Already Out-of-Africa Before Out-of-Africa?
Annual Reflection on Archaeology and Genetics

***Mother Tongue: Journal of the Association for the Study of Language in Prehistory* XVIII, 2013: np.**

AUTHOR'S PRE-PRESS COPY

(TABLE 1 has revised datings, Post-*Mother-Tongue*-Submission after reading Mishra, Chauhan and Singhvi 2013)

James B. Harrod

Abstract

New archaeogenetic and archeological studies imply that the mtDNA biological clock requires rescaling and may have serious validity problems and branches of the out-of-Africa mtDNA phylotree itself may need to be realigned. Middle Paleolithic *Homo sapiens sapiens* dispersed with 'modern' symbolic behavior by MIS 5e ~120,000 years ago, 40,000 years before the emergence of L3-mtDNA. Drawing on mtDNA studies, I hypothesize a new paradigm: 'already out of Africa before out-of-Africa'.

By 120,000 years ago (MIS 5e/d), early *Homo sapiens sapiens* spread from the Mahgreb to the Levant, and may have had L2'3'4'6 mtDNA. By 100,000 years ago (MIS 5c/b) these Mahgreb-Levantine cultures evidence even more extensive symbolic behavior and Tabun-C culture covers most of northern SW Asia. They may correlate to L3'4'6 and L3'4 mtDNA. By 80,000 years ago (MIS 5a) Tabun-C culture was in decline and displaced by the arrival of Neanderthals. L3 could have emerged in a homeland in East Africa, North Africa or even the Levant. After a pause of 5,000 years N, M and R-mtDNA emerged around 69-74 ka at the MIS 5a to MIS 4 transition. Apparently, N moved northward out of SW Asia into Eurasia and appears correlated to Dené-Caucasian languages and M emerged in India or beyond and appears correlated to Eurasiatic languages. R clades migrated all the way to SE Asia/Sahul along with some N clades and this seems to correlate to the Austric and Pama-Nyungan language families. Later in SW Asia R→U clades; some remained in SW Asia and others spread to Europe, North Africa, and South Asia; they possibly correlate to early forms of Semitic, Dravidian and Kartvelian. Notions of a 'fast track' to Australia and drawing a single or even a couple of arrows from East Africa to Australia are no longer tenable.

Broken Clock

It appears that genetic studies published in 2012 have yielded results that are stunningly self-contradictory and have put the field of out-of-Africa mtDNA archaeogenetics and archaeology in disarray. They call into question a decade of findings. The new studies have caused me to reconsider a tentative inference I made in the 2011 issue of *Mother Tongue* that there were multiple diffusions from Africa. In this paper I review selected studies and offer a new hypothesis: 'Already Out-of-Africa Before Out-of-Africa'.

As I noted last year, Soares, Ermini et al (2009) provides a global overview of mtDNA phylotree and the most up-to-date molecular clock dating procedures for determining the

major haplogroups TMRCAs for the entire tree. It adheres to the view that L3-mtDNA remained in Africa and N and M diffused to SW Asia, while reducing the TMRCA to ~72 ka.

- Soares P, Ermini L, Thomson N, Mormina M, Rito T, Röhl A, Salas A, Oppenheimer S, Macaulay V, Richards MB. 2009. Correcting for purifying selection: an improved human mitochondrial molecular clock. *American Journal of Human Genetics* 84(6): 740-59.

Stephen Oppenheimer (2012a) argues that Soares, Ermini et al (2009) as still the 'gold standard' and sticks to L3-mtDNA emergence in Africa ~71.6 ka and South Asia N ~71.2 ka and M 49.4 ka and excludes any Eemian exit as lacking progeny (778). Oppenheimer (2012b) acknowledges that modern humans first dispersed circa 125 ka and may have spread via Arabia to the Far East at the same time, but there is "no evidence of surviving non-African DNA lineages dating from anywhere near the Eemian." Because of the lack of fossil evidence and disputed genetic dates with wide confidence intervals, there is as yet no definitive exit date, but all non-African uniparental lineages derive from L3 as a single group by the southern route, likely via Yemen. Since M and N are 4 and 5 mutations away from African L3 there was a long period of drift and extinction in both lineages after the founding event, with 10,000 years implied by the Soares et al (2009). Oppenheimer notes that two clades of L3 and M and N share a transition at position 195, and this would recalibrate M and N to same time period as L3 around 72 ka.

- Oppenheimer S. 2012a. Out-of-Africa, the peopling of continents and islands: tracing uniparental gene trees across the map. *Philosophical Transactions of the Royal Society of London B Biol Sci.* 367(1590): 770-84.
- Oppenheimer, S. 2012b. A single southern exit of modern humans from Africa: Before or after Toba? *Quaternary International* 258: 88-99.

With respect to corroborating the late 72 ka out-of-Africa date in relation to East and SE Asian fossils and rejecting an Eemian exit, Oppenheimer (2012a,b) excludes Zhirendong, South China, on morphological grounds, a 'robust between early modern *Hss* and late archaic *Hs'* and possibly 'as the authors suggest hybridisation'. [Liu, Jin et al (2010) found U-series age 106±7 ka consistent with faunal remains and compare morphological measurements of mandible and dental features variably close to a range of human groups from archaic *Homo sapiens* to Skhul/Qafzeh and Sub-Saharan MSA.] I wonder if this is a bias against 'robustness'? Oppenheimer (2012b) also discounts an *Hss* fossil from Callao, Luzon, U-series minimum 66.7±11 ka (Mijares, Détroit et al 2010) arguing that morphologically the species designation is unclear. [Mijares et al state their morphological analysis shows definitely small-boded *Homo*, such as *H. habilis* and present-day Negritos.]

Soares, Alshamali et al (2012)—with mostly the same research team as 2009 minus Oppenheimer—reanalyzed African mtDNA samples and this resulted in a further lowering of the genetic age of 'expansion' of L3 to 65±5 ka "virtually ruling out a successful exit before 74 ka, the date of the Toba volcanic supereruption in Sumatra."

- Soares P, Alshamali F, Pereira JB, Fernandes V, Silva NM, Afonso C, Costa MD, Musilová E, Macaulay V, Richards MB, Cerny V, Pereira L. 2012. The Expansion of mtDNA Haplogroup L3 within and out of Africa. *Molecular Biology and Evolution* 29(3): 915-27.

This study (Fig. 1) actually gives age estimates for N-mtDNA 61.9 ka and M-mtDNA 60.5 ka, and the map (Fig. 5) shows date M and N exodus 'out-of-Africa' over the Bab-al-Mandeb 55-65 ka. Focused on Africa it does not comment on southern Asian archaeology, which, I suggest, appears to contradict such a low date for out-of-Africa and would appear to be an objection to Oppenheimer's sticking to the ~72 ka date for out-of-Arica.

Adding to the upheaval in out-of-Africa modeling, Soares, Alshamali et al (2012) make no reference to archaeology in SW Asia other than Skhul/Qafzeh and now argue for decoupling evidence of symbolic behavior from L3-M-N mtDNA dispersal out-of-Africa.

In their discussion, Soares, Alshamali et al (2012) suggest a possible alternative to the their inference of 55-65 crossing of the Bab, namely a North African origin of L3, only to rule it out based on the results of their proposed dating of L3.

> "There is an intriguing possible rider to this conclusion. North Africa has been entirely depopulated and repopulated, at least with respect to mtDNA variation (Pereira et al. 2010), since the time of the Aterian industry, where modern symbolic behavior is attested very early, similar to Southern Africa and in contrast to Eastern Africa (Barton et al. 2009). We might therefore contemplate a possible North Africa ancestry for L3, with its rapid radiation corresponding to an early range expansion into Eastern Africa. However, any potential dispersal between the Mediterranean and the Horn of Africa around the time of the MIS4/3 transition would face severe environmental difficulties, unlike the ''green Sahara'' conditions of MIS5 and the early Holocene (Drake et al. 2011). We therefore conclude that an indigenous origin for L3 in Eastern Africa remains by far the most likely scenario" (924).

It seems to me that this caveat ignores the obvious fact that the same "severe environmental difficulties"—namely severe drought conditions—that might inhibit L3 diffusing from North Africa to East Africa occurred in SW Asia at the same time. If so, then by this Soares argument out-of-Africa by the Bab would be an equally unsupportable inference. I sense the desperation of those still holding on to a broken mutation clock.

Broken Branch

Given the conflicting archaeogenetic studies on L3-M-N out-of-Africa, I took a closer look at how the studies identify the SNPs used to define L3. Oppenheimer (2012) and Soares, Ermini et al (2009) and Soares, Alshamali et al (2012) and Behar and van Oven et al (2012) all state that they are using the international standard van Oven and Kayser (2009) and their revised Phylotree Builds (which have the same L3 SNPs from the 2009 build to present), namely SNPs 769, 1018, 16311). While Behar and van Oven et al (2012) use these SNPs, Soares, Ermini et al (2009) and reiterated Oppenheimer (2012a,b) has phylotree L3 (SNPs 766, 1018, but not 16311)→L3+195→L3subclades including M and N. Oppenheimer (2012b) includes M and N and 'two other clades' under SNP 195. Soares, Alshamali et al (2012, Supplementary Material) defines L3 by SNP 16233, apparently a change from (2009), and with no reference to L3+195 and has 195 scattered across over a dozen subclades of L3.

