open-air site in the same region, Xishi. This is about 12,000 years later than the famous blade-based industry from Shuidonggou, Ningxia Hui Autonomous Region (Gao et al. 2013; Li et al. 2013). It should be noted, however, that the above scheme is based on a single spot in the vast Chinese subcontinent. Other researchers emphasize that the technological transition in Late Pleistocene China was regionally variable, complex, and not abrupt (Gao and Norton 2002).

Lastly for East Asia, Lien (chapter 17, this volume) describes (for the first time in English) a lithic assemblage from Pa-hsien-tung (or Baxiandong), the oldest and one of the very few Paleolithic sites in Taiwan. The materials she reports are from one of a complex of caves that probably date to around the Last Glacial Maximum (LGM), but a similar lithic industry is documented here from ~29,000 cal BP to the mid-Holocene. Although no associated Pleistocene hominin fossil evidence was found, this apparent continuity in lithic technology and terminal Pleistocene ages strongly suggest that the assemblage was left by *H. sapiens*, as Lien argues. However, the Pa-hsien-tung site appears to lack deposits older than ~30 ka, and thus is not suitable to determine when modern humans first appeared in Taiwan. Another related question is when a land bridge emerged to facilitate people's migration to Taiwan, or whether they used watercraft to reach Taiwan before the land bridge became established. We need additional new evidence to answer these intriguing questions.

Later Migrations in East Asia

Morisaki (chapter 26, this volume) studied the appearance and disappearance of a particular form of stone tool called "hakuhen-sentoki," or simply the HS point, found in Kyushu, southwestern Japan. The occurrence of this uniquely shaped stemmed point is largely restricted to Kyushu and the Korean Peninsula (Matsufuji 1987), and Morisaki concluded that this tool was brought from Korea to Kyushu immediately after the catastrophic supereruption of the Aira volcano in southern Kyushu at 30,000 cal BP. From then it became a major component of the local tool kit but mysteriously disappeared after 26,000 cal BP. Interestingly, local lithic variability and production methods in Kyushu were not significantly affected by this introduction of HS points, and there is little evidence to suggest a large-scale population replacement. Rather, as Morisaki suggests, the new tool form was likely introduced by a small group of people, and the locals incorporated it into their own tool-production technology. Because Kyushu was separated from the Korean Peninsula by a narrow strait even during the LGM, people had to have used watercraft to move between the two regions (see below).

Lee (chapter 20, this volume) describes additional materials that indicate frequent cultural interactions, if not migrations, across this strait separating Korea and Japan, the width of which varied between <10 km and 70 km, supposing a sea-level lowering of 100–130 m between 30,000 and 15,000 cal BP. He discusses a few more lithic tool forms ("kakusuijo-sekki" and "knife") excavated from South Korea, which previously had been known only from Japan. Furthermore, an obsidian source analysis offered new evidence of obsidian transport from Kyushu, Japan, to South Korea (Lee, chapter 20, this volume). More detailed comparative and chronometric studies should be published to determine whether these represent cultural transmissions across the strait or merely cultural convergence, but the growing evidence strongly points to the former.

A genetic study based on prehistoric human remains by Adachi et al. (chapter 28, this volume) provides a fresh perspective on migration history in Northeast Asia. As an extension of their previous studies (Adachi et al. 2009, 2011), these authors analyzed a large sample (n = 56) of mtDNA derived from mid-Holocene (Jomon/Epi-Jomon eras) inhabitants of Hokkaido, the northernmost island of Japan. Although possible errors in haplogroup frequencies are not statistically controlled, their main conclusions seem robust. Most of the mtDNA haplogroups and subhaplogroups found among the Hokkaido Jomon sample are absent or very rare in modern East and Southeast Asian populations except the Japanese, but they are relatively common in modern native Siberians. Given the estimated divergence dates for these haplogroups at around the LGM or slightly later, Adachi and his colleagues conclude that the ancestors of the Hokkaido Jomon migrated from Siberia via a land bridge at the onset of the LGM as climate deteriorated. Importantly, such a migration has long been postulated by Paleolithic archaeologists, who noted the appearance of microblade industries similar to Siberian industries dated to ca. 25,000 cal BP in Hokkaido (Kato 1970; Kimura 1997; Nakazawa et al. 2005). This scenario is also consistent with the model by Graf (chapter 24, this volume) showing that, at the peak of the LGM, harsh climate in southern Siberia could have led to Upper Paleolithic people moving south. Adachi and colleagues' study leads to a number of other interesting questions: Were Jomon populations in other areas of the Japanese archipelago also descendants of Upper Paleolithic Siberians, or did they have a different genealogical past? What happened to the people who lived in Hokkaido before the onset of the LGM, before the presumed migration from the Siberian mainland?

Siberia and Mongolia

The appearance of anatomically modern humans in Siberia and bordering inner Asia has long been considered to relate to the Middle-to-Upper Paleolithic transition. A dearth of modern human remains, though, has always made this correlation tenuous, despite the strong similarities between the transition in Siberia and the transition in southwestern Asia and Europe, where a correlation with modern *H. sapiens* is more obvious. Goebel (chapter 30, this volume) recounts the spread-and-replacement model as it applies to Siberia, what he refers to as the "overland" dispersal across inner Asia from the west. The transition, he argues, occurred ca. 46,000 cal BP, based primarily on finite radiocarbon dates from Kara-Bom in the Altai Mountains and infinite radiocarbon dates from Makarovo-4 and Varvarina Gora near Lake Baikal, and was characterized by wholesale changes in lithic technology and tool forms, as well as the appearance of osseous tools, jewelry, and possibly art throughout the region. Rybin (chapter 32, this volume) provides the most exhaustive review of these new Upper Paleolithic characteristics yet presented in English, but stresses the occurrence of intermediate, "transitional" industries, and chronologically overlapping Middle Paleolithic and Early Upper Paleolithic occupations suggest that the transition may have been more complex than Goebel predicts, and perhaps even the result of local changes and regional evolution of modern *H. sapiens*.

Buvit et al. (chapter 33, this volume) provide a focused look at a single region of southern Siberia, the Trans-Baikal, a mountainous region to the east of the Lake Baikal in Russia. The Trans-Baikal has some of the richest early Upper Paleolithic sites known for Siberia, because of a long tradition of excavation-based research there (e.g., Konstantinov 1994; Okladnikov and Kirillov 1980). Buvit et al. identify "archaeological elements of modern behavior" applicable to their study area. This "kitchen list" was derived from widely cited lists of Paleolithic modern human behavior (see Mellars, chapter 1, this volume) and includes, for example, blade technology, osseous tools, stone-slab-lined dwellings, and beads. By focusing on published radiocarbon ages but also adding some new AMS dates, Buvit and his colleagues conclude that the cultural horizons that contain these modern traits date to as early as ~44.5 ka, although we should pay attention to the large error ranges associated with these oldest ages. Buvit et al. caution, however, that the lack of hominin fossil evidence precludes any firm conclusions about their makers—whether they represent modern or archaic hominins.

Paleolithic chronology in Mongolia is reviewed by Jaubert (chapter 31, this volume) with cautious notes about geoarchaeological issues. Researchers agree that Middle Paleolithic with Levallois components exists in this area. A few such assemblages are recovered from stratigraphic contexts, and one case, Level 10 (Horizon 5) at Orkhon-7, is reported as ~60–45 ka. These Middle Paleolithic assemblages are probably the products of archaic hominins such as Neanderthal or "Denisovan." How the transition from the Middle to Upper Paleolithic occurred is uncertain; however, it is documented by lithic technological changes similar to those in Siberia. The earliest blade-based Upper Paleolithic technocomplex is documented at the lowest cultural horizons of Tolbor-4 in northern Mongolia, radiocarbon dated to ca. 41,000 cal BP (Horizon 6) or as old as ~45,000 cal BP (Horizon 5) (Gladyshev et al. 2010). Some researchers suggest that this Mongolian form of blade technology was transmitted originally from the Altai region of Siberia and further dispersed into northern China (Brantingham et al. 2001; Gladyshev et al. 2012; Li et al. 2013; Zwyns et al. 2012).

Finally, Graf (chapter 34, this volume) attempts to reconstruct population dynamics and people's behavioral responses in southern Siberia during the period succeeding the early Upper Paleolithic—the cold, arid environment of the LGM. The Yana RHS site tells us that Upper Paleolithic people reached the Arctic by ca. 33,000 cal BP (Pitulko et al. 2013), but currently this still stands as the sole known site from the far north of Asia before the LGM. In fact, at present, very few Upper Paleolithic sites are known in the areas north of 58°N latitude before the LGM; such older sites, regardless of their age, are seemingly concentrated in southern Siberia. The presence of Upper Paleolithic people in the Arctic and Subarctic by 30 ka is yet another testament to the rapid adaptation of modern humans to new challenges presented by Asia's diverse environments. Nonetheless, according to Graf's compilation of reliable chronometric data, even *H. sapiens* populations seem to have passed through a bottleneck at the peak of the LGM between 23,000 cal BP and 22,000 cal BP (but see Kuzmin 2008). This suggests, as Graf argues, that the colonization of the northern Asian frontier, as well as Beringia and the Americas, was accomplished not smoothly and gradually, but through a complex episodic process of starts and stops, retreats, and recommencements (also see Goebel 1999, 2004).

