

Early Modern Humans

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Abstract

Perceptions of the emergence and spread of modern humans have changed recently through the reanalysis of fossils, an improved geochronological framework, and the discovery of a few specimens. Early modern humans in various portions of the Old World exhibit complex and varying mosaics of archaic, modern, and regional morphological characteristics. On the basis of this pattern, in conjunction with the emerging chronology of the earliest modern humans, the paleontological data indicate an assimilation model for modern human origins, in which the earliest modern humans emerged in eastern Africa, dispersed briefly into southwestern Asia, and then subsequently spread into the remainder of Africa and southern Asia, eventually into higher latitude Eurasia. The earliest modern humans outside of the core area of eastern Africa can be understood only if a variable degree of admixture with regional groups of late archaic humans occurred. Current and expected fossil and molecular data are unlikely to illuminate the degree of assimilation that took place in most regions of the Old World. However, the current chronological and phylogenetic framework provides the basis for ongoing investigation of the nature of this Late Pleistocene transitional period.

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INTRODUCTION

Paleoanthropology has been focused for the past two decades on the human biological and cultural evolutionary processes referred to as the origins of modern humans. In this discussion, there has been some consideration of the earliest modern humans, but much of the debate has centered on late archaic humans, especially the Neandertals of western Eurasia. Yet, the primary focus of the discussion should not be regional groups of late archaic humans, but the evidence available for the biology and behavior of early modern humans.

For this reason, it is appropriate to revisit the distribution and the biology of these earliest modern people. Current knowledge helps resolve some questions, brings into focus some of our assumptions regarding their evolutionary emergence, and poses other issues. It also sets the stage for considerations of their paleobiology and behavioral patterns.

A MATTER OF A TERM

In the following discussion, the term modern human encompasses a variety of human biological groups, which vary geographically

in the recent world and have continued to evolve since their emergence in the later Pleistocene. Moreover, it may be difficult to draw clear distinctions between them and late archaic humans, depending on the criteria and approach employed to delimit “modern humans.” At the risk of excluding some individuals from the hallowed grounds of modernity, a series of morphological criteria are employed here, whose constellations and limitations should emerge from this discussion of the earliest “modern humans.”

CHANGING CHRONOLOGY

The assessment of early modern humans has been strongly influenced by improvements in their chronology. This process began with the application of TL and ESR dating to southwestern Asian Middle Paleolithic sites (Table 1), and it has continued through the development, refinement, and increasing application of TL, ESR, uranium series, $^{40}\text{Ar}/^{39}\text{Ar}$, OSL, and especially AMS ^{14}C dating. The last method is increasingly applied directly to human fossils (Tables 2 and 3) because stratigraphic association between human bone and archeological remains cannot always be taken for granted. Indeed, the redating of a series of “early Upper Paleolithic” specimens to the terminal Pleistocene or Holocene (Table 3) has demonstrated just how tenuous our perceptions of the antiquity of morphologically modern human bones can be. The other techniques assume good stratigraphic association. They also require a variety of analytical and/or interpretive assumptions, which vary from relatively straightforward to indirect and complex, resulting in cases in which the accepted age of the fossil remains is little more than a best approximation. Regardless of these caveats, a geographical and chronological framework is emerging from the fossil remains generally attributed to early modern humans.

In this presentation, radiocarbon ages are given in ^{14}C years, even though most of these values are probably a few thousand years

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- TL:** thermoluminescence
ESR: electron spin resonance
 $^{40}\text{Ar}/^{39}\text{Ar}$: argon-argon
OSL: optically stimulated luminescence
AMS: accelerator mass spectrometry
 ^{14}C : radiocarbon
-

Table 1 Approximate ages of Middle Paleolithic/Middle Stone Age specimens frequently included among candidates for early modern humans*

Specimen	Approximate current age	Dating technique(s)	Reference
Omo-Kibish KHS and PHS	≤195,000, ≥150,000	⁴⁰ Ar/ ³⁹ Ar, paleoclimatic and stratigraphic correlation	McDougall et al. 2005
Herto	ca. 150,000–160,000	⁴⁰ Ar/ ³⁹ Ar, stratigraphic correlation	Clark et al. 2003
Singa	ca. 140,000–150,000	ESR, U-series	McDermott et al. 1996
Mumba	ca. 110,000–130,000	U-series	Bräuer & Mehlman 1988
Klasies River Mouth LBS	ca. 100,000–120,000	OSL, U-series	Vogel 2001, Feathers 2002
Qafzeh	ca. 90,000–100,000	TL, ESR, U-series	Schwarcz et al. 1988, McDermott et al. 1993
Skhul	ca. 90,000–110,000	ESR, TL, U-series	Stringer et al. 1989, McDermott et al. 1993, Mercier et al. 1993
Aduma	ca. 80,000–105,000	⁴⁰ Ar/ ³⁹ Ar, U-series, luminescence	Haile-Selassie et al. 2004
Bouri	ca. 80,000–105,000	Stratigraphic correlation with Aduma	Haile-Selassie et al. 2004
Sea Harvest	OIS 5	Paleoclimatic and faunal correlation	Grine & Klein 1993
Klasies River Mouth SAS	ca. 65,000–90,000	OSL, U-series	Vogel 2001, Feathers 2002
Die Kelders 1	ca. 60,000–70,000	OSL, ESR	Feathers & Bush 2000, Schwarcz & Rink 2000
Blombos	ca. 65,000–70,000	Archeological correlation	Henshilwood et al. 2001
Taramsa Hill	ca. 50,000–80,000	OSL	Vermeersch et al. 1998
Pinnacle Point	OIS 4/3	Paleoclimatic and archeological data	Marean et al. 2004

*TL, thermoluminescence; ESR, electron spin resonance; U-series, uranium series; OSL, optically stimulated luminescence. Ages are rounded off, frequently to the nearest 10,000 years B.P., given the approximate natures of the dating techniques and minor differences between the results of various techniques and/or analytical assumptions. Detailed considerations are present in most of the references.

younger than their calendar ages. The other dates are in the ages specific to the technique.

The earliest fossils, variably referred to as modern human, are within sub-Saharan Africa (**Table 1**). The oldest of these candidates for modernity are from Omo-Kibish KHS and PHS (Omo-Kibish 1 and 2), Ethiopia. They are dated by ⁴⁰Ar/³⁹Ar determinations on bracketing deposits to between ca. 104,000 and ca. 196,000 years B.P., with stratigraphic and paleoclimatic considerations placing them closer to the earlier limit. The Herto, Ethiopia, cranial remains, at least 150,000 years old, are the next oldest candidates, and the Singa cranium from Sudan is approximately the same age. The South African and Tanzanian Klasies River Mouth

LBS and Mumba remains, and then several samples from sub-Saharan Africa and south-western Asia, follow these candidates chronologically. Subsequent African early modern humans >40,000 years B.P. are from Taramsa Hill in southern Egypt and several sites in South Africa (**Table 1**). The proposed pre-40,000-year-B.P. age for the modern human fossil from Liujiang, China, is questionable given stratigraphic uncertainties (Wu & Poirier 1995, Etler 1996, Shen et al. 2002). Similar stratigraphic ambiguities combined with redating of the geological context surround the Lake Mungo (Willandra Lakes) 3, Australia skeleton (see below).