To my mind this raises doubts about what exactly the phylotree branches are for L3 and its ancestors and subclades. In the section next Behar and van Oven et al (2012) note clock violations around L3 and to my mind this raises further doubt about the Phylotree. I

would hope that future research studies by archaeogeneticists might deal with the discrepancies, which I presume affect the reliability of their phylotree and TMRCA dating that depends on it.

Broken Clock Again

Three 2011 and 2012 studies have seriously called into question the Soares et al 'gold standard' mtDNA mutation clock used to calculate the TMRCAs of haplogroups for out-of-Africa. Langergraber, Prüfer et al (2012) using revised generation spans for chimpanzees and humans calculate the chimpanzee/human divergence (CHCLA) at between 7 to 13 mya. In this light they rescaled four prior studies to show—by my calculation—an average split time (low) 7.71 mya to (high) 12.55 mya.

- Langergraber KE, Prüfer K, Rowney C, Boesch C, Crockford C, Fawcett K, Inoue E, Inoue-Muruyama M, Mitani JC, Muller MN, Robbins MM, Schubert G, Stoinski TS, Viola B, Watts D, Wittig RM, Wrangham RW, Zuberbühler K, Pääbo S, Vigilant L. 2012. Generation times in wild chimpanzees and gorillas suggest earlier divergence times in great ape and human evolution. *Proceedings of the National Academy of Sciences USA* 109(39): 15716-21.

Soares et al (2009) used the then best chimpanzee/human divergence date of 6.5 mya + 0.5 mya for coalescence date = 7 mya. If we round up the new CHCLA ~8 mya + 0.5 mya for coalescence = 8.5 mya, that yields a multiplier of 1.2, which can be applied to Soares et al haplogroup TMRCAs. Applying this multiplier would raise Soares' 65 ka TMRCA date for L3 to around 80 ka.

Scally and Durbin (2011) show how next-generation and nuclear DNA sequencing, as opposed to the traditional method of sequencing a small mtDNA reference section, reveals a slower than expected genome mutation rate, which increases the timescale of human evolution. They rescale estimates of the nuclear DNA divergence between Africans and non-Africans, putting this date at 100-120,000 years ago.

- Scally A, Durbin R. 2012. Revising the human mutation rate: implications for understanding human evolution. *Nature Review Genetics* 13(10): 745-53.

If so, this would appear to decouple genetic 'out-of-Africa' from the diffusion of L3, and do so even with a CHCLA rescaled Soares date of 80 ka.

To cap the archaeogenetic chaos of the last year, Behar, van Oven et al (2012) begin what they term a 'Copernican re-assessment'; they re-orient reconstruction of the *Homo sapiens sapiens* phylotree to an Africa-based reference sequence as opposed to the Cambridge sequence which belongs to haplogroup H2a2a. This requires re-counting mutations along the phylotree branches, which affects some, though not all, prior date calculations.

- Behar DM, van Oven M, Rosset S, Metspalu M, Loogväli EL, Silva NM, Kivisild T, Torroni A, Villems R. 2012. A "Copernican" reassessment of the human mitochondrial DNA tree from its root. *American Journal of Human Genetics* 90(4): 675-84

At the same time, they demonstrate that use of a continuous mutation rate molecular clock for mtDNA, such as that used by Soares, cannot pass a basic test of statistical validity. Further, when Behar does apply the continuous rate clock 'for the sake of sheer interest' it yields multiple clock violations (child clades older than parent clades), including—and alas for out-of-Africa hypotheses—clock violations between L3'4 and its two branches L3 and L4. (Apparently adding to the problem, As I noted in previous section, Behar, Soares 2009 and Soares 2012 use different SNP mutation definitions for L3 though stating in their narrative they are using the van Oven and Kayser Phylotree.)

> Behar, van Oven et al (2012) **L3'4'6** 71±6 ka → **L3'4** 64±5 ka → **L4** 79±7 ka (older than grandparent) and **L3** (SNP 769, 1018, 16311) 67±4 ka (older than parent); x 1.1 = 74 ka
> Soares, Ermini et al (2009) **L3'4'7'6** (L3'4'6 not in Soares phylotree) 105±24 ka → **L3'4'7** (L3'4 not in Soares phylotree) 86±20 ka → **L4** (does not date) and **L3** (SNP 766, 1018) 71.6±15 ka; if 72 ka x 1.1 = 79 ka
> Soares, Alshamali et al (2012) [L3 SNP 16223] **L3** 65±5 ka, but earliest clade L3h = 66 ka! For what its worth, if we eliminate the outliers for L3'4'6('7) and L3'4, namely 105 ka and 64 ka, then the range for that cluster is 71 to 86 ka. Similarly, if we take the four L4 and L3 dates and eliminate their outliers (65 and 79 ka) the range for that cluster is 67 and 72 ka, average 69.5 ka, which if x1.1=78 ka, or x1.2 = 83 ka. If average all four dates, 71 ka x 1.1=78 ka or x1.2 = 85 ka. Or if only use Soares, Alshamali et al (2012) 'expansion' date 65 or L3h 66, then x1.1= 72/73 ka, or if x1.2=78/79 ka. To be conservative I will use the Soares, Ermini et al (2009) date of 72 ka, presumably the coalescence date prior to expansion, x1.1=79 ka.

The most extreme TMRCA clock violations occur with respect to the M branch of L3—M diffused across South Asia, SE Asia, Central and E Asia—implying it must have had significantly variable rates of mutation over the course of its evolution. (I wonder if Toba might also play a role in the clock violations.)

In sum, as of 2012 the field of out-of-Africa archaeogenetics seems in deep disarray. One can only wonder how long it will take the field to right its ship. What might be the way out of the chaos?

Already Out-of-Africa Before Out-of-Africa?

Some new archaeological discoveries suggests a new paradigm for out-of-Africa might be emerging which shifts the focus from some sort of 'out-of-Africa from East Africa across the Bab-al-Mandeb' to 'out-of-North-Africa into SW Asia via the Sinai'. I note three recent studies.

A new Tabun-C industry site—the same industry as Skhul and Qafzeh—is reported for Jebel Qattar, Jubbah paleolake, Nefud Desert, No. Arabia (OSL) 75±5 ka (Petraglia et al 2012)

- Petraglia MD, Alsharekh A, Breeze P, Clarkson C, Crassard R, Drake NA, Groucutt H, Jennings R, Parker AG, Parton A, Roberts RG, Shipton C, Matheson C, al-Omari A, Veall M-A. 2012. Hominin Dispersal into the Nefud Desert and Middle Palaeolithic Settlement along the Jubbah Paleolake, Northern Arabia. *PLoS ONE* 7(11): e49840.

- Petraglia MD, Alsharekh AM, Crassard R, Drake NA, Groucutt H, Parker AG, Roberts RG. 2011. Middle Paleolithic occupation on a Marine Isotope Stage 5 lakeshore in the Nefud Desert, Saudi Arabia. *Quaternary Science Reviews* 30(13–14): 1555–1559.

With this new site there are now at least 10 sites in SW Asia with Middle Paleolithic Tabun-C industry, which is associated at two sites, Skhul and Qafzeh, with *Homo sapiens sapiens* 'with robust features'. Four of these sites have 'modern symbolic behavior', including shell beads, multiple hues of pigments, burials, grave goods, and stone artifacts incised with deliberate markings (crisscross lines, parallel stroke marks). Dates range from the 'C' Layers at Tabun Cave (~165-220 ka) to Hayonim Cave, Israel (150 ka) to Skhul (100-130 ka) down to the new site of Jebel Qattar 75±5 ka. When only the coastal sites in Lebanon and Israel were known—and it was erroneously believed that 'modern' *Homo sapiens sapiens* migrated out-of-Africa around 45 ka—it was assumed that the Tabun-C culture and its hominins were a cultural and genetic 'dead end'. Now we have sites spanning much of SW Asia from the coast to Aïn Hummal, El Kowm, central Syria (with 2 TL dates of 98±16 and 128±18 ka), only 50 miles from the Euphrates and now Jebel Qattar on a paleolake in northern Arabia, with watersheds to the Persian Gulf and back to the Red Sea. In short, it looks like the Tabun-C culture 'controlled' much of SW Asia and possibly the routes to South Asia via the Persian Gulf Oasis. To confirm this we need Middle Paleolithic sites from Iraq and the Oasis area, but no such sites have been excavated.

