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Modern Humans' Expansion in Eurasia: One Flew East…

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Abstract: The initial expansion of anatomically modern humans (AMH) occurred during a hyperarid event in Africa that occurred 135-75 ka. Large-scale AMH spread in northern Eurasia started during the Middle Weichselian glacial maximum, and proceeded during the subsequent mild interstadial (60-40 ka ago). This expansion which encompassed the polar regions and southern Siberia proceeded at a remarkably rapid pace, suggesting the entire area being taken up by uniform 'periglacial' landscape, equally suitable for AMH habitation. The 'transitional' industries (Chatelperronian, Szeletian, Streletsian etc) have seen archaeological manifestations of early AMH expansion.

Key Words: Northern eurasia, anatomically modern humans (AMH), palaeolithic, heinrich events.

INTRODUCTION

There are two basic hypotheses regarding the origins of Anatomically Modern Humans (AMH). The first one known as a 'multiregional evolution' [1] is based on the apparent similarity of skeletal remains of *Homo erectus* and *H. sapiens.* Its proponents trace the origins of all modern populations back to an African source, whence it gradually spread over Eurasia. The observable regional variants are viewed as a consequence of environmental differences, emerging through genetic drift and bottlenecking. The second hypothesis known as 'Out-of-Africa' scenario asserts that modern humans evolved comparatively recently from a small population in Africa, which totally replaced the archaic hominids. In recent years new data pertinent to early manifestations of anatomically and behaviourally modern humans (AMH) became available from various parts of the former USSR. This, together with new evidence from other parts of the world that includes technologically advanced radiometric measurements, climatic modeling and molecular genetics, may sufficiently clarify the origins and subsequent dispersal of modern humans. The present paper aims at a critical assessment of newly available evidence and suggesting novel scenarios for early AMH expansion in Eurasia.

ENVIRONMENT

The initial emergence and the subsequent expansion of AMH occurred during marine isotope stages (MIS) 5d-2, which lasted 117-10 thousand years (ka) ago. This period corresponded to the Last Ice Age, known in Europe as 'Weichselian' and as 'Zyryanka' in Siberia. Considerable climate changes are recognisable throughout this period. The Greenland ice-core project (GRIP) and Greenland Ice Sheet Project (GISP) which included drilling through the base of the Greenland Ice Sheet provided the materials for stable isotope rerecords. They acknowledged signals of 24 high-frequency temperature oscillations for the last 120 ka, which became known as Dansgaard/Oeschger (DO) 'interstadial' events. These events which were generally by 5-6˚ C colder than now, lasted from 500 to 2000 years, and involved shifts in climate (from the warm to cold) of about 7˚ C [2,3]. This time-span also included several 'Heinrich events' [4] recognised on the Atlantic Ocean bottom in the form of ice rafted debris. They were formed by icebergs drifting from the margins of the Laurentide ice lobe during the cold 'stadial' events. In calendar years these episodes are dated: H6 (60 ka); H5 (45 ka); H4 (38 ka); H3 (31 ka), H2 (21-ka) and H1 (15-14 ka).

The data regarding Late Pleistocene climate fluctuations are generally in agreement with recently available evidence of the ice sheet dynamics in northern Eurasia. According to now widely accepted scheme [5], this period included the Early (MIS 5d-a, 117-75 ka), Middle (MIS 4-3, 75-25 ka) and Late (MIS 2, 25-10 ka) subdivisions. During the Early Weichselian an extensive Barents-Kara Seas ice sheet was formed advancing to the Putorana Plateau in Siberia. In the west it merged with the Scandinavian ice sheet restricted to the Norwegian mainland, Finnish Lapland and northern Russian Karelia. The maximum extension of the ice sheets is estimated as c. 90 ka. During the Middle Weichselian glacial maximum (60-50 ka), the Barents Kara ice sheet readvanced onto the mainland covering the Mezen and Pechora river basins. At the same time, the lobe of the Scandinavian ice-sheet filled the entire Baltic Sea and advanced to Kola Peninsula, Finland and Denmark. This episode was largely coeval with H6 event.

As show the pollen data and the 'biomic' modelling [6], the vegetation of ice-free Eurasia during both the colder and milder episodes consisted mainly of herbaceous cold-resistant plants with a limited expansion of forests restricted to the Europe's south. On the East European Plain the colder episodes correspond to the establishment of 'cryo-xerotic' conditions, alternating with an intensive soil building during the milder episodes [7].