Models of Modern Human Origins in Eastern Asia

Chronicling the timing, routes, and number of dispersal waves are among the key issues in the ongoing debate about modern human origins in Eurasia. Other important issues, such as local adaptation, cultural diversification, and interaction with archaic hominin populations can be discussed effectively when we have solid knowledge about the above basics of the early *H. sapiens* dispersal.

Timing of Dispersal

As for the timing of *H. sapiens* dispersal, broadly three major hypotheses exist in the current debate: (1) *H. sapiens* first dispersed into eastern Asia via South Asia with a Middle Paleolithic industry during MIS 5, before the Toba volcanic supereruption at 74 ka (Blinkhorn et al. 2013; Boivin et al. 2013; Haslam et al. 2010; Korisettar, chapter 6, this volume; Petraglia et al. 2007); (2) *H. sapiens* first entered eastern Asia during or around MIS 4, along the southern coastlines (Bulbeck 2007; Field and Lahr 2005; Macaulay et al. 2005; Mellars, chapter 1, this volume; Mellars et al. 2013; Oppenheimer 2012; Stringer 2000); (3) *H. sapiens* spread to eastern Asia after 50,000 years ago as a result of an explosive, continent-wide dispersal (Klein 1999, 2009). Currently, the second model is dominating and competing actively with the first model, whereas the third model receives much less support. The MIS 5 dispersal model is put forward by archaeologists who insist that late Middle Paleolithic industries of South Asia were produced by *H. sapiens,* on the basis of their apparent commonalities with African Middle Stone Age industries. However, other researchers are skeptical about the power of such lithic analyses, and this model does not fit with genetic evidence that modern humans dispersed out of Africa during or after MIS 4. The supporters of the MIS 5 dispersal hypothesis argue that the sporadic and gradual appearance of modern human behavior (e.g., microlith, adornments, and bone tools) in South Asian archaeological records is not unusual as a product of *H. sapiens,* because a similar pattern is seen in the African Middle Stone Age, which is most likely associated with *H. sapiens* (Boivin et al. 2013). The manifestation of modern traits in South Asia, however, is substantially later, with no clear evidence available prior to ~45 ka. Many versions of the second, MIS 4/early MIS 3 dispersal models emphasizes genetic studies that suggest that modern human expansion out of Africa occurred ~80–60 ka (Field and Lahr 2005; Macaulay et al. 2005; Oppenheimer 2012; Stringer 2000), although a more recent version of this model combines archaeological evidence (similarities to the African "Howiesons Poort" complex) to suggest 60–50 ka (Mellars, chapter 1, this volume; Mellars et al. 2013). The third, late MIS 3 explosive dispersal model has gained little support in recent years, probably because of the strong influence of genetic studies.

Routes of Dispersal

Once out of Africa, there were two major possible routes of dispersal humans could have followed deep into eastern Asia: north or south of the Himalayas, which we here call the "northern route" and the "southern route," respectively. The northern route is the path to southern Siberia and is represented by two major hypotheses: via central Asia (Bar-Yosef and Belfer-Cohen 2013; Goebel 2007; Oppenheimer 2012) or eastern Europe (Klein 2009, figure 7.6).While geographically possible, the validity of this route has not been considered rigorously beyond defining some cultural similarities between archaeological assemblages from southern Siberia and the Levant or eastern Europe. There is little doubt that the southern route was taken to reach Australia because it is a direct path, climates are warmer and more similar to the African homeland, and genetic variation is significantly higher in modern South Asians than among other Eurasians (Kivisild 2007). This southern route could have been coastal, inland, or a mixture of both, but currently many researchers suppose that, in the framework of the MIS 4 or early MIS 3 dispersal model, the earliest *H. sapiens* migrants primarily followed along the Indian Ocean rim, rather than through inland routes, to move eastward rapidly (Bulbeck 2007; Field and Lahr 2005; Macaulay et al. 2005; Mellars, chapter 1, this volume; Mellars et al. 2013; Oppenheimer 2012; Stringer 2000). Proponents of the coastal route highlight the advantages of coastal environments—for example, rich food resources, ecological stability that could enhance rapid migration, and refuge from the arid inland environments of MIS 4—although some disagree with such theoretical expectations (Boivin et al. 2013). A weakness of this model is the absence of direct archaeological evidence, but this is thought to be due to the earliest coastal sites having been submerged by the terminal Pleistocene marine transgression. As an extension of this model, some even speculate or imply that this early coastal migration continued to the West Pacific rim and northward to China, the Japanese archipelago, and even the Russian Far East (Bulbeck 2007; Oppenheimer 2009; Pope and Terrell 2008).

Number of Dispersal Waves

There is controversy in the skeletal-anthropological and archaeological literature regarding whether the major dispersal out of Africa took place only once, twice, or even multiple times (Bellwood, chapter 4, this volume; Gunz et al. 2009; Klein 2009; Lahr and Foley 1994; Mishra et al. 2013; Svoboda, chapter, this volume). Genetic studies also internally disagree about this issue: studies of mtDNA strongly support a single out-of-Africa event (Macaulay et al. 2005; Oppenheimer 2012), whereas autosomal genomic analyses have produced conflicting results (HUGO Pan-Asian SNP Consortium 2009; Rasmussen et al. 2011; Reich et al. 2011). This debate is also directly relevant to the questions of when and from where *H. sapiens* left Africa—before or after 50 ka and across the Sinai Peninsula or Bal-el-Mandeb or both. The "classic" hypothesis supposes a single dispersal via Sinai around 50 ka, coinciding with the time that Neanderthals disappeared in the Levant (Klein 2009), but one mtDNA model of single dispersal supposes an earlier exit from Bal-el-Mandeb (Oppenheimer 2012). Many of the multiple-dispersal models suppose that an early offshoot via Bal-el-Mandeb led to the founding of a major lineage of modern Australo–Melanesian populations and that a later large-scale migration formed the majority of Asians and Europeans (Lahr and Foley 1994; Rasmussen et al. 2011).

Development of a New Model

All of the above dispersal models still remain controversial (see also Chauhan et al., chapter 7, this volume; Kimura, chapter 3, this volume). In our view, these debates must be finally settled by empirical paleoanthropological and archaeological (and ancient DNA) evidence that can offer a more rigorous chronology for the presence/absence of modern humans in each region than genetic studies based on people of today. Moreover, we need to move beyond our traditional regionally biased and often confusing archaeological interpretations that have seriously restricted past attempts to model a continent-wide event. Figure 35.1 is our compilation of up-to-date, reliable (or useful) FADs of *H. sapiens* based on the above review of available data. These include diagnostic fossil evidence or widely accepted or plausible signs of modern behavior including evidence for (purposeful) voyages to previously uninhabited areas, or a combination of these. The following patterns emerge from the map:

- There is no compelling paleoanthropological/archaeological evidence of *H. sapiens* prior to 50 ka anywhere in eastern Asia.
- *H. sapiens* was widespread across most of Eurasia and Sahul by 30 ka.
- *H. sapiens* was widespread in South Asia, Southeast Asia, and Sahul around 45 ka.
- FADs of *H. sapiens* in East Asia are comparatively late, 40–38 ka.
- Southern Siberia shows substantially older records of modern behavior than East Asia,[1] perhaps as early as 46 ka.