The Aterian (with tanged points and scrapers as its type tool) across North Africa, which in the early days of 14C dating was thought to date less than 45 ka, has been substantially redated across North Africa. A key site pushing back Aterian dates is Ifri n'Ammar (Morocco) (TL) MSA with tanged items as well as personal ornaments (shell beads) 83.3 ± 5.6 kya; MSA lacking tanged pieces, 130.0 ± 7.8 kya; early MSA with tanged items—the now earliest known appearance of tanging, 145 ± 9 kya. (Richter, Moser et al. 2010). Grotte des Pigeons, Taforalt, NW Algeria has yielded red ochred shell beads (OSL, U-series, and TL) between 73.4 and 91.5 ka with likely date ~82.5 ka (Bouzouggar, Barton et al 2007). Oued Djebbana, Bir-el-Ater, Algeria, the Aterian type site (so far only 14C date >40 ka) produced perforated shell beads, which were recently reanalyzed; they have the same perforation pattern as Skhul beads, inferring trade exchange or common ancestry across North Africa into SW Asia (Vanhaeren, d'Errico et al 2006).

- Vanhaeren M, d'Errico F, Stringer C, James SL, Todd JA, Mienis HK. 2006. Middle Paleolithic Shell Beads in Israel and Algeria. *Science* 312: 1785-1788.

Hublin and McPherron (2012) represent a major re-assessment of North African Middle Stone Age archaeology and paleontology.

- Hublin, Jean-Jacques (ed), McPherron, Shannon P. (ed). 2012. *Modern Origins: A North African Perspective* (Vertebrate Paleobiology and Paleoanthropology). Springer.

Its overall thesis is summarized in a Letter to the journal *Science*, Hublin and Klein (2011):

> "… fossils and archeology show that the Aterian people, who simultaneously occupied northwestern Africa, were comparably modern or near-modern. In addition, Aterian craniodental fossils resemble fossils dated between roughly 120,000 and 90,000 y ago at

the Skhul and Qafzeh Caves in Israel, as well as fossils dated to about 40,000 y ago from the Peştera cu Oase (Cave with Bones) in Romania. In morphological details, the Peştera cu Oase fossils further resemble a fully modern skull dated to roughly 37,000 y ago at Nazlet Khater, Egypt. The fossil similarities matter, because the Skhul/Qafzeh people are often thought to signal a precocious spread of modern Africans to southwestern Asia, whereas the Peştera cu Oase people are believed to represent an early wave of modern African migrants to Europe. Fossils therefore suggest that northern Africa must also be considered as a possible source for the modern human expansion."

- Hublin J, Klein R. 2011. Northern Africa could also have housed the source population for living humans. *Proceedings of the National Academy of Sciences USA* 108(28): E277

In reviewing the North African Middle Stone Age, Scerri (2012) applies a principal components analysis to six lithic assemblages across North Africa labeled Aterian, Early Nubian Complex and MSA, which reveals regionalized population structure and social boundaries more or less permeable rather than geographic isolation or behavioral adaptation differentiates Maghreb Aterian, Haua Fteah uniqueness, NE African Aterian and Nubian, which overlap. Scerri concludes that tanged tools cannot serve as the main criterion for the 'Aterian' technocomplex.

- Scerri, Eleanor ML. 2012. The Aterian and its place in the North African Middle Stone Age. *Quaternary International* in press (online).

Clarkson, Jones and Harris (2012) analyze lithic assemblage variability comparing 867 cores including those from sites in Jurreru Valley Andhra Pradesh, including Jwalapuram, to South Africa to Australia. Conducting a Discriminant Function Analysis they find four clusters: (1) Indian Late Acheulian (Middle Son Valley), Neanderthal, East African MSA and early Hss from North Africa and the Levant; (2) SW Asia and Aurignacian circa 40 ka; (3) Indian microlithic; and (4) South Africa MSA, Jurreru Valley pre-and-post Toba, East Timor and oldest Australian sites. They associate out-of-Africa with the latter.

- Clarkson C, Jones S, Harris C. 2012. Continuity and change in the lithic industries of the Jurreru Valley, India, before and after the Toba eruption. *Quaternary International* 258: 165-179.

While the authors argue they have provided lithic evidence to support out-of-East-Africa to Sahul by the southern route and lean against North-Africa and the Levant, I find their analysis problematic. First, they are forced by their analysis to hypothesize that South Africans went to East Africa and crossed the Bab and from there eastward, while ruling out East Africans crossing the Bab, for which I know of no archaeological evidence for such a back migration. Second, Table 9 lists the lithic assemblages by site. There is no comparative lithic assemblage for NE Africa Nubian, Nile Denticulate or MP with handaxes, for which dispersal sites exist neither in SW Asia nor for southern Arabian local MP sites; this leaves open the question how they might cluster and affect the conclusions. Also the analysis appears to support not one, but two dispersals out of Africa: one during MIS 5e/d linking East Africa, North Africa and the Levant (Skhul and Tabun early *Hss*) and further dispersal into India (termed 'Late Acheulian', but by others 'early MP'); a second circa MIS 5a linking South African MSA to pre-and-post Toba Indian MP and on to sites in Sahul.

Dennell and Petraglia (2012) 'the increasing likelihood' for more than one dispersal from both North and East Africa as well as admixture from other species including Neanderthals, Denisovans and *Homo erectus*.

- Dennell R, Petraglia MD. 2012. The dispersal of Homo sapiens across southern Asia: how early, how often, how complex? *Quaternary Science Reviews* 47: 15-2.

From the perspective of mtDNA, Oppenheimer (2012b) argues that this multiple dispersal view is falsified by the genetics, which requires a single dispersal of L3 derived lineages. One caveat I note: when Dennell and Petraglia discuss Shi'bat Dihya, Yemen as a key out-of-Africa site with 'E. African and Levantine Mousterian affinity, though idiosyncratic', this is contradicted by the site report to which they refer, since its authors state that the MP assemblage has no clear affinity to E Africa, some affinity to Jebel Faya B but not Tabun-B Neanderthal assemblages and thus is a local industry, which they take to be evidence against out-of-Africa into Yemen circa 50-60 ka.

- Delagnes A, Tribolo C, Bertran P, et al. 2012. Inland human settlement in southern Arabia 55,000 years ago. New evidence from the Wadi Surdud Middle Paleolithic site complex, western Yemen. *Journal of Human Evolution* 63, 3: 452–474.

Discussion

Given the preceding studies how are we to conceive the prehistory of out-of-Africa? While I myself in 2011 had thought there were multiple diffusions out of Africa, I here retract this model. In the light of the 2012 archaeogenetic-archaeological studies I have reviewed I suggest a revised model and timeline for out-of-Africa: 'Out-of-Africa Before-Out-of-Africa.

North-Africa-Levantine MSA/MP Mosaic of Regional Cultures. The new evidence supports the view that there was a mosaic of regional Middle Paleolithic/Middle Stone Age cultures spanning from the North African Maghreb ('Aterian') to the SW Asian 'Tabun-C' culture, and including Egyptian 'Aterian' and 'Nubian Complex' and these regional cultures have a common ancestry and/or trading exchange and possibly social alliances. All these North African-Levantine cultures are associated with *Homo sapiens sapiens* 'with robust features'. This new view actually validates the analysis of Gruet (1954) at Aïn El-Guettar, Tunisia, in which he found the closest analogy for the Guettar 'Mousterian' tool assemblage to be Tabun C and Qafzeh F level tools; Gruet also gives a detailed description of the symbolic 60 spheroid stone heap at the site.

Intertribal Contact/Trade 'African affinity' Sites. Given this mosaic, I suggest that recently discovered sites in southern Arabia, Sinai and Negev with tool assemblages having 'African affinities' may correspond to (a) intertribal trade exchange between Africans and the Tabun-C peoples, possibly evidenced by symbolic items (shell beads, etc.), and (b) African out-migrations in southern Arabia that did not penetrate or go beyond Tabun-C controlled northern SW Asia. To date, these 'contact' or 'affinity' sites include at least four distinct lithic cultures:

- 'MP-with-handaxes' at Jebel Faya, U. A. E., mean of 3 dates ~112 ka (eliminating outliers, 123±10 ka) (Marks 2009; Armitage et al 2011);
- 'Early Nubian complex' (in Africa associated with early *Homo sapiens sapiens*) at Aybut

Auwal, southern Oman (weighted mean, OSL) 107±6 ka (Rose, Usik et al 2011)
- 'Early Nubian complex' at Gebel Urayf an Naquah, central Sinai (14 miles from Har Karkom, central Negev, Israel), no date (Schild in Eddy 1999, site noted in Rose, Usik et al 2011);
- 'Nile Denticulate Mousterian' at Sinai-20 Split Rock Site, Wadi al Madibah, Zarnoq area, central eastern Sinai, about 30km from Taba on Gulf of Aqaba, Red Sea, (TL) Lower 84.5±13 ka, Upper 61.5±8.6 ka (Kobusiewicz, Schild, Bluszcz and Wendorf 2001; Kobusiewicz in Eddy 1999); compare Nile Denticulate at Nazlet Khater NK-2, Lower Nile, Upper Egypt (geostratigraphy) ~100 ka (Van Peer 1998);
- 'Aterian' at Har Karkom, Negev, Israel, at least 2 sites, HK148b, HK72a, no date (Anati E, 2006 online)

There is no archaeological or paleontological evidence that any of these cultures went beyond the locations identified. Rose, Usik et al (2011) even suggest that the Early Nubian Complex at Aybut Auwal, Oman, was a migratory dead end; but they add that it might correlate to L3'4'6-mtDNA, though fossil evidence for any theory is lacking.