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With the ocean level at c 75 m below the present one, the dry shelf was accessible for human migrations. Both the Black and Caspian Seas were mega-lakes separated from the Mediterranean Sea and each other [8]. The influx of melt water resulted in a gradual rise of the levels of these mega-lakes. The Caspian Sea culminated at 16-12 ka BP (the 'Khvalynian transgression') becoming connected with the Black Sea *via* the 'Manych spillway' [9].

EAST EUROPEAN PLAIN

During the course of MIS 5d-a, the southern part of the East European Plain and its mountainous fringes, notably the Crimea and the Caucasus, sustained considerable populations of Neanderthal humans. These are witnessed by the sites with Mousterian-type inventories in some cases (as in the Crimea and the Caucasus) associated with Neanderthals skeletal remains. Chabai [10] distinguishes three main periods of Mousterian occupations in the Crimean mountains: c. 125-60, 60 – 38 and 38-<28-27 kyr BP.

The early manifestations of AMH in Europe are acknowledged by the appearance of sites with Upper Palaeolithic (UP) technologies. The fully developed UP industries classified as Aurignacian appear in the eastern Carpathian area at about 32.7 ka [11]. A similar age (30-28 ka BP) has been obtained in the Crimea [10] and northern Caucasus [12]. Among its main attributes one note [13] the prevalence of prismatic blade technology with the common occurrence of UP-type tools, notably, end scrapers (and particularly, the carinated varieties), blade burins, notched, denticulated and scaled pieces (*piéces ésquillées*), retouched blades and points (particularly of Dufour, Font-Yves and Krems types), as well as varied bone and antler industries (split-base antler points being considered as the diagnostic tool). Significantly, early Aurignacian sites often include manifestations of symbolic behaviour, rock engravings, sculptured zoomorphic and anthropomorphic effigies and personal ornaments.

The earliest radiometric dates obtained with the use of various dating techniques in various parts of Europe suggest the age of oldest UP sites in Europe as in the order of 40-43 ka. Taking into account the possible uncertainty of radiometric dates Kozlowski [14] suggests that the spread of initial elements of UP technologies occurred in several waves during the time-span of 48 – 38 ka.

An early Upper Palaeolithic occupation is signaled for the central areas of East European Plain as exemplified by Kostenki sites on the River Don (Fig. **1(1)**). The earliest UP layers have been reached in the lowermost strata of Kostenki 12 site, radiocarbon dated to 40 – 42 and with OSL dates between 52 and 45 ka [15]. Still more important evidence comes from the Kostenki 14 site, which level IVa produced a consistent series of radiocarbon measurements ranging from 36.5 to 32.6 ka BP [16, 17]. This level yielded a rich industry which included a typical UP tool-kit combined with archaic bifacial, mainly oval convex-flat implements. The level includes symbolic manifestations, including a head of a female figurine made of mammoth tusk (Fig. **2**).

The sites of a comparable age have been identified in the extreme north-east of East European Plain, close to the Polar Circle (Fig. **1(2)**). A series of radiocarbon dates obtained for bones and mammoth tusks from the Byzovaya site, yielded the age in the range of of 25.5-30.0 ka, with one sample showing the age of 33±2 ka [18]. At the site of Mamontovaya Kur'ya still further to the north, bones of large mammals and artefacts , which included incised mammoth tusk (Fig. **3**) were found in river-channel deposits.

