

The saltational model for the dawn of *H. sapiens*, chin, adolescence phase, complex language and modern behavior

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ABSTRACT

A new model may contribute to resolve the origin problem of *H. sapiens*. According to our new viewpoint, Neandertals were neither one of our direct ancestors nor a different species. Their origin was not in Europe 150-200 or 300 thousand years ago. As for the origin of *H. sapiens*, it was neither in Africa roughly 2 million years ago nor roughly 200 thousand years ago. In other words, both the Multiregional model and the recent African origin model seem wrong. Our own species arose in the Middle East approximately 150 thousand years ago and split into two subspecies: Moderns and Neandertals. Rapid and radial expansion of *H. sapiens* from the origin implies a revolution (see **Figure 1**). Complex language, modern behavior and even adolescence phase plus chin might be included into the revolution. This possibility seems consistent with the data and could also be tested via; 1-the origin of complex language based on the modern human form of FOXP2 gene, 2-the origin of adolescence or adolescent growth spurt, 3- the genetic origin of the Flores hobbits. If all of these three origins appeared in the Levant about 150 thousand years ago then our model is true in all aspects. This speciation seems an unexpected revolution or macroevolution occurred in several thousand years. The last pre-sapiens hominids may be extinct due to the coldest stages of OIS 6 namely without replacement by sapiens.

INTRODUCTION

Is it true that *Homo sapiens* is anatomically modern humans only? When and where did they appear? Was the origin in Africa about 160 thousand years (ka) ago (White et al. 2003) or not? Why have Neandertals been disappeared? Was it due to a replacement by modern humans or admixture (assimilation)? In other words, were they a subspecies of *H. sapiens* or a separate species? If this archaic-looking humans were a subspecies, then what is the description of *H. sapiens*? Consequently the relationship between Neandertals and modern humans could not be resolved until now. Accordingly, the origin of *H. sapiens* is still controversial.

To explain some fossil and genetic findings implying rapid speciation in geological history and today some models were proposed by a number of authors such as saltation model of R. Goldschmidt (1940), punctuated equilibrium model of N. Eldredge & S. J. Gould (1972) and quantum speciation model of S.M. Stanley (1979). In this paper, our model aiming to enlighten the origin problem of *H. sapiens* can contribute to the ongoing debate of gradual versus rapid speciation.