Timeline of Out-of-Africa with Archaeological, mtDNA and Language Correlations. Considering the implications of these studies, I propose four-stages in the prehistory of *Homo sapiens sapiens* 'out-of-Africa'. First, I summarize key archaeological sites between North-and-East Africa and the Levant focusing on three successive interglacial humid periods MIS 5e, 5c and 5a, which are each about 20,000 years in duration including their following arid phases. In accord with the Sahara pump model for faunal dispersion from Africa to the Levant during humid phases, I suggest these three time periods were optimally conducive to human dispersion (in both directions); and the archaeology appears to support this. Second—setting aside the Behar, van Oven et al (2012) caveat doubting any biological clock currently available—I hypothesize correlations to mtDNA haplogroups by rescaling Soares TMRCAs based on the revised CHCLA multiplier 1.2. Third, even more tentatively I suggest some possible language correlations based on current mtDNA population samples in North/East Africa and Levant/Arabia and their current languages, which, of course, assumes at least limited language continuity over one-hundred thousand years.

1. MIS 5e (~130-117, high sea level 125-128) and MIS 5d (~115-106 ka).

   Archaeology *(Figure 1)*. A mosaic of regional Middle Stone Age cultures ranging across North Africa and Levant, some with evidence of 'modern' symbolic behavior, such as:
   - Morocco:
     - Benzú, >70 ka to 168 ka (probably 5e and 5c humid?) and ~170 ka, Levallois Mousterian
     - Jebel Irhoud, early *Homo sapiens sapiens* 160 ka, closest morphology Skhul, slightly more primitive features, and associated with Levallois Mousterian tools
     - Ifri n'Ammar Lower OS Level, 130 ka, MP without tanged tools
     - Dar es-Soltan II-7, *Homo sapiens sapiens* 121 ka, closest morphology Qafzeh; Aterian, 'enigmatic' heap of sandstone slabs H 30cm, W 1m;
     - Grotte des Contrebandiers L13d, 122 ka, Levallois Mousterian
   - Aïn El-Guettar, Tunisia, probably ~120 ka, Aterian
   - Haua Fteah, Libya, Levallois Mousterian
   - Bir Tarfawi, SW Egypt, MIS5e, Aterian

- Sai Island, northern Sudan, <153 ka, Nubian Complex with Lupemban features; K'One, Ethiopia, 140 ka, Levallois and Nubian Complex; Kharga Oasis, Egypt, <125 ka, Nubian Complex; Sodmein, Egypt, 118 ka, Nubian Complex
- Mumba Shelter, Tanzania, VIB 110 to 132 ka, MSA Levallois
- Mumbwa Caves, central Zambia, MIS 5e, MSA, with blocks of local hematite showing grinding and scraping; probable natural anthropomorphic stone
- SW Asia Early Tabun-C industry sites, such as
  - Hayonim Cave, Israel, 150 ka;
  - Skhul, 100-130 ka, red, orange, yellow pigments, some heated to change colors from yellow to red; marine shells not related to food acquisition; *Homo sapiens sapiens* 'with robust features', 10 MNI depositions and 'burials', 1 with boar mandible; perforated shell beads similar to North African Aterian beads;
  - Aïn Hummal, El Kowm, central Syria, Level 5g 128 and 98 ka
- SW Asia non-Tabun C sites, such as
  - Abdur, Eritrea, 125 ka, MSA with handaxes,
  - Jebel Faya, UAE, mean ~112 ka, or eliminating outliers, 123 ka, MP with handaxes, foliates
  - Har Karkom, Negev, multiple Mousterian sites with handaxes, designated 'Mousterian of Acheulian Tradition', [candidates for zoomorphic / anthropomorphic portable rock art—*JBH*]

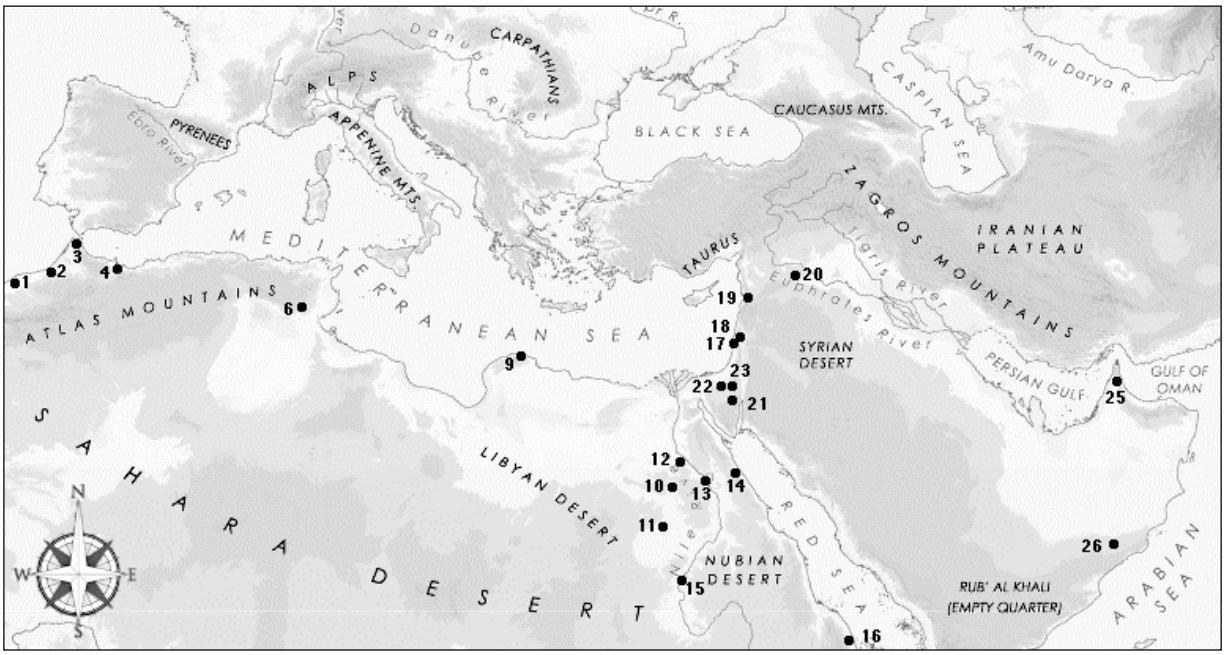

Figure 1. MIS 5e/d and 5c/b sites, dated and associated by fossil or tool with early *Homo sapiens sapiens*. 1, Jebel Irhoud. 2, Dar es-Soltan and Grotte des Contrebandiers. 3. ~~Mugharet el Aliya~~ and Benzú. 4, Ifri n'Ammar. ~~5, Grotte des Pigeons, Taforalt.~~ 6. Aïn El-Guettar and Oued Djebbana. ~~7, El Akarit. 8, Uan Afuda.~~ 9, Haua Fteah. 10, Kharga Oasis. 11, Bir Tarfawi and Bir Sahara. 12, Nazlet Khater. 13, Taramsa. 14, Sodmein. 15, Sai Island. 16, Abdur, Eritrea. 17, Skhul, Tabun, and Kebara. 18, Qafzeh and Hayonim. 19, Nahr Ibrahim and Ras-el-Kelb. 20. Aïn Hummal, El Kowm. 21, Sinai-20 Split Rock. 22, Gebel Urayf an Naquah (no date). 23, Har Karkom (no date). ~~24, Jebel Qattar.~~ 25, Jebel Faya. 26, Aybut Auwal. [Strikethrough sites are MIS 5a sites not shown on this map.] (map modified from Ancient World Mapping Center)

mtDNA Hypothesis:
(a) L2'3'4'5'6-mtDNA → L2'3'4'6 + L5, emergent in E Africa (111±8/12 ka Behar, van Oven [2012 with revised CHCLA x 1.2 = ~133 ka.
(b) L0a'b'f-mtDNA, emergent in E Africa (100±10 ka Behar, van Oven [2012] with revised CHCLA x 1.2 = ~120 ka.

Language Hypothesis (very speculative): Based on mtDNA haplogroup frequencies in current populations, this might be some predecessor to the Nilo-Saharan family. I note that L2'3'4'6 is the result of L5 branching off of the preceded haplogroup L2'3'4'5'6. In current African populations L5 has a high frequency in Mbuti (Central Sudanic speakers). It may be relevant to this point that L0a'b'f, which arose about 10,000 years after L2'3'4'6 has a high frequency in Datoga (Eastern Sudanic speakers).