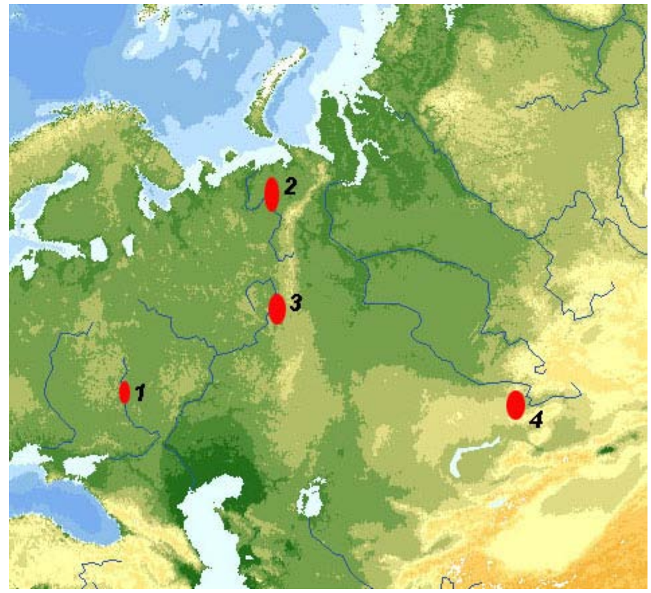

Fig. (1). Location of major Palaeolithic sites on East European Plain and southern Siberia; **(1)** – Kostenki area; **(2)** – Byzovaya-Mamontova Kurya; **(3)** – Chusovaya; **(4)** – Altai Mountains.

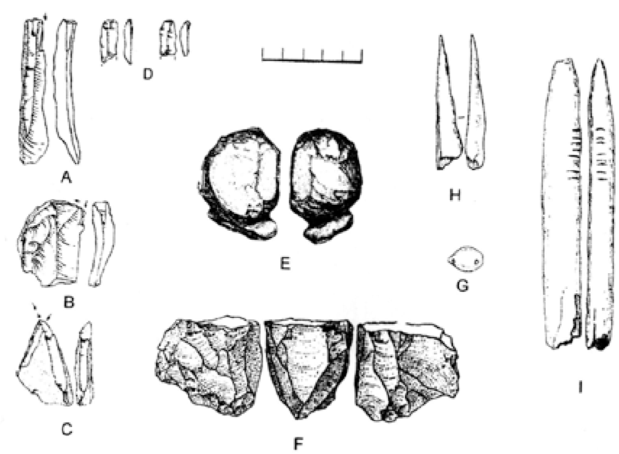

Fig. (2). Artifacts from Kostenki 14 site, layer (**A-C** burins; **D** – blade fragments; **E** – ivory anthropomorphic figurine; **F** – core; **G** – perforated shell; **H** - bone awl; **I** – incised bone point) [15].

Fig. (3). Incised mammoth tusk from Mamontovaya Kurya site [19].

Radiocarbon dated bones yielded the age of 37-35 ka [19]. A group of early UP sites has been found on the Chusovaya River in the western foothills of the Ural Mountains (Fig. **1(3)**). One of the sites, Zaozer'ye yielded a series of radiocarbon dates in the range of 31.5-30.7 ka [20].

SIBERIA

Mousterian industries were reportedly identified in the Altai Mountains, both in the open-air sites (Kara-Bom and Ust-Karakol-I) and rock shelters (Ust-Kan, Strashnaya, Denisova, Okladnikov) [18, 19] (Fig. **1(4)**).

The Okladnikov Cave in the Altai Mountains yielded several human teeth and postcranial bones. The teeth are radiocarbon dated to 37750±750 and 43700+1100/-1300 years BP [25]. The attribution of these skeletal remains caused a considerable controversy. Turner [26] diagnosed the premolar from the Okladnikov Cave as similar to those of European Neanderthals. Alekseev [27], (1998) and Shpakova. [28] , on the other hand, found no deviations from the morphology of modern humans. Krause *et al*. [25] based on recently performed comparison of mitochondrial DNA sequences concluded that that the Okladnilov Cave skeletal remains 'belonged to a population related to European and western Asian Neanderthals'.

Several sites in southern Siberia yielded the 'transitional' industries which are referred to as 'the initial Upper Palaeolithic' (IUP) [21,22,23,24]. These industries combine the Upper Palaeolithic technology with archaic elements, bone and antler tools and ornaments. These sites dated to 42-25 ka BP have been identified in the Altai Mountains, along the Angara River and in the Bailkal Lake area [29]. The sequence of Kara-Bom includes the levels attributed to Mousterian and 'transitional' to Upper Palaeolithic industries, which yielded similar radiocarbon dates (>44 ka and 43200±1500 respectively) (Fig. **4**).

DISCUSSION

The radiometric age obtained for skeletal remains of early modern humans and related material culture is much older in Africa and the Near East, than anywhere else in the world. The AMH skeletal remains in Ethiopia show the age of 130 - 195 ka [30,31]. The age of 120-90 ka is attested for samples of South African humans from the Klasies River Mouth [32].