In terms of completeness and sample size, the most important pre-40,000-year-B.P.

B.P.: before present

Table 2 Directly AMS radiocarbon dated early modern humans from the earlier (>20,000 years B.P.) Upper Paleolithic, plus similarly old early modern humans with dates on associated burial remains (*). All are European except Nazlet Khater 2 and Moh Khiew 1. Ages are provided in ^{14}C years

Specimen	^{14}C age	Lab number	Reference
Nazlet Khater 1*	37,570 \pm 350, $-$ 310	GrA-20,145	Vermeersch 2002
Oase 1	>35,200 34,290, \pm 970, $-$ 870	OxA-11,711 GrA-22,810	Trinkaus et al. 2003b
Kostenki unnumbered	32,600 \pm 1100	OxA-7073	Richards et al. 2001
Mladeč 1	31,190 \pm 400, $-$ 390	VERA-3073	Wild et al. 2005
Mladeč 2	31,320 \pm 410, $-$ 390	VERA-3074	Wild et al. 2005
Mladeč 8	30,680 \pm 380, $-$ 360	VERA-3075	Wild et al. 2005
Mladeč 9	31,500 \pm 420, $-$ 400	VERA-3076a	Wild et al. 2005
Kent's Cavern 4	30,900 \pm 900	OxA-1621	Stringer 1990
Muierii 1	30,150 \pm 800	LuA-5228	Păunescu 2001
Cioclovina 1	29,000 \pm 700	LuA-5229	Păunescu 2001
Cro-Magnon misc.*	27,680 \pm 270	Beta-157,439	Henry-Gambier 2002
Dolní Věstonice 13–15*	26,640 \pm 110	GrN-14,831	Svoboda et al. 1996
Moh Khiew 1*	25,800 \pm 600	TK-933Pr	Matsumura & Pookajorn 2005
Dolní Věstonice 16*	25,570 \pm 280	GrN-15,276	Svoboda et al. 1996
Paviland 1	26,350 \pm 550 25,840 \pm 280	OxA-1815 OxA-8025	Pettitt 2000
Cussac 1	25,120 \pm 120	Beta-156,643	Aujoulat et al. 2002
Lagar Velho 1*	23,920 \pm 220 24,520 \pm 240 24,660 \pm 260 24,860 \pm 200	OxA-8422 OxA-8423 OxA-8421 GrA-13,310	Pettitt et al. 2002
Barma Grande 6	24,800 \pm 800	OxA-10,093	Formicola et al. 2004
Eel Point 1	24,470 \pm 110	OxA-14,164	Schulting et al. 2005
Willendorf 1	24,250 \pm 180	ETH-20,690	Teschler-Nicola & Trinkaus 2001
Sunghir 3	24,100 \pm 240	OxA-9038	Pettitt & Bader 2000
Sunghir 2	23,830 \pm 220	OxA-9037	Pettitt & Bader 2000
Brno 2	23,680 \pm 200	OxA-8293	Pettitt & Trinkaus 2000
La Rochette 1	23,630 \pm 130	OxA-11,053	Orschiedt 2002
Arene Candide IP	23,440 \pm 190	OxA-10,700	Pettitt et al. 2003
Sunghir 1	22,930 \pm 200	OxA-9036	Pettitt & Bader 2000
Dolní Věstonice 35	22,840 \pm 200	OxA-8292	Trinkaus et al. 1999
Kostenki 4	21,020 \pm 180	OxA-7128	Richards et al. 2001

remains are the associated skeletons from Skhul and Qafzeh, Israel, from ca. 90,000 years B.P. (McCown & Keith 1939, Vandermeersch 1981, Tillier 1999). These samples appear to represent a range extension of east African early modern humans into southwestern Asia during a warm phase of

OIS 5. Body proportions (Holliday 2000), limb robusticity patterns (Trinkaus & Ruff 1999), and associated fauna at Qafzeh (Tchernov 1998) support such a dispersal; remaining uncertain is what happened to these populations when late archaic humans reoccupied the region during later OIS 5

OIS: oxygen isotope stage

Table 3 Directly AMS radiocarbon dated specimens, formerly considered to represent early modern humans, in order of their resultant ages. Only Koněprusy-Zlatý kůn 1 remains Pleistocene in age. Ages are provided in ^{14}C years

Specimen	Previous "age"	^{14}C age	Lab number	Reference
Koněprusy-Zlatý kůn 1	early Upper Paleolithic	12,870 \pm 70	GrA-13,696	Svoboda et al. 2002
Hahnöfersand 1	ca. 36,000 years B.P.	7500 \pm 55	OxA-10,306	Terberger et al. 2001
Wajak femur	Late Pleistocene	6560 \pm 140	AA-7718	Storm 1995
St. Prokop 1	early Upper Paleolithic	5020 \pm 50 5710 \pm 50 1760 \pm 45	GrA-23,099 GrA-22,864 GrA-23,100	Svoboda et al. 2004
Velika Pečina 1	ca. 34,000 years B.P.	5045 \pm 40	OxA-8294	Smith et al. 1999
Vogelherd 1	ca. 32,000 years B.P.	4910 \pm 25 4985 \pm 30 4715 \pm 35	KIA-20,967 KIA-20,969 KIA-19,538	Conard et al. 2004
Vogelherd 3	ca. 32,000 years B.P.	4995 \pm 35	KIA-19,540	Conard et al. 2004
Vogelherd 4	ca. 32,000 years B.P.	4735 \pm 30	KIA-19,539	Conard et al. 2004
Vogelherd 2	ca. 32,000 years B.P.	3980 \pm 35	KIA-19,537	Conard et al. 2004
Krems-Hundssteig 1	early Gravettian	3540 \pm 35 3480 \pm 35	OxA-8291 OxA-8290	Trinkaus & Pettitt 2000
Svitávka 1	Gravettian	1180 \pm 50	GrA-13,711	Svoboda et al. 2002

to mid OIS 3. If they died out or retreated to Africa with the onset of cooler temperatures, then the pre-40,000-year-B.P. range of modern humans was, in effect, "African." Although based on the absence of evidence to the contrary, these data beg the question of why early modern humans were apparently restricted to an African ecological zone for >100,000 years.