2. MIS 5c (~106-93 ka Brørup) and MIS 5b (~93-85 ka)

Archaeology *(Figure 1)*. A mosaic of regional Middle Stone Age cultures ranging across North Africa and Levant, many with evidence of 'modern' symbolic behavior, such as:

- North Africa 'Aterian *sensu lato'*
  - Grotte des Contrebandiers L9/10, 107 ka, Aterian, with *Homo sapiens sapiens* teeth 'with robust features', closer to Skhul/Qafzeh and Peştera cu Oase, Romania, than South African or Neanderthal
  - Dar es-Soltan I-G2, *Hss* 115 ka MIS 5c, Aterian with foliates, ivory objects
  - Oued Djebbana, Bir-el-Ater, Algeria, only old 14C >40ka (probably 5c), Aterian type site, shell beads same pattern as Skhul beads, inferring exchange or common ancestry
  - Haua Fteah, Libya, Aterian
- NE Africa:
  - Bir Tafawi, SW Egypt, MIS5c/a, Aterian
  - Nazlet Khater NK-1 and NK-3, 110 ka, Nubian Complex
  - Taramsa I, Upper Egypt, EMP Phase II, between 89-117 ka, Levallois and Nubian with foliates
  - Nazlet Khater NK-2, Upper Egypt, 100 ka, Nile Denticulate Mousterian
  - Aduma, Ethiopia, 80-100 ka, 'Aduma' Industry (Aduma, Nubian, and Levallois, including blades and bladelets, and micro-Aduma, micro-Levallois
- SW Asia Late Tabun C sites, circa 85-100 ka, such as
  - Qafzeh, Israel, isochron 92±5 ka, 18 MNI *Homo sapiens sapiens* with 'robust features', min. of 3 'burials', 1 with fallow deer antler over hands over upper chest; min. 84 ochre pieces, 6 worked, hues selected, associated with burials; marine shells not related to food acquisition, 4 perforated, several with wear traces of being strung, a few with red, yellow and black pigment stains; Q8 burial near broken triangular Levallois core incised with parallel stroke marks;
  - Naamé, Lebanon, 90 ka
  - Nahr Ibrahim, Lebanon, 80-90 ka, fallow deer skeleton 'burial' with red ochre

- Ras-el-Kelb, Lebanon, <90 ka, red ochre pieces; flint flake with incised crisscross lines

• Late non-Tabun C sites of 'African affinity', circa 80-90 ka, such as
  - Aybut Auwal, southern Oman, 107 ka, Early Nubian Complex (possibly via Bab al-Mandeb)
  - Sinai-20 Split Rock—Lower, Eastern Sinai, 85±13 ka MIS5b, Nile Denticulate Mousterian (probably via NE Africa)
    And if they could be dated and dates fell into MIS 5b/c:
  - Gebel Urayf an Naquah, central Sinai (14 miles from Har Karkom), no date Early Nubian Complex
  - HK148b, HK72a, Har Karkom, Negev, no date, 'Aterian', hutfloor [with geometric, anthropomorphic and zoomorphic stone sculptures—*JBH*]

mtDNA Hypothesis:

(a) L3'4'6-mtDNA, homeland not identified (eliminating clock violations by cluster outliers—see details under discussion of Behar, van Oven et al article—yields) 71 to 86 ka, and with revised CHCLA x 1.2 = 85 to 103 ka, which falls squarely within MIS 5c/b.

(b) L3'4-mtDNA. Around ~77 or 103 ka (= 64±5 ka Behar, van Oven [2012]; 86±20 ka Soares, Ermini [2009], revised x1.2) —in other words, still within MIS 5c/b—L3'4'6 spun off L3'4. Later ~22 ka (Behar, van Oven [2012], with no revision) L3'4'6 spun off L6. It may be relevant to note that in current populations high frequencies of L4 and L3 occur in East Africa, while a frequency of 12%L6 occurs distinctively in Arabian Yemeni and rare in Ethiopia (Kivisild, Reidla et al 2004. To my mind this suggests by triangulation that the homeland of '3'4'6 is around the Sinai or East Africa and crossed over via the Bab to Yemen, where by either route it branched L6. This seems to support the hypothesis that L3'4'6 correlates to the MIS 5c/b mosaic of regional cultures across North Africa and the Levant.

Language Hypothesis (very speculative): L2'3'4'6 spun off L2 around ~100 ka, a haplogroup strongly associated with Niger-Congo area and speakers. If L2'3'4'6 spoke some sort of Pre-Nilo-Saharan, the remaining L3'4'6 haplogroup may have continued evolving Nilo-Saharan. In my review of mtDNA genetics articles, I could find no current population samples with L3'4'6. High frequencies of L3 and lesser of L4 occur in Kanuri and Kanembu (Western Saharan). Other Chadian groups with high frequency of L3 and lesser L4 appear to have subsequently adopted Afroasiatic Chadic. The L6 is a marker uniquely Yemen and dates to ~ 20 ka. L4 has high frequencies in East Africa (Tanzania, Ethiopia) and lesser in Yemen, Saudi Arabia and Syria.

3. MIS 5a (~85-74 ka, humid phase).

Archaeology *(Figure 2)*. Continues a mosaic of Levallois MP, Aterian, Nubian, Nile Denticulate and Tabun-C cultures ranging across North Africa and Levant, many with evidence of 'modern' symbolic behavior, such as:

• North Africa:

- Ifri n'Ammar, Morocco, 83 ka, Aterian; shells, ornaments
- Dar es-Soltan I-G3, Morocco, 68-87 ka MIS 5a, Aterian with foliates
- Grotte des Pigeons-E, Taforalt, NW Algeria, 60-85 ka, 'Aterian facies of MP', 13 marine shells, 1 red ochred, 9 perforated beads, evidence strung
- Aïn El-Guettar, Tunisia, spring site, probably MIS 5a wet, 'Mousterian' with Aterian tanged points, closest tool analogy Tabun C and Qafzeh F; symbolic art: 60 spheroid stone heap with intricate internal features;
- El Akarit, Tunisia, 90 ka, Aterian
- Uan Afuda, Libya, 65-90 ka, Levallois

- NE Africa:
  - Bir Tafawi, SW Egypt MIS5a Aterian
  - Taramsa I, Upper Egypt, MMP Phase III, 76 and 79 ka loci, Levallois and Nubian; child *H. sapiens sapiens* skull, similar to Qafzeh 9 'burial'
- Central Africa:
  - Katanda, Semliki, D. R. Congo/Zaire, 80-90 ka or minimum 75 ka, MSA, barbed and unbarbed harpoon points
- SW Asia Late Tabun C sites, circa 75-85 ka, such as
  - Jebel Qattar, Jubbah paleolake, Northern Arabia, 75±5 ka
- Late non-Tabun C sites of 'African affinity', circa 75-85 ka
    - Sinai-20 Split Rock, Eastern Sinai, Upper Horizon 62±9 ka MIS4 and continuing to Lower Horizon, 85±13 ka MIS 5b, Nile Denticulate Mousterian

  Possibly, if they were dated and dates fall into MIS 5a rather than MIS 5b/c:
    - Gebel Urayf an Naquah, central Sinai (14 miles from Har Karkom), no date Early Nubian Complex
    - HK148b, HK72a, Har Karkom, Negev, no date, 'Aterian', hutfloor [with geometric, anthropomorphic and zoomorphic stone sculptures—*JBH*]

  Otherwise MIS 5a in SW Asia evidences only Late Tabun-D and Early Tabun-B industry Neanderthal sites, some with symbolic behavior, such as
    - Tabun Cave B-Unit1, 90+30/-16 ka, Neanderthal remains, Tabun-B type site
    - Nahal Aqev (D35), Negev, Layer D, 74/85 ka, Tabun-D
    - Boker Tachtit, Negev, Level 1, 80±10 ka, Tabun-D
    - Umm el Tiel IV, El Kowm, Syria, 76±16 ka, Tabun-D
    - Douara Cave, Syria, 75 ka, manuported baked barite nodules with natural geometric patterns (concentric circles with double stars), Tabun-D
    - Dederiyeh Cave L8-9, Syria, 60-90 ka; 15 MNI Neanderthal mortuary cache, Tabun-B
    - Tor Sabiha, Wadi Hisma, Jordan, 62-70 ka, Tabun-B
    - Kebara Cave-FXII, Israel, 60 ka; Neanderthal mortuary cache; 1 engraved bone with stroke and chevron marks, Tabun-B

  In SW Asia, the Neanderthal range is generally considered to cover coastal Levant and the Syrian Desert, and the entire region north of it from Anatolia to Zagros Mountains and the Iranian Plateau to Afghanistan and Pakistan and into Central Asia. There are no fossil *Homo sapiens sapiens* in SW Asia prior to Ksar Akil ~37

ka except the Tabun-C industry sites, Skhul and Qafzeh, which have '*sapiens sapiens* with robust features', ~90-120 ka.