A similar age has also been obtained for early modern human sites in the Near East. The cave sites of Qafzeh and Skhul which contain early forms of *Homo sapiens* have been dated with the use of TL technique to ca 80 - 120ka [33,34]. Recently performed U and ESR analyses of bones and teeth from AMH burial at Skhul yielded the age in the order of 135-100 ka [35].

Both archaeological and genetic data [36,37] strongly signal the large-scale population expansion of early AMH groups. The causal mechanism of large-scale migrations of early modern humans remains a debatable issue. There is little doubt that the adverse environment and food shortages played a significant role in this process. Observations of baboons in their natural habitats and the studies on behavioural ecology of foragers' communities [38,39,40,41] equally suggest that the climate changes leading to the depleted bioproductivity resulted in an increased residential mobility, and an extension of hunting areas. The existing palaeoclimate records [42] indicate a prolonged period of 'megadroughts' that lasted between 135 and 75 ka and virtually coincided with the initial expansion of AMH. One may reasonably suggest that the adverse environment triggered a large-scale human displacement in quest of landscapes better provided with food resources. The ensuing increase in effective moisture punctuated by several episodes of desiccation, equally acknowledgeable in palaeoclimatic records created additional stimuli for population explosion and mobility.

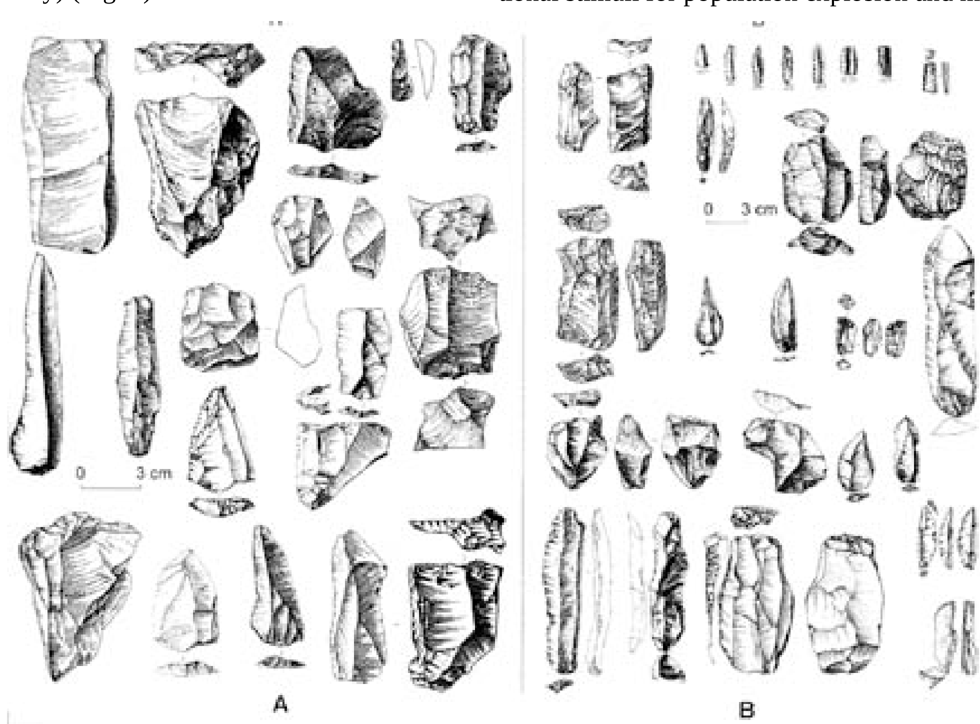

Fig. (4). Stone implements from Kara-Bom site: Mousterian layer (**A**), and Initial Upper Palaeolithic layer (**B**); [21].

Another debatable problem concerns the cohabitation and interactions between the populations of AMH and Neanderthals. Differently to *Homo erectus* and *H. sapiens*, Neanderthals most likely developed in Europe where they are acknowledgeable at least since MIS 7. The Neanderthals prolonged coexistence with the AMS in the Near East and Europe is firmly confirmed. Both the ESR and TL dates for Neanderthal sites at Kebara and Amud fall into the range of 50-65 ka. Even younger age (32-33 ka) has been obtained for Neanderthal specimens from Vindija Cave in Croatia [43]. The southern part of the East European Plain and its mountainous fringes, notably the Crimea and the Caucasus, include a high density of Mousterian sites in several cases associated with Neanderthals skeletal remains, which existed at least until 28-27 ka [10].