After ca. 40,000 years B.P., early modern humans appear over a broader geographical area. They are present ca. 37,000 years B.P. at Nazlet Khater in northeastern Africa (Vermeersch 2002). They may have been at Ksar Akil in southwestern Asia ~35,000 years B.P. (Bergman & Stringer 1989). In northwest Africa, the Aterian (late Middle Paleolithic)-associated human remains from Dar-es-Soltane and Témara variably exhibit modern human features (see below). Yet, neither of them has radiometric dates, and dates on the Aterian (Débénath 1994, Wengler 1997) suggest ages that may extend after 30,000 years B.P.

The oldest evidence for early modern humans in Europe comes from the Peștera

cu Oase, Romania (Trinkaus et al. 2003b), where directly dated remains are ca. 35,000 years B.P. Interestingly, despite the presence of the Aurignacian technocomplex, long associated with modern humans, from western Asia to Atlantic Europe by ca. 37,000 years B.P. (Zilhão & d'Errico 2003), diagnostic and well-dated early modern human fossils are absent west of the Iron Gates prior to 32,000 years B.P. (Table 2). Moreover, only the central European Mladeč sample, possibly joined by the questionably diagnostic maxilla from Kent's Cavern, United Kingdom, provides directly dated evidence of early modern humans in central and western Europe prior to ca. 28,000 years B.P. They are joined by three later Aurignacian-associated immature mandibles and isolated teeth with variably reliable dates, of which only La Quina 25 has a stratigraphically associated radiocarbon date [ca. 32,000 years B.P. (Dujardin 2003)]. As a result, and in combination with the recent cleansing of the European early Upper Paleolithic human fossil record (Table 3), the European early modern human sample size has been reduced, and the use of archeological proxies such as

Robusticity: a relative value, indicating the strength of anatomical structures once they have been scaled to the appropriate measure of body size

Aurignacian: a phase of the early Upper Paleolithic of western Eurasia, dated approximately between 37,000 and 28,000 radiocarbon years B.P. Frequently used as a proxy for the presence of early modern humans, its authors are unknown for all but the terminal phases of the technocomplex.

Gravettian: a phase of the earlier Upper Paleolithic, principally in Europe, dated approximately between 28,000 and 20,000 radiocarbon years B.P. It is associated only with early modern humans.

the Aurignacian as an indication of modern human dispersals has been questioned (Conard et al. 2004, Henry-Gambier et al. 2004).

Most of the pre-20,000-year-B.P. human sample from Europe and western Asia, which has formed the basis for the biology of the earliest modern humans in the region, is either directly dated post-28,000 years B.P. (**Table 2**, including dates on associated burial items) and/or is stratigraphically associated with Gravettian technocomplexes (Zilhão & Trinkaus 2002). Only in areas where Neandertals survived to ca. 30,000 years B.P., such as southern Iberia (Hublin et al. 1995), have these remains had direct implications for the nature of the earliest modern humans in the region.

Early modern humans in southern Asia are scarce. The ca. 30,000-year-old Middle Paleolithic temporal bone from Darra-i-Kur, Afghanistan (Angel 1972), may represent an early modern human. Remains from Fa Hien and Batadomba lena, Sri Lanka (Kennedy & Deraniyagala 1989, Kennedy & Zahorsky 1997), are associated with ^{14}C dates ca. 25,000 to ca. 33,000 years B.P. and ca. 28,000 years B.P., respectively (Kennedy & Elgart 1998).

In the southeastern Old World, the oldest member of this group may be the immature skull from Niah Cave, Sarawak (Brothwell 1960). This specimen is dated to ca. 40,000 years B.P. using radiocarbon dating of the inferred overlying stratigraphic horizon (Barker et al. 2002). In addition, a human burial from Moh Khiew, Thailand, is dated to ca. 26,000 years B.P. (Matsumura & Pookajorn 2005) (**Table 2**). Other Late Pleistocene modern human remains from mainland and peninsular/insular southeast Asia include the Tabon remains at ca. 23,000 years B.P. (Fox 1970, Macintosh 1978), isolated teeth from Keo Leng between 20,000 and 30,000 years B.P. (Cuóng 1985), and the ca. 16,000-years-B.P. Tam Hang skeletons (Demeter 2000, Shackelford 2003). The Wajak fossils, once considered Late Pleistocene, are Holocene (**Table 3**).

The earliest Australian humans (all of which are morphologically modern) may extend back to ca. 40,000 years B.P. using OSL dating of sediments into which Lake Mungo 1 and 3 were buried (Bowler et al. 2003). However, the remains were surface finds on deflated dunes, and therefore they are no older than ca. 40,000 years and may be considerably younger. This interpretation is reinforced by a direct ^{14}C date on Lake Mungo 1 of ca. 17,000 years B.P. (Gillespie 1997). Other confidently dated Australian Late Pleistocene human remains are <20,000 years old. It remains uncertain whether the Lake Mungo 3 burial is between 20,000 and 40,000 years old or falls with the other Late Pleistocene Australian remains. Because the earliest human occupation of Australia was close to 50,000 years B.P. (Fifield et al. 2001, Gillespie 2002, Bowler et al. 2003), one can query which human groups were responsible for the pre-20,000-year-B.P. archeological debris. Were "modern" humans responsible for these earlier Australian sites or were there successive human dispersals into the continent?

On mainland eastern Asia, the oldest modern human remains are the mandible and postcrania from Tianyundong, China, directly ^{14}C dated to ca. 35,000 years B.P. (Tong et al. 2004; Shang H, personal communication). The immature long bones of Yamashita-cho, Okinawa, (Suzuki 1983) are associated with a ^{14}C determination of ca. 32,000 years B.P. There is a series of morphologically modern human remains with varying expressions of archaic features from Mongolia, China, and Korea, including Kumchon, Ryonggok, Sulawasu (Sjara-osso-gol, Ordos), Sangsi, and Ziyang, as well as Liujang (see above). These remains have been variously dated to >30,000 years B.P. (Woo 1958, Dong et al. 1982, Etlar 1996, Wu & Poirier 1996, Norton 2000). However, they either lack radiometric dates or are not clearly associated with such dates. None of them has a direct date. Classic east Asian samples of early modern humans, such as those from the Zhou-Kou-Dian Upper Cave and Minatogawa, postdate 20,000 years

B.P. (Suzuki & Hanihara 1982, Wu & Poirier 1995, Etler 1996), but there is a small sample of remains from China and Okinawa (e.g., Laishui and Pinza-Abu) that date to between 25,000 and 30,000 years B.P. (Sakura 1985, Etler 1996).