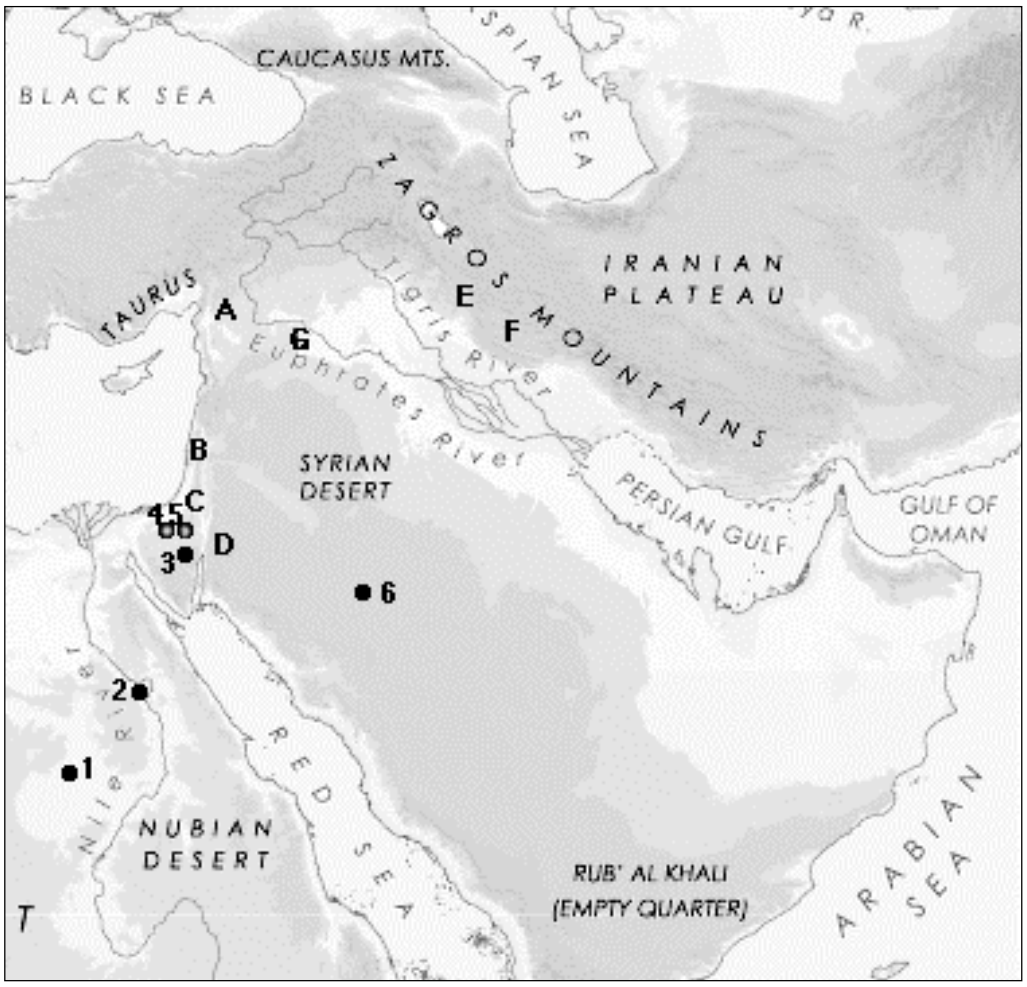

Figure 2. MIS 5a sites in NE Africa and SW Asia sites, dated and associated to species by fossil or tool industry. *Homo sapiens sapiens* sites: 1, Bir Tarfawi (Aterian). 2, Taramsa I (Levallois and Nubian, *Hss*). 3, Sinai-20 Split Rock (Nile Denticulate). 4, Gebel Urayf an Naquah (Nubian Complex, no date). 5, Har Karkom (Aterian and Levallois, no date). 6, Jebel Qattar (Tabun-C). *Neanderthal* sites (with Tabun-B and Tabun-D industry): A, Dederiyeh. B, Tabun and Kebara. C, Boker Tachtit. D, Tor Sabiha. E, Shanidar. F, Bisitun. G, Umm el Tiel.

mtDNA Hypothesis:

(a) L3. If similarly to our method in the case of MIS 5c/b, if we take L3 and L4 as a cluster and eliminate its outliers (79 and 65 ka) the range for that cluster is only 65 and 67 ka, average 66 ka; or if we average all four dates, 71 ka, thus suggesting a

range 66 to 71 ka, and with revised CHCLA x 1.2 = 79 to 85 ka, which falls squarely within MIS 5a.

L3'4—with possible homeland around the Sinai, Nile or East Africa—spun off L4 around ~95 ka (=79±7 ka Behar, van Oven [2012]—Soares gives no date for this—revised x1.2) and L3 around ~78 or ~80 ka (=65±5 ka Soares, Alshamali [2012] and 67±4 ka Behar, van Oven [2012] revised x1.2).

(b) Based on frequencies of its oldest subclades in current populations (L3h, L3a, L3i'x, Soares, Alshamali et al (2012) infer an L3 homeland in the Horn of Africa / East Africa. Subsequently L3 subclades spread across the tropical rainforest into Central and West Africa and up into North Africa and—they suggest—across the Bab into Arabia and beyond. As noted earlier, they offer a caveat that the homeland of L3 might be North Africa "with its rapid radiation corresponding to an early range expansion into Eastern Africa" (924). They reject this possibility on the basis that a 65 ka expansion date is a time of severe drought, which would have blocked a north to south dispersal (presumably along the Nile or Red Sea). On the contrary, as I've argued, a revised CHCLA divergence date puts L3 at ~80 ka, that is, the MIS5a humid period. Thus their objection falls; the most likely hypothesis now is that L3 and L4 branch off of a Northeast African L3'4 and their subclades radiate south into East Africa, and L3 then spreads across tropical Africa and across North Africa while L3 subclades N and M disperse into SW Asia and beyond.

Language Hypothesis (very speculative): As for L3, high frequencies occur (in rank order of L3 frequency from high to low) in Tanzania, Niger-Congo, Yemen, Morocco, Tunisia, Libya, Tigrais, Egypt and Iraq [language in brackets]. For example:

- Sukuma, TZ [Niger-Congo] 72%L3
- Masa, Chad, Cameroon [Central Chadic<Afroasiatic] 61%L3
- West Africa [Mande and Mel<Niger-Congo] 32%L3
- Buduma, Chad, Cameroon, Nigeria [Central Chadic<Afroasiatic] 30%L3
- Burunge. TZ [Cushitic] 29%L3
- Turu, TZ [Niger-Congo] 29%L3
- Datoga [South Nilotic-Eastern Sudanic] 27%L3
- Yemeni [Arab] 24%L3
- Morocco [Arab]16%L3
- Tunisia [Berber] 6-18% varying by tribe; Libya Tuareg 12%L3
- Tigrais [Tigrinya-Semitic] 12%L3
- Egypt [Arab] 9%L3

L3 seems to be most distinctively associated with an early form of the Afroasiatic language family.

With the caveat that absence of evidence is not evidence of absence, I find only one African-affinity tool assemblage in SW Asia during MIS 5a (~74-85 ka), Sinai-20 Split Rock, Eastern Sinai, Nile Denticulate Mousterian (AKA 'Local Nile K-group'). To my knowledge there are no dated African-affinity sites in SW Asia in the subsequent MIS 4 (~59-74 ka), excepting at this same Split Rock Site.

'Nile-K is comparable to the Initial EUP at Boker Tachtit, Negev', 47±9 kya (Marks 1981; Schwarcz et al 1979)

During MIS 5a I find only one Late Tabun-C site, Jebel Qattar, Jubbah paleolake, Northern Arabia, 75±5 ka. Apparently, the Tabun-C industry faded away or its peoples were displaced, possibly from the Levant toward the more marginal Northern Arabia or Sinai-Negev paleolakes and their watersheds. There is strong evidence for Tabun-B Neanderthals over much of the Levant; I list a few of many such sites above. Opposite to a popular view, it appears that in SW Asia during MIS 5a and MIS 4 Neanderthals actually replaced or at least displaced *Homo sapiens sapiens*.

Alternative Scenarios for L3 Out-of-Africa.

A. L3 stayed in Africa but branched N and M out via the Sinai. If MIS 5a in SW Asia was a period of widespread cultural and political turmoil under the influx of Neanderthals and the fragmentation and disappearance of the Tabun-C dominance this may have provided an opportunity for M and N to diffuse over SW Asia. That so far the only evidence for a tool industry out-of-Africa in MIS 5a is the Nile Denticulate at Sinai-20 Split Rock this is archaeological support for the Sinai route. There is as yet no archaeological evidence for a Bab crossing.