Neanderthal populations in Europe were always associated with Mousterian industries. Significantly, the early *Homo sapiens* sites in the Near East were equally associated with the 'Levantine Mousterian (of Levallois facies)'. Still more importantly, the both population exhibit essentially similar symbolic behaviour: primitive modern humans were buried at Skhul and Qafzeh, while Neanderthals, at the Tabun, Kebara, Amud and Dederiyeh caves [44].

The DNA sequencing [45,47] apparently shows that the Neanderthals were a separate lineage or species that did not mix with *Homo sapiens*. This view is contested by Templeton [47], who argues that the 'third out-of-Africa event' was characterised by AMH interbreeding with ancestral populations. This latter view is more in consistence with archaeological evidence

The assessment of Neanderthals' survival and their possible coexistence with the AMH is closely related to the problem of 'transitional industries'. Such industries combining the archaic technology with UP elements have been recognised in the Near East in the form of Ahmarian [48]. To the same category are classified several assemblages in the Balkans which include cave sites in Bulgaria: Temnata I, stratum IV and Bacho Kiro, stratum 4, with the radiometric age of 43 – 36 ka [14]. The latter site includes artistic manifestations: a plate with incised geometric ornament at Temnata (stratum IV) and perforated animal teeth at Bacho Kiro, stratum 11.

The transitional industries include such entities as Châtelperronian in Western Europe, Uluzzian in Italy, Szeletian and Bohunician in Central Europe. All these industries, albeit clearly distinct, share certain common features: the basic Levalloisian technology with the common occurrence of convex backed bladelets [14]. The Châtelperronian in France and northern Spain is unambiguously associated with ornaments, notably, decorated bone tools.

At Kostenki 14 site on the River Don in Russia, the level 14a radiocarbon dated to 36.5 to 32.6 ky BP, yielded prismatic core blades, bladlets, end-scrapers and *piéces ésquillées* combined with archaic small-size bifaces. [16,17]. This and similar assemblages are assigned to the 'Streletsian' Culture in Kostenki and areas further south. Its elements are acknowledgeable in Early UP industries in the Russia's North-East (Mamontovaya Kurya and Zaozer'ye). Further to the east one may find its analogies in 'Kara-Bom'-type industries in the Altai Mountains [49]. All these industries show the combination of archaic and advanced elements in the toolkit, diversified subsistence, evidence of long-range contacts and the occurrence of symbolic objects.

To the same category one may classify the Middle Stone Ages (MSA) industries of Africa. The discovery of symbolic objects at Blombos Cave in South Africa's Cape Province is highly significant. The finds include perforated *Nassarius kraussianus* shells and fragments of red ochre with incised geometric design (Fig. **5**) [50,51]. Perforated marine shells with residues of red pigment have been discovered in Grotte des Pigeons in Morocco in a layer dated to 82 ka [52].

Fig. (5). Engraved ochre from Blombos Cave, Southern Africa [50].

Further examples of perforated shells have been reported from early AMH sites in Algeria (Oued Jebbana) and Isreal (Skhul). Remarkably, the geometric ornaments similar to those from Blombos Cave are common in the ornamented bone industry of Upper Palaeolithic sites of Eastern European Plain (such as Yudinovo, Timonovka and Mezherich [53]. Marshak [54] considered them as 'time notations' and an evidence of human-like cognitive behaviour (Fig. **6**).