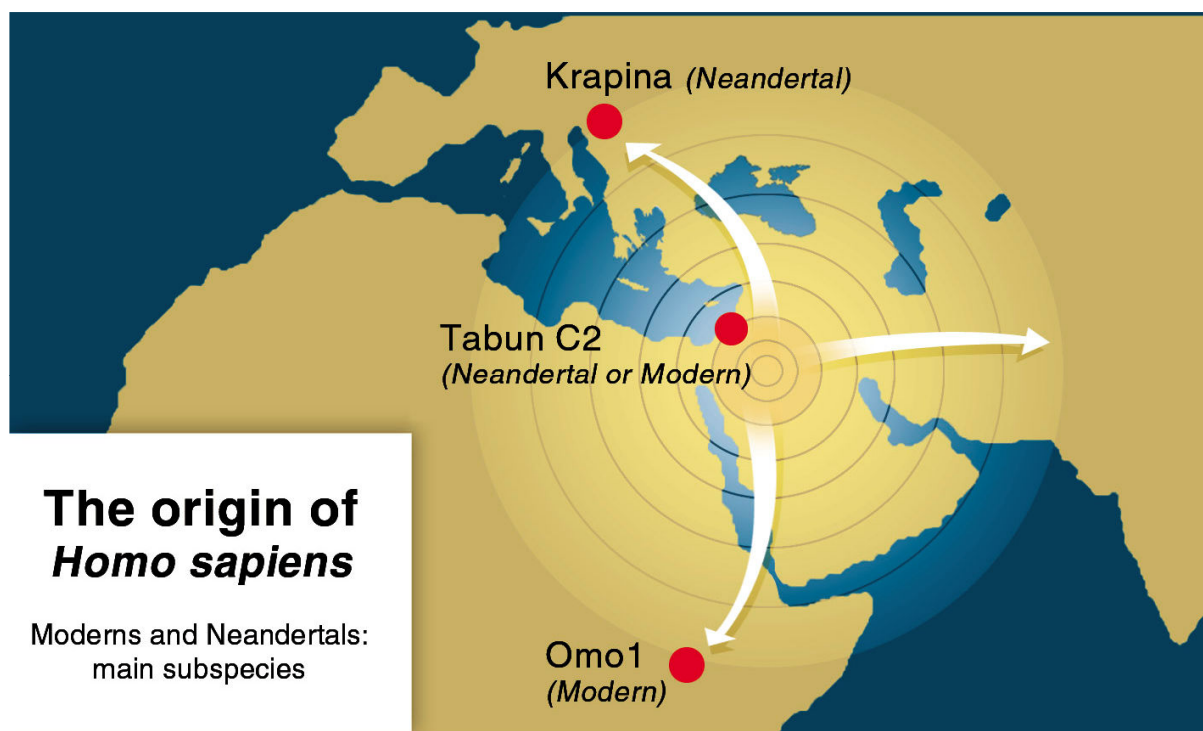


Figure 1: *H. sapiens* arose about 150 thousand years ago. The rapid and radial expansion implies a revolution and also an empty habitat. Tabun C2 mandible of circa 150 thousand years old seems relatively Neandertal. The fossils from Krapina and Omo are approximately 130 thousand years old.

CONCEPTUAL FRAMEWORK

If Neandertals were “images of ourselves” (Trinkaus and Shipman 1993) then they must be *H. sapiens*, but they were not genetically our direct ancestors (Caramelli et al. 2003; Krings et al. 1997, 1999, 2000; Ovchinnikov et al. 2000; Serre et al. 2004), then they must be neither one of our direct ancestors nor a separate species (Cakir and Noyan 2002). If so, the both subspecies must have appeared in the Middle East about 150 ka ago. Because the oldest known “**semi-split subspecific fossils**” are there: Tabun C2 (or Tabun 2) mandible seems relatively Neandertal, and Skhul/Qafzeh skulls seem relatively Modern. In other words, the fossils are neither transitional nor mixture between Neandertals and Moderns.

After the appearance of the *H. sapiens*, the choosing of the morphologically similar partners for mating (relatively Modern or relatively Neandertal) was sufficient for the progression of the subspeciation. Thereafter Neandertals became increasingly more robust (less Modern) as opposed to Modern subspecies, until the admixture with Moderns. The considerable admixture started in the Levant about 55 ka ago based on Amud 1 Neandertal from Israel, and afterwards in Europe about 40 ka ago based on the Vindija Neandertals from Croatia (Ahern et al. 2004). The fact that after a long time the Amud and Vindija fossils are more modern than previous Neandertals confirms this admixture. In other words, the “Out of Africa” migration was largely after OIS 4. Indeed, there are genetic evidence that this migration was after 60 ka ago based on Y chromosome (Wells 2002), and 58 ka ago based on the genetic diversity in *Helicobacter pylori* (Linz et al. 2007). Seemingly, after the admixture the modern subspecies became more resistant to cold climate, and consequently Moderns easily expanded towards north. Also, the admixture, after a long separation period, of the different genes of two subspecies probably triggered both Chatelperronian and Aurignacian industries.

FOSSIL EVIDENCE

According to this model, the oldest known fossil of *H. sapiens* is Tabun C2 mandible from Israel. It is approximately 150 ka old based on the newest dates for Tabun level C such as circa 165 ka with TL method (Mercier and Valladas 2003), and approximately 140 ka with ESR technique (Grun and Stringer 2000). The mandible is either Neandertal (Stefan and Trinkaus 1998) or Modern-like (Quam and Smith 1998). In