In Asia, only the Tianyundong, Lake Mungo 1, and Tam Hang specimens are directly ^{14}C dated. Luminescence determinations are available for Lake Mungo 3 (Thorne et al. 1999), but they contradict the geological maximum age for the specimen. Given the surprises when purportedly early Upper Paleolithic humans have been directly dated (Table 3), the need for direct dating of specimens within Holocene ranges of variation of human skeletal morphology should be apparent. Old field notes, confidence in the original excavator, and stratigraphic correlations with neighboring sites are not sufficient.

Therefore, the earliest candidates for modernity are African and date in excess of 150,000 years B.P. Except for a brief expansion into southwestern Asia, there is no reliable evidence for modern humans in Eurasia prior to ca. 40,000 years B.P. Modern human presence in Eurasia north of 30° to 35°N latitude appears later, starting $\sim 35,000$ years ago in southeastern Europe and China. In Europe they spread slowly westward and northeastward over several millennia. One can question the degree to which these patterns are due to the absence of evidence. However, the data suggest that early modern human dispersals paralleled in geographic pattern the gradual and irregular Early and Middle Pleistocene expansion of archaic *Homo* into higher latitudes and more challenging ecozones.

THE MODERNITY OF THE EARLIEST MODERN HUMANS

The Earliest Candidates

The oldest candidates for human modernity are those from Omo-Kibish, southern Ethiopia. Omo-Kibish 1 would be difficult to exclude from modern human status (Day

1972, Day & Stringer 1982, Kennedy 1984). The neurocranial vault is high and rounded, and it has both vertical and lateral parietal expansion. The supraorbital region shows separation of the medial and lateral portions, and despite some midline projection, it has little development of a midline supratotal sulcus. The mandible has a clear and prominent tuber symphyseos but little projection of the lateral tubercles. The mastoid process is long and prominent, and there is little development of a juxtamastoid eminence. The incomplete postcrania suggest a gracile limb skeleton, including a pilastric femoral midshaft. The apparent gracility, however, may be a reflection of an equatorial linear body form rather than any reduction in appendicular robusticity.

The Omo-Kibish 2 neurocranium has been considered a late archaic human (e.g., Bräuer 2004) on the basis of its lower vault, prominent nuchal torus, large nuchal plane, supraorbital torus, and medially sloping mastoid processes (Day 1972). However, if it is close in age to Omo-Kibish 1 (McDougall et al. 2005), these two specimens would reflect considerable intrapopulation variation.

The next oldest purported early modern humans are those from Herto, northern Ethiopia. White and colleagues' (2003) description, however, emphasized their mosaic of archaic African and modern human features, and they stated that the fossils "sample a population that is on the verge of anatomical modernity but not yet fully modern" (p. 745). The Herto remains exhibit relatively high and rounded neurocrania with parietal expansion, prominent parietal bosses, an occipital crest with a prominent external occipital protuberance, large and projecting mastoid processes, a modest juxtamastoid eminence (markedly shorter than the mastoid processes), and (in the juvenile Herto 5 cranium) a prominent frontal squamous with little indication of incipient supraorbital development.

Yet, Herto 1 has a prominent and medially thick supraorbital torus with a distinct supratotal sulcus, a wide interorbital breadth, a large and deep zygomatic bone, an

Juxtamastoid eminence: bony crest extending posteriorly and inferiorly medial to the mastoid process, on or adjacent to the occipitomastoid suture

Neurocranium: the portion of the cranium containing the brain, the special senses of the temporal region, and the blood supply to the brain

Supraorbital torus: a continuous ridge of bone above the orbits and interorbital area, exhibiting complete fusion of the superciliary arches, the orbital margin, and the lateral trigone

Suprainiac fossa: a transversely oval depression on the external midline of the occipital bone, just superior to the superior nuchal lines

Shovel-shaped central incisors: lingually (internally) concave incisors formed by the presence of lingual marginal ridges and frequently associated with large tubercles at the lingual base of the crown

Pilaster (femoral): distinct crest of bone along the posterior femoral midshaft, separated from the medial and lateral shaft by flat or concave surfaces and supporting the linea aspera

absolutely long facial skeleton, a broad palate, high temporal lines, and a long foramen magnum, all features that recall archaic humans. It therefore remains unclear to what extent the Herto fossils can be separated from preceding late Middle Pleistocene archaic African specimens (e.g., KNM-ER 3884, Laetoli 18, Irhoud 1). They may well represent a population on the “verge of anatomical modernity.” Yet, the same could be said of Omo-Kibish 1 and 2 if they were taken as a sample rather than focusing only on the more modern Omo-Kibish 1.

The similarly aged Singa 1 neurocranium has been described as having a mixture of archaic and modern features (McDermott et al. 1996, Bräuer 2004). It is “modern” in the reduction of the thickness of the supraorbital torus and its minimal projection at the midline. Yet, there is a supraorbital torus, interorbital breadth is pronounced, and the mastoid processes are small, nonbulbous, and bordered by clear juxtamastoid eminences. Moreover, the individual had congenital abnormalities (Spoor et al. 1998), some of which produced its rounded neurocranial shape. It does not provide secure evidence for early modern humans but may be part of the variable lineage represented by the Omo-Kibish and Herto fossils.

The next candidates for anatomical modernity are from Klasies River Mouth LBS and Mumba. The former are two incomplete maxillae (Bräuer et al. 1992), and the latter are three teeth (Bräuer & Mehlman 1988). They have been designated “modern” entirely on the small dimensions of the teeth or preserved alveoli. Because late Middle Pleistocene sub-Saharan African early modern human teeth are essentially unknown, with only the moderately large teeth of Herto 1 and 5 and one molar of Omo-Kibish 1 providing comparative data, this criterion for modernity must depend on comparisons with western Eurasian late archaic teeth, some of which are quite small. Moreover, there is considerable within-sample variation through the Middle and Late Pleistocene in the one region (Europe) pro-

viding a decent sample (Trinkaus 2004a). Any taxonomic assessment based on absolute dental dimensions is therefore tenuous.

These African remains are followed by the most informative sample of early modern humans, the two dozen associated skeletons, mature and immature, from Qafzeh and Skhul (McCown & Keith 1939, Vandermeersch 1981, Tillier 1999). These fossils have provided an abundance of paleontological data, but considerations of their modernity have focused on the degree to which they are distinct from the Neanderthals. The derived “modern human” traits in the Qafzeh-Skhul sample includes parietal expansion, occipital rounding, superior nuchal line morphology, suprainiac fossa absence, laterally bulbous mastoid processes, small-to-absent juxtamastoid eminences, horizontal zygomatic process above the auditory porous, distinct tuber symphyseos projection, anterior dental reduction in the context of considerable tooth size variation, absence of shovel-shaped central incisors, small thoracohumeral muscular attachments, variably straight radii, reduced carpal processes, small distal phalangeal tuberosities, relatively narrow anterior pelves, large femoral pilasters, and angular fibular diaphyses. In addition, many of the adults and all of the immature crania lack supraorbital torus development, even though Qafzeh 6 and Skhul 5 and 9 have modest supraorbital tori. Yet, noses are broad, interorbital breadths are large, facial lengths remain moderately long, and lower limbs are robust once scaled to their linear body shapes. And anomalously, they have gracile upper limbs and high femoral neck angles. Nonetheless, the overall pattern of the Qafzeh-Skhul sample is that of derived modern humans with a minority of retained archaic features.