A direct reading of the above patterns leads to the following dispersal model, which largely follows but further expands the hypothesis presented by Klein (1999, 2009): *H. sapiens* entered eastern Asia ca. 50 ka or slightly later by primarily, if not exclusively, inland routes. A group of them took the southern route (south of the Himalayas) to quickly (in an archaeological scale) reach Southeast Asia, before some of them crossed the seas of Wallacea by boats to colonize Sahul ~45 ka or slightly earlier. These early *H. sapiens* migrants were most likely not beachcombers but mainly exploited terrestrial habitats as recorded in the older archaeological sites such as Niah Cave (Reynolds and Barker, chapter 10, this volume). There is evidence of advanced marine fishing or intensive shellfish exploitation (O'Connor, chapter 15, this volume; Ono et al., chapter 14, this volume), but these are restricted to oceanic island settings and are not older than inland sites on the Asian continent. In fact, these early modern human migrants show extraordinary behavioral flexibility and rapidly dispersed into diverse landscapes including arid or forested areas of southern Asia and Australia (Hiscock, chapter 16, this volume; Reynolds and Barker, chapter 10, this volume; Veth 2010). Almost at the same time, other groups of early modern humans[2] took the northern route to reach southern Siberia as early as 46 ka. If they passed central Asia or dispersed from eastern Europe is an open

Figure 35.1 Reliable or useful FADs of *H. sapiens* in eastern Asia in calendar years (thousand years ago). Supposed late MIS 3 coastlines are indicated, assuming sea levels 90 m lower than today. 1, Site 55 (Dennell et al. 1992). 2, Mehtakheri (Mishra et al. 2013). 3, Fahien-lena, Batadomba-lena (Kennedy and Elgart 1998; Perera et al. 2011). 4, Tam Pà Ling (Demeter et al. 2012). 5, Niah (Reynolds and Barker, chapter 10, this volume). 6, Jerimalai (O'Connor, chapter 15, this volume). 7, Leang Sarru (Ono et al., chapter 14,this volume). 8, Nauwalabila, Maraknanjya II (Hiscock 2008), Nawarla Gabarnmang (David et al. 2011). 9, Carpenter's Gap, Riwi (Balme 2000; Fifield et al. 2001). 10, Upper Swan, Devil's Lair (Pearce and Barbetti 1981; Turney et al. 2001). 11, Menindee, Lake Mungo (Bowler et al. 2003; Cupper and Duncan 2006). 12, Ivane Valley (Summerhayes et al. 2010). 13, Buang Merabak (Leavesley and Chappell 2004). 14, Kilu (Wickler and Spriggs 1988). 15, Callao (Mijares, chapter 12, this volume). 16, sites of Okinawa (Kaifu et al., chapter 24, this volume). 17, Zhijidong (Wang, chapter 18, this volume). 18, Tianyuandong (Shang et al. 2007). 19, Shuidouggou (Li et al. 2013). 20, sites of South Korea (Bae 2010; Lee, chapter 20, this volume). 21, sites of Kyushu (Izuho and Kaifu, this volume). 22, sites of central Japan (Izuho and Kaifu, this volume). 23, sites of Hokkaido (Izuho and Kaifu, chapter 21, this volume). 24, Tolbor-4 (Gladyshev et al. 2010). 25, Kara-Bom (Goebel, chapter 30, this volume). 26, Kamenka A, Podzvonkaya (Buvit et al., chapter 33, this volume). 27, Yana-RHS (Pitulko et al. 2013). FADs in western Asia and Europe are based on (Mellars 2011, Pavlov, et al. 2001); and Svoboda (chapter 2, this volume). The base-map was created using the GeoMapApp software (http://www.geomapapp.org) and Global Multi-Resolution Topography synthesis (Ryan et al. 2009).

question (Zwyns 2012), but their use of the northern route (north of the Himalayas) is apparent because the FADs of *H. sapiens* in East Asia are substantially younger than the Siberian evidence. It is possible that some of the earlier, simple core-and-flake-tool industries from China were produced by early modern humans who inhabited the region before the introduction of blade technology. Still, the earlier appearance of various forms of modern traits in southern Siberia than in East Asia, as well as the generally accepted Siberian origin of northern Chinese blade technology (Brantingham et al. 2001; Derevianko 2011; Li et al. 2013; Zwyns 2012), are difficult to accommodate without supposing a northern route of modern human dispersal. The early modern human groups following the northern and southern routes eventually met and interacted with each other, probably in East Asia, as some previous researchers have discussed (Bae 2010; Kato 1996; Oda 2003). Archaeologically, the spread of blade technology in East Asia ~38 ka likely reflects migration and/or cultural diffusion from southern Siberia.[3] On the other hand, northward expansion from Southeast Asia is suggested, for example, by autosomal genomic studies that show close genetic affinities between modern Southeast Asians and East Asians (HUGO Pan-Asian SNP Consortium 2009) and between modern Siberians and East Asians (Raghavan et al. 2014). Recovery of the genome of a 24-ka Paleolithic individual from Mal'ta showing a western Eurasian genetic signature (Raghavan et al. 2014) may be explained within this framework, but for now only provisionally because it postdates the appearance of the Upper Paleolithic in the region by at least 10,000 years.

From the perspectives of the long chronology models for Asian *H. sapiens*, figure 35.1 can be interpreted in different ways. For the MIS 5 dispersal model, our archaeological selection criteria of FADs may be too strict because it focuses only on widely accepted modern traits developed for the European Paleolithic record (see Mellars, chapter 1, this volume, for a discussion about the real nature of such a modern trait list). Because such traits are not always visible in African Middle Stone Age industries that are presumably associated with early *H. sapiens,* application of these modern traits to the Asian archaeological records should be done only with caution. Although this is reasonable, in figure 35.1 there is an interesting pattern, indicating that an indisputable signature for modern behavior suddenly becomes apparent and widespread after 45–40 ka in southern Asia and Australia (e.g., microliths, bone tools, beads, hunting of animals that are difficult to catch [e.g., monkeys], advanced fishing, ritualistic burials, marine transport, and habitation in diverse landscapes), as reviewed above (also see below). For us, this spatiotemporal pattern is a strong signature of modern humans.

For the MIS 4/early MIS 3 dispersal model, supposing early coastal migration, modern human sites prior to 50–45 ka are absent because they were distributed along ancient, now-submerged seacoasts. However, if this was the case, early *H. sapiens* populations were restricted to coastal areas for quite a long time, ~25,000–5000 years, depending on the age of the African exodus, before they moved into or other modern human groups occupied inland areas of southern Asia. Why they needed a long period before adapting to inland environments is a question that needs to be addressed by this model's proponents. Contrary to this, the earliest known sites in eastern Asia clearly show adaptation to terrestrial habitats (Hiscock, chapter 16, this volume; Izuho and Kaifu, chapter 21, this volume; Reynolds and Barker, chapter 10, this volume). For example, despite its island environments, many of the earliest Upper Paleolithic sites of Japan are located in inland areas and are associated with artifacts or features that clearly indicate a focus on terrestrial food resources (e.g., uniquely developed stone points [Yamaoka 2012], hunting pitfalls [Sato, chapter 27, this volume]). A long time lag between coastal and interior colonization by the earliest Asian *H. sapiens* is difficult to explain from these observations. Such a time lag becomes less significant if the initial coastal migration occurred more recently, around 50 ka, but the paradox here is that such a combination of rapid coastal migration and quick inland dispersal may never be demonstrated archaeologically.

In a more global perspective, Figure 35.1 shows that *H. sapiens* reached almost every corner of Eurasia nearly simultaneously. They appeared in western Europe, northern Russian Plain, South Asia, Southeast Asia, Australia, East Asia, and southern Siberia ca. 45–40 ka. The Asian Arctic is an exception, but even this extremely cold habitat was colonized by 33 ka.

Thus, the expanded, reliable archaeological/paleoanthropological data set presented here supports a single out-of-Africa[4] event around 50 ka or slightly later, with a succeeding explosive pattern of rapid dispersals of *H. sapiens* into large areas of Eurasia (Klein 1999, 2009). By stating so, we challenge the prevailing longer timescales proposed mainly from genetic studies and urge more archaeological fieldwork to further increase empirical evidence on our origins in Asia.

Paleoenvironment: Vegetation, Fauna, and Mass Extinction

One chapter in this book provides us with fresh data on Pleistocene environments. In Japan, flora during the LGM has been intensively studied, but until now there were no vegetation maps for pre-LGM periods. Based on pollen data reported from 47 localities in Taiwan, the Japanese Archipelago, Sakhalin, and the Amur Basin, ~60–30 ka, Takahara and Hayashi (chapter 22, this volume) present an MIS 3 paleovegetation map of these regions. Although such maps can be simulated through climate modeling, maps based on direct material evidence are always essential. MIS 3 is the crucial period for the appearance and early development of modern human communities in East Asia, but previous discussion about the potential influence of climate on people's behavior had to rely largely on vegetation maps of the LGM (e.g., Sato, chapter 27, this volume, see below). The new MIS 3 map provided by Takahara and Hayashi is a more suitable reference to improve the precision of such behavioral models. It should be noted, however, that this map reflects average tendency of the entire MIS 3 and does not reflect minor changes due to climatic oscillations 60–25 ka. We also have to point out that more such updated maps are needed for each region of Asia for a better reconstruction of MIS 3 human histories.