another study by Holton (2002) the mandible is reassessed rather Modern: *“There are a number of features on the Tabun C2 mandible that appear to be rather modern. For instance, this specimen seems to exhibit a chin. While most of the symphysis is broken, one can see mental fossae which are indicative of a modern chin. Also, Yoel Rak, in 1998 examined ramus morphology in Neandertals and concluded that the shape of the coronoid process was very much like modern humans as opposed to Neandertals. When I did my thesis on the Tabun specimen, I came to the same conclusion about the shape of the ramus although found that the retromolar space appeared to be more consistent with Neandertals. The retromolar space comparison was based on a very small comparative sample and therefore preliminary at best. Of course Stefan and Trinkaus argued that Tabun C2 was more consistent with Neandertals. However, its just one of those specimens (ramus morphology or retromolar space) that doesn't fit well in either category”* (Nathan E. Holton, private communication). A more recent study has confirmed the ambiguity and decided that it is relatively Neandertal (Harvati et al. 2006). The dual affinity is also valid for Skhul/Qafzeh crania (e.g. Kramer et al. 2001). This fact supports that both Moderns and Neandertals originated in the Middle East. Indeed it is interesting that the oldest ones of the indisputable Neandertal crania from Krapina Cave (Croatia) about 130 ka old (Rink et al. 1995) and from Saccopastore quarry in Rome (Italy) about 125 ka old are more modern than the subsequent crania. Additionally, there is dental closeness between Tabun C2 and the Krapina sample (Stefan and Trinkaus 1998). More important, European Neandertals exhibit a suprainiac fossae (probably excluding, Krapina 11.5) while this feature is exist in Skhul 9 (Smith et al. 2005, Table 2). All these points present a consistency with our approach that the origin of Neandertals was in the Middle East, and until the mixing with the Modern subspecies, they became gradually more robust because of both genetic and environmental factors. So their strict isolation in Europe between 130 and 40 ka ago produced the European classic Neandertals. Due to non-strict isolation, Near Eastern Neandertals were less robust.

The dates of the fossils decrease towards western Europe for example at Scladina Cave (Belgium) about 127 ka, at Moula-Guercy Cave (France) about 110 ka, towards southern Africa for instance at Klasies River Mouth Cave (South Africa) about 115 ka, towards eastern Asia at Tongtianyan Cave (Liujiang hominid, China) interestingly 111 ka or more years (Shen et al. 2002) and so completely consistent with our

model. Furthermore, a “design matrix” test for the origin of anatomically modern humans implies single origin out of southwest Asia (Sokal et al. 1997), namely the origin of Modern humans is in the Levant.

Some of the relatively Moderns passed into Africa circa 135 ka ago, through probably the Bab-el-Mandeb Strait. Accordingly, early African modern humans were somewhat Neandertal-like (less modern), for instance Omo 1, Klasies River Mouth and Border Cave remains (Churchill et al. 1996; Pearson and Grine 1997; Pfeiffer and Zehr 1996).

Additionally our model could perfectly explain the problematic sequence in the Levant. For example Skhul/Qafzeh humans seem 122 (+20/-12) ka old based on the new dating with “the combined U series/ESR method” on dental material from Skhul burials (Grun et al. 2002). This spectrum too, is fully compatible with our model. Apparently, the relatively Modern subspecies migrated to north (to Israel) about 135 ka ago due to the Eemian interglacial period and lived until roughly 115 ka ago. Indeed, the stable isotope data from Qafzeh imply Eemian (Hallin et al. 2003). Since Skhul/Qafzeh humans are younger 15-35 ka the distinctness between Tabun 2 and Skhul/Qafzeh mandibles is explicable. In other words, the interval is sufficient for the rapidly subspeciation due to the rich gene pool of *H. sapiens*.

As for Tabun C1 (or Tabun 1) female burial, it could not be 120 ka old, because both Neandertals were a cold-preferred subspecies and became gradually less modern (more robust) until the admixture. Then Tabun 1 must be an intrusive burial from Level B into Level C, the case which was emphasized previously by several authors (e.g. Bar-Yosef and Callander 1999). Tabun 1 probably returned from north about 70 ka ago because of harsh climatic conditions (OIS 4). As for Kebara 2, the male burial is about 60 ka old and naturally more robust (less modern) than Tabun 1 (Likewise, in Iraq, Shanidar 1 of 60 ka old is more robust than Shanidar 2 of 75 ka old). Finally, Amud 1 male burial is more modern due to the admixture about 55 ka ago.