   If they could be dated and dates fell into MIS 5a these two sites could be added to the African affinity list:

      Gebel Urayf an Naquah, central Sinai, Early Nubian Complex
      Har Karkom, 'Aterian'

   Each of these is consistent with a Sinai crossing rather than via the Bab.

   From the Sinai crossing, N dispersed both northward into Central Asia, East Asia, and Europe but also into South Asia, SE Asia and Australia; and M dispersed into South Asia and East and SE Asia, but left no trace in SW Asia.

B. L3 stayed in Africa but branched N and M out via a Coastal Crossing. If in the future African-affinity sites are found in southern Arabia dating to MIS 5a, L3 and or M and N crossing the Bab-al-Mandeb or even clockwise around the end of the Red Sea might be supported.

C. L3 indigenous in SW Asia. Root-L3 emerged in SW Asia off of L'3'4 in SW Asia, radiated into NE and then E Africa, but left no ancient genetic trace in SW Asia. If so, Sinai-20 Split Rock could be the remains of a root-L3 people, as could Jebel Qattar, northern Arabia.

D. The current mtDNA Phylotree has somehow misassigned M and N to L3, when they actually are branches of L3'4 already in SW Asia MIS 5b (~93-85 ka). In this case, M and N would likely be associated with Tabun C sites circa 75-85 ka, such as Qafzeh (isochron 92 ka), Naamé (90 ka), Nahr Ibrahim (80-90 ka), Ras-el-Kalb (<90 ka), and Jebel Qattar, N Arabia (75±5 ka).

Under the two scenarios C and D in which L3 is already-in-SW-Asia, M-mtDNA likely diverged during a Zagros Crossing into South Asia. This would best explain why M-mtDNA appears to have left no trace in SW Asia and its homeland appears to be South or SE Asia. Scenarios A and B cannot explain no M in SW Asia and only opine that it disappeared. More

relevant archaeological sites, mtDNA population samples and the discovery of ancient DNA in SW Asia and South Asia are needed to determine which scenario appears most on target.

4. MIS 4 (~74-59 ka).

Whichever of the preceding alternative scenarios, N-mtDNA emerged around 74 ka (62 x 1.2), followed by M 73 ka (60.5 x 1.2), at the MIS 5a to MIS 4 transition, which was the start of a long period of aridity. If these dates are correct, *Homo sapiens sapiens* migration must have paused for about 5,000 years in SW Asia between L3 ~79 ka and M/N ~74 ka, presumably due to the geographic bottlenecks at the Transcaucasus and Zagros Crossing to India, both areas already occupied by Neanderthals, as well as the displacements caused by the influx of Neanderthals into SW Asia at the time. Probably a compounding stressor was the ~74 ka Toba volcanic supereruption in Sumatra; indeed that may have been a factor in the arrival of the Tabun-B industry Neanderthals as well as the branching of M and N from L3.

> There is a recent fashion to argue that there were no *Hss* in southern Asia prior to the Toba supereruption ~74 ka. Current debate may refer to the well-excavated site, Jwalapuram, Kurnool District, Andhra Pradesh. This area has archaeological layers with similar Middle Paleolithic tool assemblages at Locality 3 (OSL) before Toba, 77±6 ka and after the Toba ash layer, 74±7 ka (Petraglia, Korisettar et al 2007; Haslam, Clarkson et al 2012). On this basis authors argue that Toba ashfall did disrupt cultural continuity, though authors acknowledge there is no fossil or other evidence to confirm the tools were made by *Hss*.

As noted above, under scenarios C and D in which L3 is already-in-SW-Asia, M-mtDNA likely diverged during a Zagros Crossing into South Asia. Whichever scenario genetics counts the homeland of M as South Asia or SE Asia. My review of global haplogroup occurrences indicates that M clades most often correlate to the Eurasiatic language family, with one anomaly being D-mtDNA, which implies that ancestors of the Han Chinese dropped their Eurasiatic language and adopted one from the Dené-Caucasian family.

While in SW Asia N-mtDNA branched off R-mtDNA around 69-73 ka (57-60 x 1.23) ~68 ka (Behar, van Oven: 56.5x1.2) with clades that eventually migrated all the way to SE Asia/Sahul by a southern route *sensu lato* (and if the date is right, post-Toba) and later R→U clades, some remaining in SW Asia and others spreading to North Africa, South Asia and Europe.

N in SW Asia may have first diffused northward (as Hublin and Klein 2011 based on paleontology and Scally and Durbin 2011 based on nuclear DNA surmise) and subsequently both N and R diffused into South Asia and on to SE Asia and Sunda/Sahul—the so-called 'Southern Route'. Or N may have split into subclades at the Persian Gulf Oasis, some clades back-migrating to the northwest into the Transcaucasus, Central and East Asia, while other clades diffused eastward through South Asia. The north diffusing N-mtDNA appears to most often associate to the Dené-Caucasian language family. Southern route R-mtDNA most correlates to Austric (R21, R9→F) and Pama-Nyungan (R→P) language families. Exceptional is an N lineage diffusing southward, presumably with R, eventually to Australia (N→O) already having or adopting Pama-Nyungan; it may also be that N and R migrated together in peoples with dual moiety organization, which is not infrequent among 'Indo-Pacific' tribes.

R-mtDNA U-subclades remaining in SW Asia appear to be associated with a precursor of Semitic, Dravidian, Elamitic and Kartvelian language families. The fact that R-mtDNA correlates to Indo-Pacific languages in South and SE Asia and Sunda/Sahul but also languages like Semitic and Kartvelian may present a problem for linguists, which I leave to linguists to sort out. I do note that a deep reconstruction of global mythology Yuri Berezkin (2010) locates the 'rainbow snake' motif in Europe as well as tropical Africa and widespread across Indo-Pacific Asia.

- Berezkin Y. 2010. From Africa and back: some areal patterns of mythological motifs. *Mother Tongue* XV: 1-67.

Looking over Berezkin's list of European and three Central Asian populations having the rainbow snake motif, I suggest that they seem to correlate to R-mtDNA offshoots R0/HV (precursor to Sumerian, Basque?) and U-mtDNA groups (U4'9 precursor to Kartvelian?).

Table 1 summarizes the preceding account of the four epochs of out-of-Africa. The SW Asia differentiation of M, N and R as well as expansion of L3 subclades in Africa appears to have been complete by around 70,000 years ago. Archaeological sites and dates are from recent field reports. TMRCAs from these reports are multiplied x 1.2 in accord with new revised earlier dating of chimpanzee/human split. The column with mtDNA haplogroup correlations is based on most recent archaeogenetic studies that give TMRCAs. The correlation of mtDNA haplogroups to archaeological sites are my predictions based on currently available studies; fossil DNA would be needed for any definitive proof.

For my highly speculative predictions for ancestral language macrofamilies, I have drawn on genetic studies of present day population samples and the present language associated with that population. I leave it to linguists who reconstruct proto-languages and the sapiens sapiens language phylotree to rule in or out any of these speculations. I emphasize that as a non-linguist I have prefixed all these hypothetical ancestral languages with 'Pre', e.g., 'Pre-Nilo-Saharan'. This is to affirm that I do not take the language spoken at a given time period to be a reconstructed proto-language. I am only suggesting that with respect to a population at time 'x' who likely had the mtDNA haplogroup to which I correlate it, and who undoubtedly had a language, when we look for currant populations bearing this haplogroup (in high or unique frequency compared to other groups) the language they currently speak, subtracting known recent invasive or adopted languages, likely has some probability of retaining features of the language of their paleolithic ancestors. In my review, as might be expected, the genetic and language correlations seem to me much stronger for the later language families in MIS 4.

With respect to the early dating of language, in addition to extensive evidence of symbolic behavior in the archaeological record for archaic *Homo sapiens*, Neanderthals and *Homo sapiens sapiens*, I find two recent paleolinguistic studies especially relevant. Atkinson (2010) reviews glottochronology methods and observes that the standard method for glottochronology developed by Swadesh places an upper limit on language classification at around 8,000 years and a modified method (Pagel, Atkinson and Meade 2007) may extend the limit to 50,000 years or so.

• Atkinson QD. 2010. The prospects for tracing deep language ancestry. Interdisciplinary views on Molecular Anthropology in the Genomic Era. *Journal of Anthropological Sciences* 88: 231-233.

If so, such methods appear to be incapable of dealing with predictions for out-of-Africa languages. A more recent study at least confirms that '*proto-Sapiens sapiens'* language arose in tandem with the emergence of the species. Based on phonemic diversity Perreault and Mathew (2012) calculate that the language of *sapiens sapiens* emerged between 163 and 242 ka, a date range corresponding to the earliest fossil attributed to our species, Omo 195 ka.

• Perreault C, Mathew S. 2012. Dating the Origin of Language Using Phonemic Diversity. *PLoS ONE* 7(4): e35289.

Since language reconstruction methods to date appear to me—admittedly a non-linguist—to not be able to predict the emergence dates of very ancient language families, I have thrown my wild speculations into the ring.