Subsequent African Samples

The Qafzeh-Skhul fossils are followed by a series of small and incomplete samples from Africa, including cranial vault pieces from Aduma and Bourj; isolated teeth from

Blombos, Die Kelders 1, Pinnacle Point, and Sea Harvest; isolated phalanges from Die Kelders 1 and Sea Harvest; a larger sample from Klasies River Mouth SAS; and an immature skeleton from Taramsa Hill.

The Aduma and Bouri parietal bones (Haile-Selassie et al. 2004) appear to exhibit the parietal expansion of early modern humans. However, the Aduma 3 occipital bone has a transversely oval suprainiac fossa, a feature best known for European Neandertals (Hublin 1978) but also present on the Middle Pleistocene African archaic Eyasi 1 and the Pinza Abu east Asian early modern human (Sakura 1985, Trinkaus 2004b).

The southern African isolated teeth (Grine & Klein 1993; Grine 2000; Grine et al. 1991, 2000; Marean et al. 2004) tend to be moderately larger than those of recent Africans but are smaller on average than contemporaneous western Eurasian specimens; they fit morphologically with recent African ranges of variation, although the marked shoveling of the Pinnacle Point incisor is archaic. The Die Kelders middle-hand phalanges are undiagnostic, and the Sea Harvest distal phalanx, although lacking distal expansion (Grine & Klein 1993), could derive from an archaic human fifth digit.

The large and fragmentary Klasies River Mouth SAS sample has been seen as both "modern" and "archaic" (Singer & Wymer 1982; Rightmire & Deacon 1991, 2001; Smith 1993; Bräuer & Singer 1996; Churchill et al. 1996; Lam et al. 1996; Wolpoff & Caspari 1996; Pearson & Grine 1997; Grine et al. 1998). It may have some derived modern human features, such as the form of one supraorbital region and a temporomandibular articulation. However, some of the apparent modernity is related to the small teeth, a trait of uncertain significance. The small teeth are associated with small alveoli and give the impression of facial reduction despite the absence of complete mandibles or associated crania. An isolated zygomatic bone is large and robust. And despite some projection of the inferior mandibular symphysis in one patholog-

ical specimen, the three other mandibles with symphyseos have little or no projection of tuber symphyseos. Two incomplete forearm bones are archaic and unlikely to derive from early modern humans.

A persistent problem is the dearth of Middle Pleistocene archaic African remains to assess whether the Klasies River Mouth remains are "modern" or simply the southern African equivalent of late archaic humans. Global reduction in human facial robusticity is an earlier Late Pleistocene phenomenon, and the relatively short facial skeletons of later Middle Pleistocene sub-Saharan specimens, such as Florisbad 1, KNM-ER 3884, and Laetoli 18, suggest that facial retreat may have occurred earlier in Africa than in western Eurasia. Too often, the African Middle Stone Age fossils are assessed with respect to the Neandertals; the contrasts merely demonstrate that they are not Neandertals (not an issue of contention) but fail to determine their modernity.

The juvenile Taramsa Hill 1 partial skeleton from southern Egypt (Vermeersch et al. 1998) has supraorbital and neurocranial anatomy similar to the Qafzeh-Skhul sample. Yet, its teeth are large, and the facial size was large in correspondence.

The chronologically next relevant early modern human remains are those from Nazlet Khater II, Egypt (Thoma 1984, Crevecoeur & Trinkaus 2004). Nazlet Khater 2 is aligned with early modern humans, presenting a robust craniofacial skeleton without a supraorbital torus, a reduced facial length, prominent canine fossae, a distinct if moderately projecting tuber symphyseos, large and bulbous mastoid processes, small juxtamastoid eminences, parietal expansion, a rounded occipital squamous, a narrow nasal aperture, modest dental dimensions, little radial curvature, a proximally oriented ulnar trochlear notch, and a femoral pilaster. The robusticity of its mandibular corpus and the exceptional breadth of its mandibular ramus are unusual.

At about the same time period as the Nazlet Khater remains are the Aterian fossils from Dar-es-Soltane and Témara (Vallois &

Roche 1958; Ferembach 1976, 1998; Ménard 1998, 2002). They have dentitions that are reduced relative to the preceding late Middle Pleistocene remains of the region (Hublin & Tillier 1981) but are still moderately large. Témara 2 lacks a supraorbital torus and has a rounded occipital region, and Dar-es-Soltane 5 has some prominence of the tuber symphyseos, reduction of the nasal region, distinct canine fossae, and a high and rounded anterior neurocranium. Yet, Témara 1 lacks a chin, and Dar-es-Soltane 5 has a clear supraorbital torus and a relatively wide mandibular ramus. For their late OIS 3 age, they exhibit an archaic/modern morphological mosaic unusual in Africa.

The Earliest Modern Eurasians

The immature specimens from Ksar Akil and Niah Cave appear modern in morphology; the latter resembles Holocene Melanesian-Australian populations (Brothwell 1960, Bergman & Stringer 1989). However, given the lessons of direct ^{14}C dating of “archeologically secure” specimens (Table 3), any conclusions based on these remains are tentative.

The Tianyundong mandible has a projecting chin and a moderately gracile corpus (Tong et al. 2004), confirming its early modern human status, but further morphological information on the sample is not yet available. The Sulawasi remains provide a mix of modern human features, including absence of a supraorbital torus, a clear if nonprojecting tuber symphyseos, and a pilastic femur, which are accompanied by an archaic low frontal curvature (Woo 1958, Dong et al. 1982). However, their uncertain geological age makes their significance unclear. The Yamashita-cho immature long bones (Suzuki 1983, Trinkaus & Ruff 1996) are modern in their high femoral neck angle and incipient pilaster. The more recent Laishui and Pinza-Abu remains present a prominent supraorbital region in the former (Etler 1996) and a nuchal torus with a distinct suprainiac fossa in the latter (Sakura 1985). Even the later Minatogawa

and Zhou-Kou-Dian Upper Cave crania, as well as the Liujiang specimen, appear relatively archaic although not particularly close to earlier African and southwest Asian remains (Hanihara 1994).