As a result; more primitive fossils could not be *H. sapiens*, such as Herto (BOU-VP-16/1), about 160 ka old from Ethiopia (White et al. 2003) and Zuttiyeh between 200 and 250 ka old from Israel (Zeitoun 2001). Also, pre-Eemian European fossils such as Biache-Saint-Vaast partial crania between 160 and 195 ka old from France, and the deciduous molar (S14-5) from Abri Suard, France circa 150 ka old are not Neandertal.

As a last note, Omo Kibish's (Omo 1) new dating of 195 ka ([McDougall et al. 2005](#)) could not be true because the cranium is more modern than the Herto specimen. Also, Omo 1 exhibits a chin and Tabun 2 mandible implies a weak chin. There is no earlier evidence of chin, for instance Jebel Irhoud 3 mandible of 160 ka old does not display a chin. In this case, the dawn of chin seems revolutionary, contrary to Schwartz and Tattersall's ([2000](#)) approach.

GENETIC EVIDENCE

According to mitochondrial DNA and Y chromosome studies the origin of modern humans is generally between 100 and 200 ka ago for example roughly 145 ka ([Chen et al. 2000](#)) and 150 ka ago ([Hammer et al. 1998](#)). And the origin of modern form of FOXP2 gene that is related with speech and language is considered between 120 and 200 ka ago ([Enard et al. 2002](#)).

Regarding the separation time of Africans and non-Africans a study of genetic absolute dating based on microsatellites has estimated that the deepest split in the human phylogeny occurred about 156 ka ago ([Goldstein et al. 1995](#)). Another study has calculated this separation time approximately 137 ka with *Alu* insertion polymorphisms ([Stoneking et al. 1997](#)). And according to another work it was about 190 ka ago based on X-linked PDHA1 ([Harris and Hey 1999](#)). The dates are earlier than 130 ka and therefore the time of separation is exactly consistent with our model.

In addition, it is noteworthy that there was a population growth for modern humans outside Africa about 143-136 ka ago based on chromosome 16p from British and Japanese individuals ([Alonso and Armour 2001](#)). The roughly synchronous expansion of Europeans and Asians circa 140 ka ago is compatible with only our model. Likewise, there is another hint in Zietkiewicz et al.'s study ([2003](#)) that the origin of *H. sapiens* may be outside of Africa as early as 160 ka ago.

Based on the mitochondrial DNA of European Neandertals between 42 and 29 ka old Neandertals are commenced to be considered as a different species. But our model points out that they were not ancestor to European Moderns, they were a subspecies of *H. sapiens*. The large differences between their mtDNA sequences and those of living Moderns could be explained via our model, based on the subspeciation of *H. sapiens* at the origin, and on a long isolation of Neandertal subspecies in Europe during 110 ka. So the large

differences are a foregone conclusion and confirm our model. In according to the estimation based on ancient DNA analyses, Neandertals and Moderns last shared a common ancestor between 741 and 317 ka ago ([Krings et al. 1999](#)), but this seems incorrect because these two subspecies originated in the Levant circa 150 ka ago.

Meanwhile, there is an ongoing debate regarding the dwarf fossils from Flores island, Indonesia, between 12 and 95 ka old. They are either an extinct species as *H. floresiensis* ([Brown et al. 2004](#); [Falk et al. 2007](#); [Morwood et al. 2005](#)) or a pygmoid/microcephalic sapiens ([Jacob et al. 2006](#); [Martin et al. 2006](#)). If they had the FOXP2 gene and also their genetic origin was in the Middle East about 150 ka ago then the hobbits are *H. sapiens* not a distinct species. So the genetic studies may confirm our model and the rich gene pool of *H. sapiens*.

LANGUAGE, BEHAVIOR AND ADOLESCENCE

Sudden or fast expansion of *H. sapiens* from the Middle East can be a strong sign of complex language and modern behavior. Such rapid expansion hints to curiosity, communication, high adaptation ability etc. In this case, behavioral modernity seems synchronous with *H. sapiens* not tardily.