A number of large-bodied mammals disappeared during the terminal Pleistocene in Eurasia, Australia, and the Americas. Researchers continue to debate possible causes of this mass extinction, focusing mainly on relative roles of climate change and anthropogenic pressure (hunting, competition, etc.), but so far such studies in Asia have been largely confined to northern Siberia. Generally poor fossil preservation is obviously one reason for this regional bias, but the lack of reliable chronological data is another obstacle for meaningful discussion in South, Southeast, and East Asia. Iwase and colleagues (chapter 23, this volume) are trying to improve this situation by collecting and screening radiocarbon dates to construct a reliable extinction chronology for the Japanese terminal Pleistocene megafauna. The results show that woolly mammoth (*Mammuth primigenius*) and Naumann's elephant (*Paleoloxodon naumanni*) coexisted with humans on the Japanese Archipelago for at least 7000–12,000 years, indicating that these animals did not go extinct quickly by human "overkill." They also compared reconstructed vegetation and habitat for the two Proboscidean species and found an apparent correlation in range expansion/contraction between the two. Although the available fossil sample was too small to allow more detailed demographic studies, the above observations led the authors to emphasize the role of climate-induced vegetation changes rather than anthropogenic factors as the primary cause that drove these animals to extinction 30–20 ka.

Modern Human Behavior

There is extensive debate over how we define behavioral modernity and in what way it should be documented from archaeological records, as reviewed by Mellars (chapter 1, this volume). In particular, some researchers criticize the validity of investigating this issue based on a long list of individual, hypothetical modern traits such as systematic blade production, hafting and composite tools, formal osseous tools, personal ornaments, ritualistic burials, etc. Here, we do not discuss this debate in detail, but we agree with Mellars that the "trait list" approach is methodologically appropriate. These are hypothetical but archaeologically or paleoanthropologically demonstrable features whose validity is to be tested individually by additional data and are to be used to construct more general models regarding the actual nature of humanity. The approach taken by McBrearty and Brooks (2000) is a good example: these authors proposed four key characters of modern human behaviors (abstract thinking, planning depth, ingenuity, and symbolism) and then listed twenty-six traits of "archaeological signatures of modern human behavior" that variably reflect the four key characters (their table 3, p. 492). To describe individual aspects of possible modern human behavior in eastern Asian Paleolithic records, below we review the chapters of this book focusing on several such traits.

We find great regional variation in material culture and other behavioral expression detected from early *H. sapiens* sites in our focal region, eastern Asia and Sahul. This is not surprising, given the varying climatic, ecological, and geographical conditions in this vast area. The implications of this variability, however, are not so straightforward. For example, while symbolic items such as personal ornaments and figurative artworks are fairly abundant in Siberian early Upper Paleolithic sites (Buvit et al., chapter 33, this volume; Rybin, chapter 33, this volume), such materials are generally rare, or absent, in southern Asia and Sahul until the early Holocene. Lithic technology also differs considerably; northern industries are characterized by specialized blade production, formal tool types, and intensive use of elaborate manufacturing techniques such as pressure flaking, whereas southern lithic industries remained relatively "simple" so that they are often difficult to distinguish from lithic assemblages left by earlier, archaic hominins (e.g., Bellwood, chapter 4, this volume; Mijares, chapter 12, this volume; Ono et al., chapter 14, this volume; Pawlik, chapter 13, this volume), although there are a few uniquely shaped elements such as waisted or edge-ground axes in Sahul (Geneste et al. 2012; Summerhayes et al. 2010; also see O'Connor et al. 2014 for a unique bone tool recovered from Timor). In short, signals of behavioral modernity are more apparent in northern Asia but less so and difficult to detect in southern areas.

Although the need for repeated sea crossing alone is compelling evidence for the creativity of the early *H. sapiens* who reached Sahul (Davidson and Noble 1992), and some reviews emphasize that a few aspects of behavioral modernity do exist in early archaeological records from Australia and New Guinea (Brumm and Moore 2005; Habgood and Franklin 2008), the above north–south dichotomy still remains and the evidence becomes increasingly ambiguous on mainland Southeast Asia. One plausible explanation for this observation, which is argued by Hiscock in chapter 16 of this book and probably agreed upon by many researchers, is that such regional variability is a reflection of the capacity for the behavioral flexibility of early *H. sapiens* and a result of diverse behavioral responses to varying environmental, social, and economic conditions encountered as modern humans colonized the different parts of the world.

Before we try to resolve the conundrum, however, we should ask ourselves the following questions: Do we already know enough about the Late Pleistocene archaeology of the region? Is past field research sufficient to understand the essence of each regional characteristic? Are there any misinterpretations or oversights in the known archaeological evidence? Is there important regional information that already exists but has not yet been shared with the international community? These were among the major interests at the Tokyo symposium, and there were, as expected, many interesting reports and lively discussion about these issues. In this book, some contributors have attempted to elaborate theoretical frameworks to detect behavioral modernity (e.g., Mellars, Hiscock), and others report evidence that has not been widely shared among researchers. In the following sections, we summarize the latter findings.

Behind the "Poor" Evidence

Researchers have been long puzzled by the apparently poor visibility of modern human behavior in the Late Pleistocene archaeological records of Southeast Asia. Does this simply reflect the absence of such evidence, or does it require different perspectives to elucidate the hidden facts? Simanjuntak et al. (chapter 11, this volume) review archaeological evidence from Indonesia and surrounding regions and propose the following list as potential, regional signals of behavioral modernity in the Late Pleistocene: (1) geographic expansion to remote islands of Wallacea and exploitation of both coastal and inland habitats; (2) intensive use of caves and rockshelters; (3) a flake-based lithic industry lacking a chopper/chopping tool component, which may be accompanied by evidence for relatively long-distance transport of raw materials; (4) emergence of nonlithic tools such as shell implements; (5) fireplaces or systematic control of fire; (6) diverse food resources collected from various ecosystems, including the forest and the sea; and (7) burial practices. As the authors stress, this is a hypothetical list that needs to be tested or modified through future studies, but the proposal from local experienced archaeologists is noteworthy.

Lithic technologies in the Late Pleistocene of Southeast Asia are often described as simple (Mijares, chapter 12, this volume; Ono et al., chapter 14, this volume) and disregarded as being insignificant in documenting behavioral modernity, except for the edge grinding of pebble axes that appeared in the terminal Pleistocene. But in reality detailed systematic studies of these lithic assemblages are rare (e.g. Moore and Brumm 2007; Moore et al. 2009; also see Borel et al. 2013). Pawlik (chapter 13, this volume) notes this in his preliminary study of microwear on Late Pleistocene stone artifacts from the Philippines. The analyzed materials were chosen from a morphologically simple and generally amorphous small-flake assemblage excavated from the terminal Pleistocene context of Ille Cave, Palawan Island, where fragmented human skeletons with evidence of complex ritualistic treatment was found in the early Holocene level (Lara et al. 2013). Pawlik's preliminary interpretation with regard to these artifacts is that they were used on a variety of hard and soft materials such as bone, antler, wood, bamboo, hide, and possibly shell. Moreover, residues of red ocher were also observed on some of them, and patterns of surface polishing and scarring, together with possible remnants of organic resin, suggest hafting and even use as projectile points. Pawlik considers that some of these behaviors, particularly the hafting activity, signal behavioral modernity of the terminal Pleistocene inhabitants at Ille Cave. Although this last point of his interpretation may be controversial in view of claims for early hafting technology as old as 500 ka (Wilkins et al. 2012, and references therein), the evidence of composite toolmaking in a dominantly amorphous, simple, unretouched flake industry from Southeast Asia is a significant finding. As Pawlik stresses, traditional typological and technological studies have their own limitations, and microwear analysis is a useful approach to further understand the real nature of the apparently simple lithic technologies in Southeast Asia.

Reynolds and Barker (chapter 10, this volume) summarized their multidisciplinary research project at Niah Cave, Borneo. This project combined field sampling and various laboratory analyses as well as restudy of materials excavated by Harrisson in the 1950–60s. It has significantly improved our understanding of Late Pleistocene geoarchaeology, chronology, paleoecology, and human activities at this world-famous site. Important cautions were also offered. For example, the nonhorizontal nature of the deposits recognized at the site meant that Harrisson's excavation of the site by arbitrary levels truncated and mixed archaeological materials from different ages. Thus, a fine-scale chronological analysis of the Harrisson collection is unfortunately impossible. According to the authors, the archaeological record at the cave entrance extends back to ~48,000 cal BP and possibly >50,000 cal BP, and that it is likely the product of *H. sapiens* (see above). A wide range of faunal remains such as pigs, primates, freshwater mollusks, and fish were identified in the collection from the levels dated to ~50,000–35,000 cal BP (Rabett 2012), indicating that humans exploited various habitats outside the cave and had skills to hunt arboreal mammals and fish in rivers. The unbiased age composition of the pig assemblage implies that hunting techniques included trap or snare technology as well as spearing. There was also some indirect evidence for forest burning, possibly by people, to maintain a habitat preferable for these foraging activities. Analyses of starch grains and phytoliths suggest that humans were collecting plants such as palms, yams, fruits, and nuts for food or other purposes. Some of these plants are toxic, so it is possible that people knew how to neutralize those toxins. This inference is supported by the discovery of nut fragments in some of the terminal Pleistocene pits. These behaviors, if accurately portrayed, point to "strategic awareness, targeting, and forward planning" rather than an opportunistic lifestyle. This obviously appears inconsistent with the comparatively simple lithic technology from the site, but the pattern of microwear on some of the stone flakes was consistent with an interpretation that these were used to process organic materials and that people used various implements made from wood, rattan, bamboo, etc., in addition to stone, as suggested by other researchers (see Pawlik, chapter 13, this volume, for a review and discussion regarding this issue). Traces of resin on a few stone flakes suggest hafting. The research team also identified polished bone artifacts, five of which were considered to have derived from the initial occupation level. Although some of the above views need to be further strengthened by future field excavations, the emerging picture for the Late Pleistocene inhabitants of Niah Cave is strikingly “modern,” as the authors say. Another important note put forward by Reynolds and Barker (chapter 10, this volume) is that Niah Cave, albeit famous and a rich source of information, is unlikely to provide an overall picture of human activities in the Late Pleistocene of the region because it is a single cave site and cannot represent, for example, people’s use of open areas. Not surprisingly, other researchers note some degree of cultural diversity in the known, limited number of MIS 3 sites in Southeast Asia (White 2011; also see Higham 2013).