The Moh Khiew 1 partial skeleton provides a facial and dental morphology similar to robust recent Melanesian-Australian remains (Matsumura & Pookajorn 2005), an interpretation that applies to the younger Tabon and Tam Hang remains (Fox 1970, Macintosh 1978, Demeter 2000) as well as the Niah Cave 1 skull. The earliest south Asian modern humans, from Fa Hien and Bata-domba lena, are aligned with later south Asian populations and secondarily with Melanesian-Australian groups (Hawkey 2002).

The earliest Australian human remains fall within the Holocene range of variation of native Australians. Late Pleistocene remains from Australia provide a considerable range of variation in craniofacial robusticity (Thorne 1971, 1976; Bowler & Thorne 1976; Brown 1989; Webb 1989; Thorne et al. 1999; Hawks et al. 2000); the Lake Mungo 1 and 3 specimens fall at the gracile end of that range of variation. In addition, Lake Mungo 3 has linear (or tropical) body proportions, more so than late Holocene populations of southern Australians (Lindsell 2001).

The European early modern humans at least 28,000 years old exhibit parietal expansion, clear parietal bosses, absence of nuchal tori with variable development of an external occipital protuberance, large and laterally bulbous mastoid processes, superiorly positioned and horizontal temporal zygomatic processes, reduced nasal breadths, some facial shortening, angled zygomatic bones with clear canine fossae, a projecting tuber symphyseos, reduced upper limb muscularity, and formation of a femoral pilaster (Szombathy 1925; Rainer & Simionescu 1942; Vallois 1958; Nicolăescu-Plopșor 1968; Frayer 1986; Garralda et al. 1992; Trinkaus et al. 2003a,b, 2005a,b; E. Trinkaus, personal observations). Although most of these crania ($N = 6$) lack a supraorbital torus, one is present on

Cioclovina 1. In addition, the preserved nasal apertures appear tropical in their lack of a clear angulation of the inferior sill (Franciscus 2003, Trinkaus et al. 2003a), and biomechanical scaling of the Mladeč limb remains indicates linear bodies (Trinkaus et al. 2005b); both features support substantial and relatively recent tropical (probably African) ancestry.

Yet, these specimens exhibit a variably present suite of archaic human features, including low temporal squamous profiles, prominent juxtamastoid eminences, broad interorbital breadths, large dental arcades, exceptionally large third molars, broad mandibular rami, mandibular corpus robusticity, and variable maxillary incisor shoveling. These morphological attributes are generally present among late archaic humans, but they are largely absent from the sample that best characterizes the modern human ancestors of the European early modern humans: the Qafzeh and Skhul remains. Only one feature appears to be distinctly Neandertal, the unilateral bridging of the mandibular foramen on Oase 1, although it is possible to find most of these other archaic aspects among the Neandertals. The broad mandibular ramus of Oase 1 is found among contemporaneous north African remains, especially Nazlet Khater 2, and not among the Neandertals.

The subsequent post-28,000-B.P. Gravettian human sample of Europe includes numerous associated skeletons (**Table 2**) (Zilhão & Trinkaus 2002). Most of these specimens are fully modern in their morphology, and there is a persistence in them of both linear (equatorial) limb proportions and more “African” nasal morphology (Trinkaus 1981, Holliday 1997, Franciscus 2003). However, one Iberian specimen (Lagar Velho 1) exhibits Neandertal limb segment proportions and a series of relatively archaic cranial and postcranial features (Trinkaus & Zilhão 2002). In addition, central incisor shoveling, ubiquitous among the Neandertals, absent in the Qafzeh-Skhul sample, and variably present in the earlier European sample, persists at modest frequencies.

And scapular axillary border dorsal sulci, an apparently Neandertal feature also absent in the Qafzeh-Skhul sample, is present (Trinkaus 2005).

Summary

1. The earliest candidates for human anatomical modernity, those between ca. 150,000 and 195,000 years B.P. in Africa, are best considered as bridging a morphological gap between late archaic and early modern humans.
2. The earliest clear candidates for morphological modernity are from east Africa or an ecozonal extension of it.
3. The southern African OIS 5 and 4 humans have a mix of archaic aspects, considerable variability, and a few possibly derived modern features. They are best considered as southern African late archaic humans or possibly (see Lam et al. 1996) the product of gene flow from eastern African early modern humans.
4. The spread of modern humans throughout Africa and into Eurasia occurred after 50,000 years B.P. and probably after 40,000 years B.P., 100,000 years after their appearance.
5. The oldest modern humans in south and southeast Asia and Australasia are similar to Holocene human populations from that region, and the earliest modern humans between 40,000 and 25,000 years B.P. in the circum-Mediterranean world are clearly less “modern” than the name implies. Although exhibiting suites of morphological features that classify them as early modern humans, these remains—from Dar-es-Soltane and Témara in Morocco, to Nazlet Khater in Egypt, to Cioclovina, Muierii, and Oase in Romania, to Mladeč in the Czech Republic, to Les Rois in France, to Lagar Velho in Portugal—present varying combinations of archaic features. As with some of the sub-Saharan African fossils,

Assimilation model (of modern human emergence):

phylogenetic scenario in which modern humans emerged from late archaic humans in one region of the Old World and then subsequently dispersed into the remainder of the Old World, assimilating (absorbing) other regional populations of late archaic humans

they are “modern” without being fully modern.

6. Even though the early modern human fossil record for eastern Asia prior to 20,000 years B.P. is small and variably well dated, early modern east Asians exhibit a mix of modern, archaic, and regional features that are reminiscent of the better-documented situation in the circum-Mediterranean world.

PHYLOGENETIC CONCERNS

Two dozen years ago, human paleontologists suggested that modern humans originated in equatorial Africa and subsequently expanded into at least western Eurasia and the remainder of Africa, variably absorbing regional late archaic human populations in the process (Trinkaus 1981, Bräuer 1982). After two decades of debate, the field has come to the consensus that modern humans originated in equatorial Africa and subsequently expanded into Eurasia and the remainder of Africa, variably absorbing regional late archaic human populations in the process (e.g., Hublin 2000, Relethford 2001, Wolpoff et al. 2001, Templeton 2002, Trinkaus & Zilhão 2002, Holliday 2003, Bräuer 2004, Bräuer et al. 2004, Pearson 2004). This is known as the assimilation model (Smith et al. 1989).

Versions of the assimilation model have remained contenders for the interpretation of modern human phylogenetic emergence, if frequently overshadowed by the more polarized regional continuity (with gene flow) and (out of Africa with) replacement scenarios. The last two interpretations are finally intellectually dead. Both are contradicted by available evidence, and it is time for the discussion to move on. Yet, despite the general acceptance of some form of the assimilation model, issues remain.

What Is the Question?