Personal adornment is a form of symbolic behavior. Interestingly the oldest known shell beads are at Skhul Cave, Israel, between 135 and 100 ka old ([Vanhaeren et al. 2006](#)) namely in the Levant, much earlier than the shell beads of 82 ka old from North Africa ([Bouzouggar et al. 2007](#)), and 75 ka old South Africa ([Henshilwood et al. 2004](#)). Likewise, the oldest known “real” burials too, are in the Levant. According to our model, the oldest known burials are at Skhul (probably Skhul 9) circa 135 ka old ([Grun et al. 2002, 2005](#)) and at Krapina about 130 ka old. Earlier possibilities are not real burials such as Sima de los Huesos (Spain) 400-500 ka old and Pontnewydd Cave (Wales) 200-250 ka old. It should be explained that Krapina is not a burial in the usual sense of the word, although the bones were certainly buried in a pit. However, there was mortuary ritual behavior at Krapina ([Cook et al. 2005](#)). The abnormal burials, bizarre rituals and cannibalism for instance at Moula-Guercy Cave ([Defleur et al. 1999](#)) might be due to religious trends. And religion implies a complex language, otherwise religion (and so deliberate burial) could not spread.

Besides, the oldest known color symbolism seems in the Levant too. In Qafzeh's oldest levels the discovery of 71 pieces of red ochre, ochre-stained stone tools, of the remains of large hearths and scattered shells of inedible mollusks suggests that the relatively Modern subspecies produced the red pigment and used it with the shells in symbolic activities related to burial ritual (Hovers et al. 2003). Eventually symbolic behavior, complex language and religion (intentional burial) probably appeared with the revolution in the Levant.

Some important signals of modern behavior are seen at Lazaret Cave in Nice, France. *"Since 1969, the excavations have shown clearly 25 levels of hominid occupation. Habitat organization seems special to the upper level. On the other levels, there is no a real organization of the habitat"* (Patricia Valensi, private communication). Also, several areas with quantities of tiny marine shells suggested that humans were bringing dried seaweed (and so the tiny shells) for bedding material. These behaviors seem simultaneous with the first European Neandertals, because a last dating of the upper level with the combined U-Th /ESR method is about 130 ka (Michel 1996). Moreover, in Europe there was shellfishing about 110 ka ago at Moscerini Cave/Italy (Stiner et al. 1999), and this date is near to those of Moderns at Klasies River Mouth/South Africa and Abdur/Eritrea (Walter et al. 2000). Finally, there is no strong evidence earlier than 130 ka for modern human behavior in Europe or Africa. So, the hypothesis that it evolved in Africa 250-300 ka ago from the behavior of *H. helmei* (McBrearty and Brooks 2000) could not be true.

On the other hand, there is evidence that *H. ergaster* (or *H. erectus*) could not speak. Because the thoracic vertebral canal of Nariokotome KNM-WT 15000 skeleton was narrow (ape-like), and so its nervous system capacity was insufficient for a fine breathing control and speech (MacLarnon 1993). This evidence is rejected by several authors (e.g. Meyer et al. 2006), however there is no dispute that Neandertals had a wide thoracic vertebral canal like Moderns (MacLarnon and Hewitt 1999).

Also, it is known that adolescence phase is unique to *H. sapiens* among animals today, and there is evidence that both *H. ergaster* (WT 15000) and *H. erectus* (Sangiran S7-37) did not have an adolescence phase (Dean et al. 2001). Jebel Irhoud 3 juvenile of 160 ka old (Morocco) implies a more similar growth to modern humans than to earlier members of genus *Homo* (Smith et al. 2007) but it is unknown whether they had adolescence phase. As for Neandertals, they present the dental evidence of a modern human-like slow

growth (Dean et al. 2001; Guatelli-Steinberg et al. 2005; Macchiarelli et al. 2006), which suggests the existence of adolescence phase.