Symbolism

The earliest modern human colonists of Asia and Sahul are supposed to have possessed a capacity for symbolic behavior (Balme et al. 2009; Davidson and Noble 1992). However, supporting material evidence for this expectation, such as adornments, figurative arts, and ritual practices (e.g., beads, rock art, and complex or decorative burials) are only sporadically known from the Late Pleistocene contexts of South Asia and Sahul (Brumm and Moore 2005; Clarkson et al. 2009; David et al. 2013; Habgood and Franklin 2008; James and Petraglia 2005; Perera et al. 2011). Southeast Asia and South China are even vast archaeological voids in this regard, with the first clear signatures of symbolism appearing as late as the early Holocene in the form of ritualistic treatments of burials (Bellwood 1997; Lara et al. 2013; Majid 2005).

~~Ngyuen~~ (chapter 9, this volume) partly filled this gap in our knowledge. He reports the first convincing evidence for symbolism dating back to around the LGM in Vietnam. At the Xom Trai Cave in northern Vietnam, Hoabinhian cultural layers dated to 22,000–19,000 cal BP yielded stones with incised geometric designs and a perforated tooth, together with numerous pieces of red ocher with traces of grinding and scraping. Five (or at least three) stones with numerous short incised lines, many of which are arranged in parallel and/or zigzag patterns were recovered in excavations. These are basalt or river cobbles with red stains. Such geometric designs are also known from the 30,000 BP level at Patne, India (Chauhan et al., chapter 7, this volume). ~~Ngyuen~~ hypothesizes that these incisions were originally made to facilitate grinding ocher. The perforated tooth is similar to another perforated mammalian tooth from a contemporaneous layer at Du Sang rockshelter, where it was again associated with a large number of red-ocher fragments. These are most likely personal ornaments, as ~~Ngyuen~~ argues. Regarding the red ocher, its presence per se does not necessarily indicate symbolic or modern behavior because ocher can be used for practical purposes such as animal skin processing and as an ingredient in adhesives (Wadley et al. 2009). Moreover, it occurs in late Acheulian contexts in India (James and Petraglia 2005), and there are claims that Neanderthals also used colors (Zilhao et al. 2010). Still, the reported abundance of red ocher at Xom Trai and Du Sang (~~Ngyuen~~, chapter 9, this volume) and its presence in other Hoabinhian sites (Bellwood 1997; Matthews 1966; Solheim 1980) are noteworthy. Red ocher is the most preferred colorant in prehistory and is widespread in early modern human sites in Asia and Sahul (Clarkson et al. 2009; Habgood and Franklin 2008; Hovers et al. 2003; Jaubert, chapter 31, this volume; Pei 1939; Perera et al. 2011). Although ~~Ngyuen~~ suggested that Hoabinhian people may have eaten red ocher, with reference to a local tradition in northern Vietnam, this is currently practiced only by pregnant women and concealed from other village members (~~Ngyuen~~, personal communication). Such a practice would seemingly not explain the abundant occurrence in the occupation sites ~~Ngyuen~~ excavated.

Wang (chapter 18, this volume) also reports the presence of possible structured remains from two occupation sites in central China, which are preliminarily broadly dated to around 40,000 cal BP. At the open-air site of Zhaozhuang, his team found a skull of an elephant lying directly on a pile of nonlocal sandstones. Wang also notes that, among numerous hearths excavated at another open-air site, Laonainaimiao, four were arranged in a semicircle. Although more detailed descriptions of these features are awaited before assessing their symbolic significance, this report highlights the potential importance of this (and other) continental areas for further pursuit of Paleolithic symbolism and complex spatial organization of occupation areas.

Evidence of symbolism is more abundant in northern Asia, particularly in southern Siberia. A variety of symbolic items, including bone and stone beads and figurative arts are known, as mentioned by Buvit et al.

(chapter 33, this volume) and Rybin (chapter 32, this volume). In Mongolia, a small number of ostrich eggshell beads are known, and some rock-art features depicting extinct animals such as mammoths and rhinoceroses probably belong to the Pleistocene (Jaubert, chapter 31, this volume). In addition, a few sites in northern China also yielded ostrich eggshell beads in association with blade-based lithic industries (e.g., Shuidonggou) (Gao et al. 2013; Li et al., in press). Beads made of animal teeth and stones, and possible evidence of ritualistic treatment of human dead bodies, are known from Upper Cave at Zhoukoudian (Pei 1939). A small number of stone or amber beads and incised stones are also known from terminal Pleistocene sites in Hokkaido (and also in Honshu), Japan, although detailed reports of these materials have not yet been published in English.

Discussion

The new report from Vietnam (~~Ngyuen~~, chapter 9, this volume) pushes back the oldest record of Southeast Asian symbolic behavior from around the Pleistocene–Holocene boundary to the LGM. Coupled with additional implications from central China (Wang, chapter 18, this volume), and given the fact that earlier evidence of symbolism exists in Sri Lanka and Australia in the forms of beads and ritualistic mortuary use of red ocher and fire, dated to 40–37,000 cal BP (Habgood and Franklin 2008; Kennedy and Deraniyagala 1989; Perera et al. 2011), the paucity of Pleistocene symbolic items from Southeast Asia and southern China is likely due at least in part to limited field studies and taphonomy. Langley et al. (2011) examined possible taphonomic biases in Pleistocene archaeology in Sahul and reached the conclusion that earlier sites tend to lack evidence for symbolism at least partly because of poor preservation of organic materials.

Still, the general observation that archaeologically recognizable material evidence for symbolism is much less in southern as compared with northern Asia does not change. Korisettar (chapter 6, this volume) discusses the case in India, where the emergence of symbolic items postdates the appearance of unquestionable Upper Paleolithic lithic technology by about 15,000 years. He ascribes this observation to limited field research and late recognition of the significance of such materials from securely dated contexts, while noting that all aspects of behavioral modernity should not necessarily be expected to appear at the same time, a notion widely shared among contributors in this book (e.g., Hiscock, Mellars, Pawlik). Another possibility we should keep in mind is that Paleolithic people in Southeast Asia made symbolic items primarily from perishable, organic materials such as flowers and feathers. Although the presence of such materials is extremely difficult to test archaeologically, some researchers are challenging this issue by microwear and residue analyses on stone tools (Barton in Reynolds and Barker, chapter 10, this volume).

Maritime Adaptation

Maritime resource exploitation and voyaging skill are often cited as elements of behavioral modernity (e.g., Davidson and Noble 1992; McBrearty and Brooks 2000; Norton and Jin 2009). Although controversy exists about whether these are truly specific to *H. sapiens* (Colonese et al. 2011; Cortés-Sánchez et al 2011; Hardy and Moncel 2011; Klein and Steele 2008; Ruxton and Wilkinson 2012; Simmons 2012; Stringer et al. 2008), no one would deny that our species was extremely successful in this respect. So far, discussion about early maritime adaptation has focused on evidence from South Africa, Europe, Wallacea, and New Guinea. The Tokyo symposium was a place to share some new evidence from Wallacea and expand our scope to include other areas in the west Pacific.