When it became recognized that modern humans probably had a single evolutionary

emergence in Africa and subsequently dispersed outward, the phylogenetic question was, what were the population dynamics (blending, absorption, competition, avoidance, etc.) as those early modern humans encountered regional groups of late archaic humans? In recent years, as the ambiguities inherent in interpreting human phylogeny during the Late Pleistocene have become apparent, the question has shifted. The issue has increasingly become whether one can perceive the ancestry of non-African late archaic humans (especially of the Neanderthals) in the biology of living humanity. This is not a question addressing the evolutionary processes involved in the emergence of modern human biology. This is a question regarding the evolutionary purity of living humanity.

This second question confuses the human population dynamics of 30–100 millennia ago with the complex human population history of the past 30 millennia. Given the human demographic dynamics associated, minimally, with the climatic and ecozonal changes of the last glacial maximum (OIS 2), the development and spread of food-producing societies, the rise and interaction of complex societies, and the globalization of the human population during the past two millennia, it remains curious how one can even pose the second question. The only justification would be a macroevolutionary approach in which all past and present “modern” humans are perceived as the same; such a perspective is typological and irrelevant to the populational processes involved in the establishment of modern humanity.

For these reasons, the phylogenetic question here concerns solely the human populational dynamics of OIS 6 to OIS 3. It was then that modern humans emerged, dispersed, and became established. The question can be therefore rephrased to ask, to what extent can the early modern human paleontological record and other data help refine the regional biological, behavioral, and chronological details of the assimilation model?

Genetic Ambiguities

A plethora of analyses [for reviews, see Relethford (2001) and Pearson (2004)] of extant human genetic variation have been relatively uniform in placing the emergence of modern humans within Africa and considering it to have occurred sometime in the later Middle Pleistocene or earliest Late Pleistocene. Most of the analyses have argued for a uniquely African origin for living human genetic diversity, although a significant minority has acknowledged some non-African ancestry for current Eurasian genetic variation (Relethford 2001, Templeton 2002, Pearson 2004). Most of these studies have contributed little to our understanding of the phylogenetic processes of modern human emergence.

The analyses of extant human molecular data generally have little biologically relevant statistical power (whatever probability values their statistical computations may generate); most analyses use analytical algorithms whose biological assumptions and appropriateness are unstated, untested, and frequently untestable; many assume demographic stability over the past 50,000–200,000 years (see above); most consider the human population dynamics of the past 30 millennia to have been trivial; many use distance statistics and graphic techniques (such as dendrograms), which deny the reticulate nature of human population evolution (hence assuming replacement); a number of them invoke molecular clocks whose reliability and precision within the time period of concern is undemonstrated and/or whose calibration (based on the fossil record) is simply wrong; and many employ living human samples of opportunity when those samples have biases relative to the issue of modern human origins. And finally, all of them have a real-time depth of perhaps a century, and the interpretations based on those data are dependent on their analytical assumptions. This last point is evident in the large number of articles concerned more with the analytical techniques and their

assumptions than with interpreting the available data.

These considerations of living human molecular data have been joined by interpretations of limited quantities of mitochondrial DNA (mtDNA) extracted from a modest number of Neandertal and Upper Paleolithic European fossils (e.g., Krings et al. 1997, 1999, 2000; Ovchinnikov et al. 2000; Schmitz et al. 2002; Caramelli et al. 2003; Serre et al. 2004). These aDNA analyses have demonstrated only that some Neandertals had mtDNA sequences outside the documented range for living humanity, not a surprising result given the anatomical differences.

The aDNA is compatible with both replacement and assimilation scenarios (Nordborg 1998; see also Wall 2000, Gutiérrez et al. 2002, Serre et al. 2004), and we are not likely to ever have sufficient reliable Neandertal or early modern human aDNA to distinguish between replacement and a more-than-trivial level of admixture (Wall 2000, Cooper et al. 2004). Rejection of only a couple of the purported early modern human aDNA sequences in Europe [only two of which, from Mladeč, are within 5000 years of the time of potential admixture, and their poor organic preservation (Wild et al. 2005) places their antiquity in question] would make it impossible to reject a null hypothesis of Neandertal–early modern human population blending (Cooper et al. 2004).

Combined with the low success rate in obtaining aDNA from Late Pleistocene European fossils (Serre et al. 2004, Pääbo et al. 2004) and the poor organic preservation in bone from much older or lower-latitude samples (Reed et al. 2003, Smith et al. 2003), sample sizes or an appropriate spectrum of samples are unlikely to be available to sort out the pattern of human aDNA in time and space in the Middle and Late Pleistocene. Moreover, despite careful screening of samples for organic preservation, handling of specimens to reduce contamination, and occasional independent lab confirmation (see Cooper &

aDNA: ancient DNA

mtDNA: mitochondrial DNA

Poinar 2000, Pääbo et al. 2004), the only reliable criterion for determining the presence of endogenous Late Pleistocene aDNA is a sequence contrast with living humans (Krings et al. 2000, Beauval et al. 2005). As a result, any Neandertal aDNA within extant human ranges of variation is excluded as contamination (thereby potentially biasing the Neandertal sample), and acceptance of early modern human aDNA as ancient becomes a plausibility argument based on preservation (Krings et al. 2000, Serre et al. 2004). It also remains uncertain to what extent diagenesis could affect the sequences (Willerslev & Cooper 2004).

Consequently, it appears uncertain whether recent and/or Pleistocene human DNA will have the resolution and reliability to provide insight beyond being compatible with some version of the assimilation model.

Evidence from the Past

Despite the limitations of the human fossil record, which involve small sample sizes, dating uncertainties, fragmentary material, uneven temporal and geographic distributions, and ambiguities regarding the phylogenetic valences of morphological features, the fossil record has some ability to document Late Pleistocene human biology in time and space. What emerges from the early modern human fossil record is a model in which modern humans originated in equatorial Africa and subsequently expanded into the remainder of Africa and into Eurasia, variably absorbing late archaic human populations in the process.

Eastern Africa is the geographical region that provides the best evidence for both the earliest modern humans and for a relatively continuous morphological transition from late archaic to early modern humans. This sample is followed closely by the early modern humans at Qafzeh and Skhul. The OIS 5 remains from southern Africa are best seen as regional late archaic humans, perhaps influenced by a dispersal with admixture of

early modern humans from eastern Africa. In north Africa, Nazlet Khater 2, although basically modern, has archaic features in the facial skeleton, and the human remains from the Aterian of northwest Africa exhibit a complex mosaic of archaic and modern human features.