Table 1: Out-of-Africa-Before-Out-of-Africa: Hypothetical Correlations			
Date (ka)	**Key Archaeological Sites**	**mtDNA Hg** (TMRCA x 1.2 or 1.1)	**Language Family** (speculative)
MIS 5e ~130-117 MIS 5d ~115-106	Maghreb, Levallois Mousterian, Aterian Bir Tarfawi, Aterian Early Nubian Complex Abdur, MSA handaxes Skhul, Tabun-C Jebel Faya, MP handaxes [Zhirendong, S. China, *Hss* min. 106±7 ka]	L2'3'4'6 ~133 ka (x1.2)	Pre-Nilo-Saharan? [preceded by L2-6→L5 = split of Hadza / Sandawe and high% L5 in Mbuti (Central Sudanic)]
		L0a'b'f ~120 ka (x1.2)	Pre-Nilo-Saharan? [high% in Datoga Eastern Sudanic]
MIS 5c ~106-93 MIS 5b ~93-85	Contrebandiers, Aterian Bir Tarfawi, Aterian Nazlet Khater, Nubian Complex Qafzeh, Tabun-C Sinai Split Rock-L, Denticulate Aybut Auwal, Nubian Complex	L3'4'6 ~103-85 ka L3'4 ~103or77 ka (x1.2)	Continues Nilo-Saharan? [high% L3 Saharan] [L6 unique Yemen] [L4 Ethiopia, Saudi Arabia, Syria, Yemen, Tanzania area] [L2 emergence ~100 ka = Niger-Congo?]
MIS 5a ~85-74	Ifri n'Ammar, Aterian Pigeons, Taforalt, Aterian El-Guettar, 'Final Mousterian' Taramsa I-Phase III, Levallois and Nubian Bir Tarfawi, Aterian Jebel Qattar, Tabun-C Sinai Split Rock-U, Denticulate	L3 ~79 ka (x1.1)	Pre-Afroasiatic? [L3 high% Tanzania, Niger-Congo, Yemen, Morocco, Tunisia, Libya, Tigrais, Egypt, Iraq]
MIS 4 ~74-59	[Callao, SE Asia, *Hss,* min. 67±7 ka]	N ~74 ka (x1.1) M ~73 ka (x1.1) N→R ~69-73 ka (x1.1)	N=Dené-Caucasian M=Eurasiatic Southern-R = Austric, Pama-Nyungan Northern-R/U = Semitic, Dravidian, Kartvelian

Conclusion

In short, new archaeogenetic and archeological studies imply that the mtDNA biological clock requires rescaling and may have serious validity problems. Re-orienting the mtDNA Phylotree to Africa rather than Cambridge, UK has resulted in clock violations suggesting parts of the phylotree itself may need to be reorganized.

New paleontology findings reveal a mosaic spread of mid-Middle Paleolithic *Homo sapiens sapiens* 'with robust features' from the North African Mahgreb to the Levant. Skhul, Qafzeh and other Tabun-C industry sites are not a 'genetic dead end' but the eastern wing of this mosaic. New archaeological discoveries confirm this mosaic of cultures and indicate that the Tabun-C culture appears to have spread over northern SW Asia and its territorial boundary must now be factored into any out-of-Africa scenario.

My analysis shows that that the *Homo sapiens sapiens* dispersal of 'modern' symbolic behavior occurs by MIS 5e ~120,000 years ago, 40,000 years before the emergence of L3-mtDNA. This analysis confirms the need to decouple the spread of symbolic behavior and the spread of L3, M and N mtDNA in any reconstructions of out-of-Africa prehistory.

Synthesizing and correlating the latest genetic and archaeological discoveries, including rescaling the Soares mtDNA mutation clock to the revised 8 mya chimpanzee/human split date—assuming the van Oven Phylotree Build for the L3 branch is not misaligned—I have inferred a four-stage model for middle Middle Paleolithic cultural prehistory of *Homo sapiens sapiens* across North Africa and SW Asia.

By around 120,000 years ago (MIS 5e/d), early *Homo sapiens sapiens* spread from the Mahgreb to the Levant. Whether beyond into South or SE Asia is an open question. Tool industries associated with this mosaic include Levallois Mousterian, Aterian, Early Nubian Complex, MP with handaxes and Tabun-C. Based on mtDNA TMRCAs, this dispersion is probably associated with L2'3'4'6 and also L0a'b'f. Based on current genetics, languages associated with these haplogroups might have been some predecessor form of Sudanic and Cushitic.

By 100,000 years ago (MIS 5c/b) these Mahgreb-Levantine cultures continued development of the same tool industries, with addition of Nile Denticulate. Evidence of 'modern' symbolic behavior is even more extensive. The Tabun-C culture has spread from coastal sites over most of northern SW Asia. According to TMRCA dates they are probably now associated with L3'4'6 and L3'4 mtDNA. Tentatively, I predict that they continued some form of Sudanic-Cushitic language.

By 80,000 years ago (MIS 5a) the mosaic of early *Homo sapiens sapiens* cultures continues across North Africa, but, tentatively, the archaeology indicates that the Tabun-C culture was in decline and displaced by the arrival of Neanderthals. Only one Tabun-C site is known for this time period, the recently discovered Jebel Qattar in northern Arabia. Only one African-affinity site in SW Asia is known, the Split Rock Nile Denticulate in the eastern

Sinai. During this time from L3'4 L3 emerged in a homeland that might be East Africa, although a North Africa or even Levantine homeland has not been ruled out. L3 seems to be most distinctively associated with an early form of the Afroasiatic language family, perhaps Berber-like with admixture of Sudanic and Cushitic features. How to name this language entity is an open question.

After this there seems to have been a pause of L3 in SW Asia for about 5,000 years during which emerged N, M and R, around 69-74 ka at the MIS 5a to MIS 4 transition, the start of a long period of aridity stress. The pause was likely due to the geographic bottlenecks at the Transcaucasus and Zagros Crossing to India, both areas already occupied by Neanderthals, and possibly the compounding stressor of the Toba volcanic supereruption ~74 ka. N moving northward out of SW Asia into Eurasia may correlate to Dené-Caucasian languages and M in India and beyond, Eurasiatic languages. R clades migrated all the way to SE Asia/Sahul by a southern route *sensu lato* and did so along with some N clades, and this Southern R correlates to Austric and Pama-Nyungan languages. Later in SW Asia R→U clades, some remaining in SW Asia and others spreading to North Africa, South Asia and Europe and correlating to early forms of Semitic, Dravidian and Kartvelian.

Given the rescaling of L3 dates the notion that there was some sort of 'fast track' to Australia is no longer tenable; it appears to have been a slow walk with many pauses at various geographic bottlenecks, along with species admixtures along the way. Given the mosaic of early *Homo sapiens sapiens* cultures across North Africa and SW Asia the notion that one can propose a single or even a couple arrows from East Africa to Australia is a definite oversimplification if not a falsifiable illusion. What all this has to say about reconstructions of language superfamilies, such as Nostratic, Borean and 'southern route Indo-Pacific' languages, I leave to linguists.

Limitations

The focus of this review has been mtDNA; I have not reviewed Y-DNA studies. Whether proposed hypotheses are or are not supported by recent Y-DNA I leave to others more familiar with this side of archaeogenetic research. I only mention in passing that Cruciani, Trombetta et al (2011) proposes a major revision and age increase for the root for the Y-phylotree.

- Cruciani F, Trombetta B, Massaia A, Destro-Bisol G, Sellitto D, Scozzari R. 2011. A revised root for the human Y chromosomal phylogenetic tree: the origin of patrilineal diversity in Africa. The *American Journal of Human Genetics* 88: 814–818.

They report new DNA findings that require identify a new root 'Adam' (142 ka), which branches into A1b and A1a-T (108 ka) which gives rise to A1a and A2-T (105 ka), then A2-T yields A2, A3 and BT (75 ka), and the latter yields B and CT (39 ka) with the out of Africa lineages C and R. They conclude that "contrary to previous phylogeny-based conclusions, the deepest clades of the revised MSY phylogeny are currently found in central and northwest Africa. MSY lineages from these regions coalesce at an older time (142 ka) than do those from east and south Africa (105 ka), opening new perspectives concerning early modern human evolution" (817). I note that their proposed TMRCA dates for 'Adam' (142 ka) and

for the next branch A1a-T (105 ka) place the root in MIS 5e or earlier and the next branch in MIS 5c, which appears to be in agreement with my hypotheses for the stages of out-of-Africa from NW Africa to the Levant.

Given the 2012 chaos of out-of-Africa mtDNA archaeogenetics, which raises doubts about the mtDNA mutation clock and even the phylotree branches around L3, any out-of-Africa hypotheses must be considered highly tentative. My guess is that it will be a few years before the field reconsolidates itself. We must await new genetic analysis methods, rescaling of prior timelines and new discoveries. I look forward to readers' thoughts and comments on my suggested new model for out-of-Africa before out-of-Arica.