Wallacea

Although direct evidence of watercrafts is lacking, the presence of archaeological sites in Sahul is taken as evidence that Paleolithic people had sophisticated skill to cross some distance of open sea 45,000 cal BP or earlier (Davidson and Noble 1992; O'Connell et al. 2010; O'Connor 2010). However, the cultural and behavioral uniqueness of these earliest voyagers has been largely unknown. An excavation at Jerimalai rockshelter in East Timor provided us with a fresh perspective in this regard (O'Connor 2007; O'Connor et al. 2011). In chapter 15 of this book, O'Connor summarizes and details particular aspects of her research. Her team's faunal analysis indicates that at Jerimalai people actively caught marine fish from the time of the lowest occupation layer dated to 42,000–38,000 cal BP. Surprisingly, the bone assemblage included a substantial number of fast-moving pelagic fish, mostly immature tuna 50–60 cm in length. At present, we can only speculate about the methods of this early fishing (see O'Connor et al. 2014), but catching fast-moving fish like tuna must have required a high level of planning, maritime capacity, and perhaps "sophisticated organic technology," as O'Connor argues. Another exciting discovery at Jerimalai was a broken fishhook made of a *Trochus* shell, which was indirectly dated to sometime between 23,000 cal BP and 16,000 cal BP. This is currently the world's oldest fishhook. Marine turtles were the second-most dominant faunal component, and shellfish, crabs, and urchins were also present, but the proportion of land-based fauna such as rats, bats, birds, and reptiles was poor and small. It seems that marine products were essential food resources for the Paleolithic people in this insular setting with impoverished terrestrial mammalian fauna, and they had advanced skills to exploit such marine resources.

An aspect of the marine capacity of Late Pleistocene modern humans can also be seen in their geographic distribution. Simanjuntak et al. (chapter 11, this volume) note that *H. sapiens* appear to have been widespread across all of Wallacea by the terminal Pleistocene. One of the strongest lines of evidence for this view is provided in this book by Ono et al. (chapter 14). These authors report their reexcavation of Leang Sarru rockshelter on one of the Talaud Islands located between the Mindanao and Halmahera Islands (also see Ono et al. 2010). This small limestone rockshelter is currently ~400 m away from the coast. A large number of marine shells and flaked stone artifacts were excavated from layers dated to 35–32,000 cal BP and 22–8,000 cal BP. The Talaud Islands are currently >100 km away from the nearby islands, and this geographic condition was basically the same during the terminal Pleistocene. The islands' Pleistocene fauna seem to have been poor: although no bone materials were found in the excavations, extant terrestrial mammal species on the islands include only bats, rats, flying foxes, and cuscuses, besides presumably more recently introduced chickens, dogs, cattle, and pigs. Early occupation on such a remote island with limited land food resources is noteworthy.

Philippines

At the present stage of research, the implication of the ~67 ka foot bone from Callao Cave in northern Luzon is not clear because of ambiguous taxonomic allocation to *H. sapiens*. However, the occupation layer dated to ca. 30,000 cal BP (25,968±373 ^{14}C BP) in the same cave, which is associated with chert flake tools, hearths, burnt animal bones, and botanical remains may well be the products of modern humans (Mijares, chapter 12, this volume). Because Luzon Island was never connected to the Asian mainland during the Late Pleistocene, people had to use watercraft to get there. These people also must have had enough skill to adapt to the different environments they encountered during the move, as Mijares argues. Two or three possible entry routes can be supposed—from Borneo or Sulawesi to Luzon, but currently not enough data exist to determine which was actually taken by the first *H. sapiens* colonizers.

Japan

Previous researchers tend to postulate that the Japanese Archipelago was connected to the Asian continent by land bridges during the Last Glacial, when the Late Pleistocene colonists first appeared there (Suzuki 1982, 1983). However, this view is no longer tenable, and it is now clear that migration into the islands of Japan (except Hokkaido, which had been connected to the continent via Sakhalin) during MIS 3 needed substantial sea crossings by watercraft (Kaifu 2005; Kaifu and Fujita 2012; Norton and Jin 2009; Ohshima 1980). Most researchers believe that the first immigrants to Japan came through the strait separating the Korean Peninsula and Kyushu Island of Japan, because the oldest Japanese Upper Paleolithic sites at ~38,000 cal BP are known from Kyushu and Honshu islands (Izuho and Kaifu, chapter 21, this volume). The strait could be crossed by two legs of ~35 km via Tsushima Island, supposing that the sea level was ~80 m lower than today. As noted above, crossing this strait was probably repeated 30,000 cal BP, when the HS point form was introduced from Korea to Kyushu (Matsufuji 1987; Morisaki, chapter 26, this volume), and at other occasions to transport obsidian and other types of lithic tools (Lee, chapter 20, this volume). But these are not all. Two papers in this book detail cases of early human maritime voyages to Kozu Island (Ikeya, chapter 25) and the Ryukyu Islands (Kaifu et al., chapter 24).

As Ikeya (chapter 25, this volume) states, Kozushima is a small volcanic island ~50 km offshore from the present-day coast of central Japan. The island was appreciated by prehistoric people as a source of high-quality obsidian. The initial claim that this tradition of marine transportation went far back to the Paleolithic era was put forward by Suzuki (1974). Since then, numerous studies have been made regarding this issue, but these results were published in the Japanese literature, and only brief English overviews have so far been available for the international community. In this book, one of the principals of the Kozushima obsidian study, Nobuhiro Ikeya, reports that Suzuki's original claim is now confirmed by intensive mapping of possible sources and large-scale studies based on x-ray fluorescence (XRF) as well as nuclear activation analysis (NAA). Moreover, a series of excavations on Honshu Island now indicates that marine transport of Kozushima obsidian started during the earliest stage of the Japanese Upper Paleolithic, ~38,000 cal BP. Assuming an 80-m sea-level drop at this time, Kozushima was still about 38 km away from Honshu Island in direct distance. Furthermore, as Ikeya notes, like today, a strong ocean current may have been present in this sea area. Considering these potential difficulties, he speculates that a simple raft commonly supposed for Paleolithic voyages may not have been useful. Another interesting observation reported by Ikeya is that people ceased this marine transport during MIS 2 when the strait became narrower because of the lowered sea level, for unknown reasons.

Another paper is about the Ryukyu Islands that stretch between Kyushu and Taiwan (Kaifu et al., chapter 24, this volume). The presence of Paleolithic people on some of these islands has been known since the 1970s by human skeletal remains from Minatogawa Fissure and Yamashita-cho Cave 1 on Okinawa Island and a few other sites. However, the islands' significance in the study of early maritime technology has not been acknowledged until recently, mainly because of the erroneous supposition that they were connected to the Asian mainland by an extensive land bridge during the Late Pleistocene. In addition, many of the archaeological sites recently discovered from the northern Ryukyu Islands are only briefly reported in the Japanese literature. Kaifu et al. (chapter 24, this volume), as a first step in reconstructing the Pleistocene migration history across the Ryukyu Islands and discussing the maritime technology associated with it, synthesize available paleoanthropological, archaeological, paleogeographic, and other relevant evidence. According to these authors, the entire Ryukyu Islands had been occupied by early modern humans 36–30,000 cal BP. During this period of sea-level lowering, the areas of the islands were only slightly larger than they are today, and the Paleolithic people had to repeat sea crossings of substantial distances to colonize the archipelago. At the southern entrance to the Ryukyu Islands, the first target, Yonaguni Island, was invisible from the shore of Taiwan. Furthermore, if these voyagers traveled from Miyako to Okinawa Islands 36,000 cal BP, as the authors suppose, that voyage included at least one leg of 150–160 km or even 220 km. Kaifu and colleagues also note that these Pleistocene sea crossings in the Ryukyu Islands were more difficult than suggested from direct distances between the islands if the strong ocean currents flowed in this sea area as they do today.

Discussion

Wallacea and New Guinea have been central in the discussion of these issues, but we now know that evidence of MIS 3 sea crossings is ubiquitous in a wide area of the western Pacific, including the Philippines and Japan. Based on currently available information, in figure 35.2 we update the chart of "Pleistocene evidence of sea crossings in the west Pacific" by Anderson (2010, figure 1.2). Chronology of Wallacea and New Guinea are based on our own understanding of the literature. Only the longest leg in each course, measured using the GeoMappAPP software (http://www.geomapapp.org) is indicated in figure 35.2. These are direct, minimum distances, and the real voyages must have been more or less longer. Some destinations can be reached by repeating more than one shorter leg (island-hopping). In such cases, both the direct distance to the destination ("d") and the longest leg in each island-hopping route ("i") are indicated.

Anderson (2010) observed that passages of greater than about 60 km are few through the Late Pleistocene and concluded that such cases might have been accidental. However, our revised chart shows that voyages of >150–80 km were certainly practiced 45–30,000 cal BP in several different regions in Wallacea (northern and southern routes to Australia, Talaud) and Japan (Yonaguni, Okinawa). The presence of multiple examples

Figure 35.2 Pleistocene evidence of sea crossings in the west Pacific. Updated and expanded from Anderson (2010). Lowest sea levels are supposed to be −60 m 50,000–40,000 cal BP, −80 m 40,000–30,000 cal BP, and −130 m around 20,000 cal BP (Clark et al. 2009; Siddall et al. 2008; Yokoyama and Esat 2011). Comparatively wider straits are selected in each region. Color codes: Wallacea = gray, New Guinea = light gray, Philippines = black, Japan = bordered and hatched. Voyage routes are as follows (d = direct, i = island-hopping): Australia = Seram → Misool or Timor → Australia or Jamdena → Tual; Bismarcks = New Guinea → New Britain (Umboi); Buka = New Ireland → Buka; Kozu = Izu Peninsula → Kozushima; Kyushu = South Korea → Kyushu; Luzon = Palawan → Mindoro (northern route) or Borneo → Sanga Sanga (southern route); Manus = New Ireland (New Hanover) → Manus (Rambutyo) or New Guinea → Manus; Okinawa = Miyako → Okinawa; Yonaguni = Taiwan → Yonaguni. See text for more details.

of long-distance voyages, including those toward small targets like Talaud and Yonaguni, strongly supports that these were nonaccidental, purposeful voyages and our MIS 3 ancestors already had capabilities for such advanced voyaging. If some of these were direct travels without stopping at small islands on the way, the navigation distances in MIS 3 were much longer, 170 km (Buka) or even 220 km (Okinawa).