Adolescence phase allows extra time for learning. Its absence implies the absence of complex language. If extra time for learning was absent, extra learning also was absent, and if extra learning was absent then complex language was absent too. Because extra learning especially requires a complex language. Consequently, without an adolescence phase, existence of complex language seems meaningless, perhaps impossible. If adolescence phase did not exist until about 150 ka ago, in that case the dawn of complex language was revolutionary. In other words Noam Chomsky's approach seems right. Then the hypothesis that complex language began at least 400 ka ago based on the hypoglossal canal size (Kay et al. 1998) could not be true. Also the hypoglossal canal is not a reliable criterion (DeGusta et al. 1999).

In the present case, art also must be unique to *H. sapiens*. The venus of Mumbwa from Zambia, a natural dolomite form resembling a headless human with two legs and truncated arms is about 120 ka old (Barham 2000), and its age is consistent with our model. More interestingly, the Berekhat Ram figurine, a female-like basaltic tuff pebble 35 millimeter in length is in the Levant (d'Errico and Nowell 2000; Marshack 1997). If our model is true the figurine must not be older than 150 ka instead of minimum 230 ka. There is a report about a human-like stone of circa 400 ka old, roughly 60 millimeter in length from Tan-Tan, Morocco (Bednarik 2003). However it is possible that the stone was shaped because of natural weathering.

According to our model the pre-*sapiens* species of the human genus might be extinct without replacement by *H. sapiens*. Because the rapid expansion of *H. sapiens* from the Levant implies also an empty habitat, and moreover, until now there is no evidence for interaction or replacement. The extinction might be due to the lack of adaptation to climatic changes, especially in the middle of OIS 6 which is one of the coldest stages, also due to the infertility depending on mutational and/or non-mutational illnesses, contagious diseases, lack of care etc. If modern behavior (and so conspecific care) is peculiar to *H. sapiens*, and if the last pre-*sapiens* hominids were extinct because of OIS 6, namely without replacement, then Aubesier 11 mandible 175-200 ka old from France (Lebel et al. 2001) is not *H. sapiens*, and naturally could not be evidence of conspecific care (see also DeGusta 2003).

NEANDERTAL: POTENTIALLY EQUAL TO MODERN

In according to our model, there are sufficient evidence that Neandertal subspecies is potentially equal to Modern subspecies. For instance, a complete hyoid (throat) bone from Kebara (Israel), about 60 ka old which is indistinguishable from those of us in size and shape ([Arensburg et al. 1989](#)), and also a supralaryngeal vocal tract similar to that of Moderns ([Houghton 1993](#)) hint that their speech and language ability were like that of Moderns. The famous Shanidar 4 burial, about 60 ka old which was covered with wildflower and medicinal plant pollens ([Lietava 1992](#); [Solecki 1975](#)) confirms that there were flowery burial rituals and use of medicinal plants like Moderns.

A mammoth tooth from Tata, Hungary, carved as oval-shape and of which crevices have been intentionally filled with ochre suggests that there was Neandertal art perhaps 80-100 ka ago. Lastly a rock art (Neandertal face), 32-35 ka old, was found in France ([Marquet and Lorblanchet 2003](#)). Again, there was systematic use of manganese pigment as ornament about 55 ka ago at Pech-de-l'Aze, France ([d'Errico and Soressi 2002](#); [d'Errico 2003](#)). In Europe, after the interaction they made more sophisticated ornaments and bone tools such as those at Arcy-sur-Cure, France, 34 ka ago ([Hublin et al. 1996](#)). Or perhaps before the interaction, Neandertals developed some important aspects of “modern” behaviour in Chatelperronian culture ([d'Errico et al. 1998](#)).