In south Asia to Australia, the Fa Hien, Moh Khiew, and Lake Mungo 3 fossils, plus the younger Batadomba lena, Tabon 1 and Tam Hang remains, exhibit morphological affinities to later Pleistocene and Holocene south Asian and Melanesian-Australian populations. Yet, their relative gracility and the temporal gap to the closest regional late archaic humans, the later Middle Pleistocene Narmada and Ngandong fossils, make arguments of direct ancestry difficult to evaluate. However, the abundance of OIS 2 cranio-facially robust early modern humans within Australia, samples lacking affinities to the Qafzeh-Skhul or earlier African samples, suggests that the human population dynamics within Australia and the neighboring regions of south and southeast Asia can be explained only with a substantial degree of regional genetic continuity. The east Asian early modern human sample further north presents an additional mix of modern human features with variably present, more archaic features.

Several points have emerged from a century of debate concerning the spread of modern humans in western Asia and Europe after 40,000 years B.P. The Neandertals represent a morphologically distinct group of regional late archaic humans, although it is principally the frequencies of traits shared with other human groups and/or the constellations of those traits that distinguish the Neandertals. The earliest modern humans in this region are overwhelmingly "modern" in their morphological patterns, and a couple of their features indicate African affinities. Yet, these early modern humans variably present features that either are known only for the Neandertals among their temporal and geographical neighbors and/or are archaic features lost among the principal candidate for their ancestry, the Omo-Kibish, Herto,

and Qafzeh-Skhul sample. The specifically Neandertal features include the mandibular foramen bridging of Oase 1 and the limb segment proportions of Lagar Velho 1. The other archaic features could be the result of the early modern humans dispersing into Europe variably absorbing local Neandertal populations. Alternatively, these archaic human features could have been part of the early modern human biology that was spreading into Europe after 40,000 years B.P.; in that case, there must have been significant admixture between the descendants of the earlier (OIS 5) modern humans and late archaic humans in north Africa and/or southwestern Asia.

In summary, a consideration of the morphological patterns and the distributions in time and space of the earliest candidates for modernity in the human fossil record indicates a general scenario of an initial east African emergence of modern humanity, followed by dispersals with admixture within Africa and subsequently across Eurasia. This is the assimilation model. The degree to which late archaic humans were absorbed into early modern human populations remains ambiguous for most of the Old World. It may very well be, as stated 20 years ago (Trinkaus 1984), that once some degree of blending of late archaic and early modern human populations is acknowledged, the degree of that admixture will be beyond resolution. Yet, the ubiquitous evidence among early modern humans for some level of admixture with regional late archaic human groups outside of eastern Africa indicates that assimilation was neither rare nor trivial. It was the geographically dominant pattern.

A FEW FINAL THOUGHTS

If the field can acknowledge the inherent ambiguities of the fossil record and accept some version of the assimilation model presented here, it may be possible to proceed to more profitable questions and directions.

Detailed description and analysis of a number of early modern (and late archaic) human

fossils can fill in some of the current gaps. And these analyses, as well as those of better-known remains, need to be fully paleobiological, and not focused merely on morphological affinities, ancestry, and taxonomy. Chronological questions will remain for some of these samples. Yet, the chronological frameworks for early modern humans have improved immensely during the past decade, and continued efforts can only help.

The archeological associations of most early modern humans have been generally accepted, but the recent cleansing of the European Aurignacian fossil record has raised questions about who was responsible for which archeological complex. As a result, it is no longer appropriate to use archeological complexes as proxies for human biological groups or inferred human taxonomy as a surrogate for modern human behavior. The equating of human morphological groups with Paleolithic technocomplexes was rejected by 1980 with the recognition of the modernity of the Middle Paleolithic Qafzeh and Skhul samples and the discovery of the initial Upper Paleolithic Saint-Césaire Neandertal skeleton. It is therefore time to cease searching for the “modern” behavior of “modern” humans and the “archaic” behavior of “archaic” humans.

There has been little consideration of the biological implications of what we perceive as mosaic morphology. These were functioning organisms. The combinations of features observed paleontologically must have been biologically integrated to some degree. Thus, the mosaics can be investigated profitably in terms of their paleobiological implications.

Finally, this discussion begs the question of why the modern human biological pattern became dominant in the Late Pleistocene. Despite efforts to shed light on this question, as opposed to taking it as inevitable, it has been difficult to substantiate adaptive advantages of modern human biology with respect to those of late archaic human biology. Moreover, the current chronology of modern

human emergence and dispersal shows that the earliest modern humans remained ecogeographically constrained for 100,000 years and then took thousands of years to absorb late archaic people in areas as small as the Danube basin. Whatever those adaptive advantages were, they were subtle and will be difficult to tease from the human paleontological record and the complex associations of human biology with technotypological phases of the Late Pleistocene archeological record.

The paleoanthropological study of modern human emergence therefore has reached the point where there is a general framework and some consensus on the population dynamics of the process. This framework has emerged from several decades of human paleontological research. It is hoped that we have now reached a watershed in which we can shift attention to the paleobiology of the early modern humans, those modern humans who were not quite “modern” and were all the more interesting for it.

SUMMARY POINTS

1. The earliest candidates for modernity are east African and date to between 150,000 and 195,000 years B.P. They present a mix of late archaic and early modern human anatomical features, and they are therefore best seen as documenting the transition in that region to early modern humans.
2. Despite a brief range expansion into extreme southwestern Asia and possible gene flow into southern Africa, there is no evidence for a dispersal of early modern humans prior to 50,000 to 40,000 years B.P. Moreover, the expansion into Europe and mid-latitude Asia took place after 40,000 years B.P.
3. The early modern human remains prior to 25,000 years B.P. and outside of east Africa/southwest Asia exhibit complex and varying mosaics of early modern, late archaic, and regional anatomical features. Only some of the European early modern human remains possess features that can be considered African, indicating the early appearance of regional diversity with the spread of modern humans and regional ancestry in those early modern human populations.
4. The human paleontological data for early modern humans generally supports an assimilation model, in which expanding populations of early modern humans variably absorbed regional late archaic human groups. Past and present human molecular data are compatible with this interpretation but are not able to resolve it further.

FUTURE DIRECTIONS/UNRESOLVED ISSUES

1. The state of adequate published paleontological description of most early modern human and many late archaic human fossils, even for the time periods in which they were discovered, is pathetic. A concerted effort needs to be made to integrate fully the morphology and paleobiology of the known sample into the field. Scholars who control access to fossils and are unable or unwilling to provide these descriptions should invite other qualified paleontologists to undertake the task.
2. The field has made major advances in resolving the chronological framework of Late Pleistocene humans, and this work is ongoing. A concerted effort needs to be continued, especially with the direct dating of human remains when geochemically feasible.

3. The field remains focused primarily on four small regions of the Old World: central and western Europe, extreme southwestern Asia, eastern Africa, and south Africa. The Late Pleistocene of the remaining portions of the Old World needs additional attention, a process which has started and should continue.

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