The evidence of obsidian procurement at Kozu Island since 38,000 cal BP is noteworthy in this regard. First, this is currently the world's oldest (and best-documented) evidence for intentional, repeated translocation of materials by watercraft. In Wallacea and Sahul, the earliest evidence for humanly transported animals and exotic materials come from sites not more than 20,000 cal BP in the Bismarck Archipelago (Allen 2000; O'Connor 2010). The evidence from Japan makes such evidence almost twice as old. The practice of "marine shuttle" between Kozushima and Izu Peninsula substantiates that voyaging technology ~38,000 cal BP was secure enough to repeat the cross of a >35-km-wide channel possibly with a strong ocean current. Given this evidence, it should come as no surprise if Upper Paleolithic hunters[5] occasionally, if not frequently, repeated sea crossings to share new lithic tools and raw materials across the strait between Korea and Japan, as discussed above.

Another important fact is that the evidence for Kozushima marine shuttling for obsidian procurement is documented from the beginning of the Upper Paleolithic in Japan. As Ikeya (chapter 25, this volume) notes, this strongly suggests that the modern human immigrants to Japan were seeking obsidian sources both on the land and oceanic islands from their arrival 38,000 cal BP. This means not only that they knew the significance of obsidian, but also that they were intentional explorers and never opportunistic drifters.

Foraging Skills

Sato (chapter 27, this volume) reports evidence for Paleolithic trap-pit hunting in Japan, which is unknown elsewhere (also see Sato 2012). Hunting pitfalls found in the Upper Paleolithic contexts of Japan (38,000–15,000 cal BP) are excavated in Honshu and Kyushu Islands, as well as Tanegashima, a small island located to the south of Kyushu. These pits are generally more than 1.5 m deep and are discriminated from pits for storage or graves mainly because they are not directly associated with occupation floors, are arranged in lines or form clusters on a hill slope or along a gully, and are filled with sediments without artifacts or human skeletal remains. Sato counted nearly 400 such features reported from 52 sites (some of them form site complexes). They show an interesting pattern of spatiotemporal distribution. The oldest pitfalls emerged around 38,000–35,000 cal BP in southwestern Japan and 34,000–31,000 cal BP in the Pacific side of central Japan. Then, after a long hiatus in use, pitfall hunting became popular again during the terminal Paleolithic 18,000–15,000 cal BP, mainly on the Pacific side of Honshu and Kyushu, before it flourished almost all over Japan in the succeeding Jomon era. Chronologies of these pitfalls are secure in most cases, thanks to well-stratified deposits mainly composed of tephra. There is still some debate whether these were used for drive or trap hunting, but Sato makes a convincing argument, with reference to ethnographic evidence, that they were trap pits. He also notes a distributional overlap between the Paleolithic hunting pitfalls and the zone of warm–temperate deciduous or evergreen broadleaf forests, and he hypothesizes that trap-pit hunting was developed in an environment with rich edible plant resources and where relatively sedentary living was possible as compared with northern environments where people were obligated to hunt more intensively. A challenge to this hypothesis is that it is based on a vegetation map of the colder LGM, not of the late MIS 3, when the earliest pitfalls were created. If we refer to the new "average" MIS 3 vegetation map (Takahara and Hayashi, figure 22.2, this volume), the claimed correspondence between vegetation zone and pitfalls is less clear. Sato's hypothesis will be further tested when a late MIS 3 vegetation map becomes available.

As mentioned above, Reynolds and Barker (chapter 10, this volume) note evidence of capturing monkeys and other animals at Niah Cave, which indirectly suggests the use of traps or snares. The dominance of monkeys and the presence of nocturnal mammals are also interpreted in a similar way for the 34–11,000 cal BP assemblages from Batadomba-lena in Sri Lanka, a site where abundant bone points suggest the use of projectiles (Perera et al. 2011). These skills are also suggested from African Middle Stone Age sites (Backwell et al. 2008; d'Errico and Henshilwood 2007; Wadley 2010) and likely have deep histories.

Another surprising discovery was made in the lower layer of the Jerimalai rockshelter in East Timor (O'Connor, chapter 15, this volume). As summarized above, here, people were engaging in intensive marine resource exploitation and had caught a large quantity of young tuna since 42–38,000 cal BP. One of the fishhook fragments dated to somewhere between 23,000 and 16,000 cal BP and is currently the world's oldest fishhook.

Discussion

The discovery of hunting pitfalls dated to >35,000 cal BP in Japan is significant in several ways. First, pitfall hunting needs substantial forward planning that can be used as a proxy for behavioral modernity, as Sato stressed (see Wadley 2010 for a more detailed discussion about traps and snares in general). Second, this is the first direct evidence of trap hunting by Paleolithic hunters. Use of traps or snares by early modern humans has been cautiously suggested for the Middle Stone Age of South Africa, Upper Paleolithic of Europe, as well as Niah Cave and Batadomba-lena in southern Asia (Klein 1981; Perera et al. 2011; Reynolds and Barker, chapter 10, this volume; Wadley 2010), but all of these are based on circumstantial evidence such as the types of faunal species and their mortality profiles not being indicative of the selectivity often associated with direct hunting. The pitfalls from Japan give us the first material proof that trap hunting was performed by Pleistocene *H. sapiens* at least in the late MIS 3.

Fish bones are generally rare but sporadically reported from various Pleistocene sites in eastern Asia. Stable isotopic analyses of the 39,000 cal BP human skeleton from Tianyuandong indicated that freshwater fish was a main protein source for this very early *H. sapiens* individual of northern China (Hu et al. 2009). The findings from Jerimalai were, however, surprising because they showed that early modern humans in Wallacea had enough skill to catch a large number of fast-moving marine fish. The exact fishing technique is unknown, but as O'Connor (chapter 15, this volume) argues, it required "sophisticated organic technology." The discovery of what appears to be a broken part of a bone point from the 35,000 cal BP level at Matja Kuru 2, Timor, led O'Connor et al. (2014) to suggest that people threw bone-point-tipped spears from boats to catch these and other marine animals.

In addition to the technological issues, overall, these and other studies have shown a wide range of foraging skills practiced by *H. sapiens* in Paleolithic Asia from the earliest stage of their archaeological records. In addition to the evidence for plant use in earlier sites in New Guinea (Summerhayes et al. 2010), Borneo (Barker et al. 2007; Reynolds and Barker, chapter 10, this volume), Luzon (Mijares 2008), and Sri Lanka (Perera et al. 2011), animal food resources had been procured in various ways. For example, lithic or osseous projectile points show impressive development in northern Asia, culminating in the formal microblade technology and slotted osseous points into which to insert microblades around 25,000 cal BP. On the Pacific side of Japan, a number of large pits were dug to trap possibly deer or boars. In southern Asia, people had unidentified skills to catch varying species of animals, including arboreal monkeys, nocturnal animals, and birds. At some sites on Wallacean islands, there is evidence of the catching of fast-moving marine fish and extensive shellfishing.

A question arises from this emerging pattern: Why did such substantial variability develop? Sato's hypothesis supposing more or less sedentary lifeways with abundant plant food resources for the pitfall hunters of Japan is noteworthy in this regard, regardless of the lack of clear plant-eating evidence from archaeological sites. This hypothesis can be expanded to continental Asia by querying whether such a model is also applicable to wider temperate or tropical regions in eastern Asia. Such a study of geographic subsistence variation will be essential not only to understand more about Paleolithic modern humans in eastern Asia, but also to approach questions of the later development of new technology and culture, such as the emergence of pottery in this area of the world.

Cultural Variation through Time and Space

High degrees of regional/temporal variations in tool forms or other cultural aspects occur only in the presence of high inventive abilities. Manifestation of regional variability may also reflect the appearance of regional styles or traditions. For these reasons, such variations demonstrated in the Upper Paleolithic of Europe as well as the Middle and Late Stone Ages of Africa are taken as strong signature of behavioral modernity (Klein 2009; McBrearty and Brooks 2000; Mellars, chapter 1, this volume). Paleolithic cultural successions and regional variations still remain vague in most regions of eastern Asia and Australia. This is not surprising because, unlike the cases of symbolism or sea crossing, in which a single discovery can resolve the question, large and stratigraphically/chronologically well-controlled samples are required to demonstrate spatiotemporal variations. Still, the available limited evidence does indicate the presence of such variations in these areas.