They made Mousterian tools about 45 ka ago by sticking stone heads to wooden handles with pitch, based on fossilised wood tar, containing a fingerprint, and the imprint of a flint stone tool was found near Königsau (Germany). Then, they must have possessed a high degree of technical and manual abilities, comparable to those of Moderns ([Grunberg 2002](#); [Koller et al. 2001](#)). Already, both subspecies used the same toolmaking technology (Mousterian) in the Levant. Indeed, a new computer analysis of their thumb and forefinger by using a three-dimensional dynamic simulation concludes that manual dexterity in Neandertals was not significantly different from that of modern humans ([Niewoehner et al. 2003](#)). Stable isotope analysis of Neandertal bones from Vindija (Croatia) shows that they relied almost exclusively on red meat, namely they were effective predators, not scavengers which implies a high degree of social organization and behavioral complexity ([Richards et al. 2000](#)). As a last example, they used coal for fuel at Les Canalettes (France) about 73 ka ago, based on lignite fragments in a hearth ([Thery et al. 1996](#)). In brief, *“there are reasonable indications for some specialized and structured use of space; for the construction of*

shelters; for the use of a sophisticated technology involving standardized tools, economically rational behavior and foresight; for the ability to make basic bone tools, evolved stone blades and other complex tools; for the existence of rituals; for the existence of symbolic burials; and for the existence of cultural differences between regions” (Hayden 1993), all these imply that the cultural capacities of Neandertal subspecies were not inferior to that of Modern subspecies.

As for the disappearance, Kramer et al.’s study (2001) has showed that the replacement is impossible in the Levant. More important, firstly, the resemblance of the cranial morphology between late European Neandertals and early European Moderns such as between Spy 2 and Mladec 5 (Wolpoff et al. 2001), secondly, the existence of the certain Neandertal traits in the post-Neandertal Europeans (Freyer 1992), and thirdly, the finding in Portugal, 24,5 ka old, early European modern which was a hybrid child fossil four-year-old, based on Neandertal-like limb proportions and a characteristically modern protruding chin (Duarte et al. 1999) reveal that Neandertals could breed with Moderns even after a long isolation of about 125 ka. Thus, essential factor of the disappearance is clearly admixture instead of replacement (Smith et al. 2005).

Finally, Neandertal subspecies was potentially equivalent to Modern subspecies from the time of emergence of *H. sapiens* to the assimilation. In this case, the some opposite hypotheses could not be true as follows: there was deficiency in their language and speech (Laitman et al. 1996; Lieberman 1994; Schwartz and Tattersall 1996); their graves were not intentional (Gargett 1989, 1999); there was no flowery ritual for Shanidar 4 burial; the flowers were accumulated by the Persian jird, *Meriones persicus* (Sommer 1999); and behavioral modernity is not peculiar to single species (d’Errico 2003).

CONCLUSION

The origin of *H. sapiens* was not in Africa, roughly 2 million years ago or about 1 million years ago or circa 300 thousand years ago or at least 160 thousand years ago. Apparently *H. sapiens* suddenly arose in southwest Asia about 150 thousand years ago with a larger brain, thinner skull bones (not thick-headed!), a chin (relatively pronounced in the relatively Moderns, and weak in the relatively Neandertals), a higher forehead (relatively higher and lower), a smaller brow ridge, a smaller face, smaller teeth, a wider thoracic vertebral canal, an adolescence phase, a more complex toolmaking tradition, a fully syntactic language and

modern behavior. If the situation is so, this event is a saltational macroevolution. The ancestral species of *H. sapiens* is unknown for the present.

ACKNOWLEDGEMENTS

We are grateful especially to H.C. Harpending for his first clear support in 2002-2003; *“the viewpoint that moderns and Neanderthals are two branches arising from a single origin event, is new to me and I find it very attractive. I have not seen it put this way in the literature, so your paper has the potential to change a fundamental viewpoint in the field”* *“As I said before I think that your model needs serious consideration, but it violates the consensus of European and American anthropologists. I personally believe that this consensus is artificial, but these things happen in science”*, also to F. H. Smith, J. H. Schwartz, F. Schrenk, I. Tattersall, K. Mowbray, I. Karavanic, I. Jankovic and N. E. Holton for their comments on earlier drafts of the paper, to Y. E. Hatunoglu and O. Nalin for the figure. The first author thanks to A. Aymaz, N. Bayhan, Y. Salvarci, B. Basfirinci, S.B.S. Turan and M.U. Karacayli for their support.

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