In a broad perspective, northern and southern Asian "Upper" Paleolithic industries are clearly different from each other: the former is represented by a blade-based technocomplex associated with a variety of standardized tools such as burins, whereas simpler flake-and-pebble-tool industries generally characterize the southern regions. In northern Asia, the emergence and spread of formal microblade technique around the LGM marks a significant innovation. Microliths occurred in South Asia possibly as early as 45,000 cal BP but did not appear in Southeast Asia throughout the Late Pleistocene. The "Hoabinhian" technocomplex is principally distinguished from earlier lithic industries based on the presence of highly characteristic pebble tools called "sumatraliths"; they were largely restricted to continental Southeast Asia and a part of Sumatra between about 22,000 and 6,000 cal BP (Bellwood 1997; White 2011). Sahul has a long history of stone axes, either in edge-ground or waisted forms (Geneste et al. 2012; Summerhayes et al. 2010), which are comparable to similar forms from Japan (Tsutsumi 2012). Regional variation also existed in hunting technology, as mentioned above.

What would be equally, if not more, interesting is finer-scale investigations of spatiotemporal variation in each region, which would tell us more about cultural innovation, conservativeness, population dynamics, etc. in eastern Asia and Sahul. In this book, Hiscock (chapter 16) emphasizes regional diversity in lithic technology in Pleistocene Australia. For example, edge-ground stone axes were used only in northern areas, whereas the southwest, southeast, and Tasmania exhibit other forms of lithic industries, but no axes. According to Hiscock, this variation cannot be ascribed to regional differences in the availability of raw material; rather, it reflects cultural adaptations to different resource patterns in different niches across the continent.

The case of Japan is different. Here, drastic chronological changes and regional variation in the Upper Paleolithic, which are comparable to the case in Europe, are already known (e.g., Inada and Sato 2010), but this knowledge has so far been only briefly summarized in the English literature (Kudo 2012; Morisaki 2012; Ono et al. 2002). In this book, Sato (chapter 27) and Ikeya (chapter 25), respectively, mention that trap-pit hunting and marine transportation of obsidian became inactive toward the end of MIS 3 and then reappeared slightly after the LGM. Another paper deals with this issue in more detail, focusing on Hokkaido, northern Japan. Nakazawa and Yamada (chapter 29) comprehensively studied more than 35,000 lithic tools from Hokkaido and showed statistically that the variety of tools increased from about 30,000 cal BP to 11,000 cal BP. Here, the emergence of microblade technology around 25,000 cal BP signals an "abrupt pulse of technological change," but this was not the sole notable event. The authors demonstrated that, toward the end of the Pleistocene, a few new types of stone tools had been added to the people's took kits, either by cultural transmission from outside or through local invention. This temporal trend is accompanied by the known diversification in microblade-core reduction and the appearance of multiple "technocomplexes" in Hokkaido. Nakazawa and Yamada cautiously hypothesize that such increased richness in stone tools reflects a demographic increase of hunter–gatherers, which may be associated with improved resource availability after the LGM.

Graf (chapter 34, this volume) numerically examined lithic technological and subsistence changes before (middle Upper Paleolithic; MUP) and after (late Upper Paleolithic; LUP) the LGM in the Enisei River valley in southern Siberia. The results show that microblades appeared and bipolar flaking became more popular in the LUP, suggesting economization in the use of raw materials. Because the lithic raw materials are readily available locally, Graf assumes that these changes reflect different land-use choices between the MUP and LUP people. The LUP is also characterized by a larger proportion of formal tools, which were made with explicit plans to be used repeatedly. In addition, her analyses of faunal remains suggest shifts in hunting targets and strategy. For example, as compared with the earlier period, LUP sites show a strikingly intensive focus on reindeer among large ungulate taxa, and active procurement of small animals or carnivores such as hares, birds, and Arctic foxes. Interestingly wolves (or possibly early domesticated dogs) first appeared in relatively large numbers in these LUP sites. Graf hypothesizes that the more economized, portable, and formal lithic technology in the Siberian LUP had been shaped to target mobile herd animals and associated more mobile way of people's life.

Conclusion

The paleoanthropological/archaeological evidence available from this book, combined with other published sources, refresh our understanding of: (1) the initial dispersal of *H. sapiens*, and (2) the emergence and diversity of modern human behaviors in eastern Asia.

The new data set (figure 35.1) supports simultaneous, explosive patterns of the initial dispersal of *H. sapiens* across almost all of Eurasia after 50 ka. This is in disagreement with the prevailing models predicting an earlier out-of-Africa event and longer processes of modern human dispersals in Asia. The early coastal dispersal hypothesis in southern Asia, which is an important element of many versions of long chronology views, remains problematic because there is no such evidence and it contradicts the growing recognition that ingenuity and behavioral flexibility are among the key elements of modern human capacity (Hiscock, chapter 16, this volume; O'Connor, chapter 15, this volume). The new data set also supports that early *H. sapiens* migrants took two major dispersal routes, north and south of the Himalayas, to reach deep into eastern Asia. It is possible, or even likely that these two groups met and interacted in some ways with each other in East Asia.

Despite its shortcomings, we argue that the "classic" trait-list approach for defining modern human behavior (Mellars, chapter 1, this volume) is a useful and effective way to describe each local event, keeping in mind that local expressions of modernity may have varied. Many chapters in this book review or report evidence of Late Pleistocene modern human behaviors in eastern Asia, much of which is new to or not yet widely recognized by the international community. Some of these are known traits that are documented here for the first time (e.g., symbolic items from Vietnam [Ngyuen], marine transport in Japan [Ikeya, Kaifu et al.]), while others are unique behaviors so far undocumented or very rare in the Paleolithic records of other regions of the world (e.g., hunting pitfalls [Sato], capture of monkeys [Reynolds and Barker] or pelagic fish species as well as fishhooks [O'Connor]). Rapid dispersion into diverse environments should also be considered significant in this context (e.g., Hiscock).

When Wong (2005) reviewed the world evidence of Paleolithic modern human behavior in *Scientific Amer-*

ican, only Europe, Africa, and Australia were discussed, and nothing was mentioned about vast eastern Asia. The evidence described in this book clearly shows that the huge void in Wong's review was not because of the absence of evidence, but mainly because of the lack of information sharing between the English and non-English-speaking scientific communities. What we see now in eastern Asia is ample and diverse evidence of Paleolithic modern human behaviors, even in the regions where standardized and sophisticated lithic technology did not develop. Likely the quantity and diversity of these behaviors have important meaning. On the one hand, as research advances, we are starting to realize that behavioral distinctions between our archaic relatives (e.g., Neanderthals) and early *H. sapiens* are not so clear with regard to individual behavioral traits (Bellwood, chapter 4, this volume). On the other hand, as we continue to investigate the diverse evidence dispersed across the continent, we are beginning to realize that the hallmark of early modern human behavior is "ingenuity and the flexibility to innovate in the face of changing circumstances and environments" (O'Connor, chapter 15, this volume).

This book is not a comprehensive source of all the existing information in eastern Asia because mostly each region is represented by only a few authors. Still, the book successfully improves our knowledge about early modern humans and their behaviors in eastern Asia. This makes us optimistic that exciting new findings will continue to come to light from this region. We still have a number of practical problems: traditional excavation methods based on arbitrary levels, insufficient geoarchaeological considerations, insecure dating, confusing terminologies that hamper scientific communication, and disparate theoretical perspectives, to name just a few. But all of these are worth solving to advance understanding the origins of our species.

Notes

1. These traits are associated with Siberian "Initial Upper Paleolithic" industries and include blade technology, osseous tools, ornaments, structured dwellings, and hearths, etc. (Buvit et al., chapter 33, this volume; Goebel 2002; Goebel, chapter 30, this volume; Rybin, chapter 32, this volume; Zwyns et al. 2012).

2. Although no direct fossil evidence is available for this taxonomic assessment, this is the most parsimonious interpretation given the wealth of modern behavioral traits associated with Siberian "Initial Upper Paleolithic" industries.

3. In northern China, this lithic technology may have been a temporal intrusion from southern Siberia (Li et al. 2013).

4. This "single" event does not necessarily mean that only one group of *H. sapiens* achieved the exodus. It may have been a cumulative result of a number of successive dispersals by archaeologically (and genetically) indistinguishable small but related groups.

5. We intentionally use this term here because the materials brought across the strait were principally hunting weapons, not fishing gear. This implies that those Paleolithic voyagers in East Asia were at least not specialized fishermen, or otherwise hunters were involved in such voyages conducted by those who engaged in fishing.

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