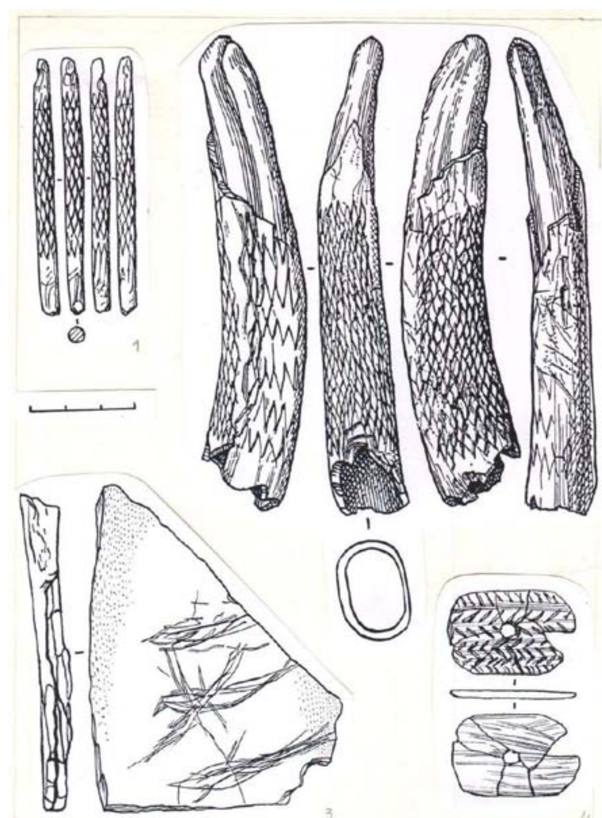

Fig. (6). Engraved antlers from Yudinovo site [53].

Summing up the existing evidence, one might suggest the following scenario of early AMH dispersal (Fig. **7**). The initial expansion of early modern humans occurred during a hyperarid event in Africa that occurred 135-75 ka. One might visualise the trajectory of early AMH dispersal, which lead from eastern Africa to the Levant mostly following the East African Rift. Likewise in the case of initial spread of tool-making hominids, these landscapes offered for early modern humans environmental mosaics sufficiently rich in food and water resources [55].

Levant was the most likely area of active interaction and interbreeding between the Neandethals and AMH. This resulted in mutual cultural borrowing: the acceptance of Mousterian technology by modern humans and elements of symbolic behaviour by Neanderthals (burial rite personal ornaments).

The further spread of AMH from the Levant occurred during the dry episode coeval with H6 event, ca 60 ky. It has been remarked that the onset of cold and dry climate in the northern latitudes corresponded to the establishment of a dry and cool climate in monsoon-affected areas of western and south-eastern Asia, as well as northern and eastern Africa. In the Levant this took the form of low precipitation and expansion of deserts [56].

In the Balkans the expanding AMH groups divided into two branches, one following into Central and Western Europe, and another to East European Plain. The expansion of modern humans in northern Eurasia including its polar regions and southern Siberia proceeded at a remarkably rapid pace, estimated by Mellars [57] as 0.4 km per year. This rapid expansion occurred during the Middle Weichselian glacial maximum (60-50 ka), coeval with H6 event. This further suggests that at that time the vast areas of northern Eurasia were taken up by uniform 'periglacial' landscape, equally suitable for AMH habitation.

The 'transitional' industries were archaeological manifestations of this rapid AMH expansion. These industries which featured cultural diversity and considerable typological and technological variability [49] developed on the base of an active cultural interaction between the expanding *Homo sapiens* and indigenous populations. In most cases these industries are firmly associated with skeletal remains of modern humans. The occurrence of Neanderthal skeletal remains at Châtelperronian sites Saint-Césaire and Arcy-sur-Cure can be viewed as an indication of special positions held by Neanderthal individuals within the *sapiens*-dominated communities.

The mtDNA sequencing of skeletal remains from Okladnikov Cave in the Altai Mountains reportedly demonstrated their affinity to a population 'related to European and western Asian Neanderthals'[25]. Not mentioning the noticeable contamination of fossil bones with modern human DNA which seriously affects the results of this analysis, this might have resulted from the interbreeding of expanding modern humans with Neanderthals as suggested by Templeton [42].

It has been remarked [58] that although the Neanderthals apparently preferred warmer climatic conditions, there is strong evidence that the spatial patterning of Neanderthals and early AMH was very similar. As it seems, the main causes of Neanderthal extinctions should be sought in the social, cognitive and genetic sphere, AMH forming more copious aggregations with an open gene flow. AMH were much better equipped for the information exchange and symbolic communication as witnessed by the systematic occurrence of symbolic objects and works of art from the very early stages of their existence. In the case of glacial advance, small Neanderthal groups became increasingly isolated and vulnerable to genetic diseases.

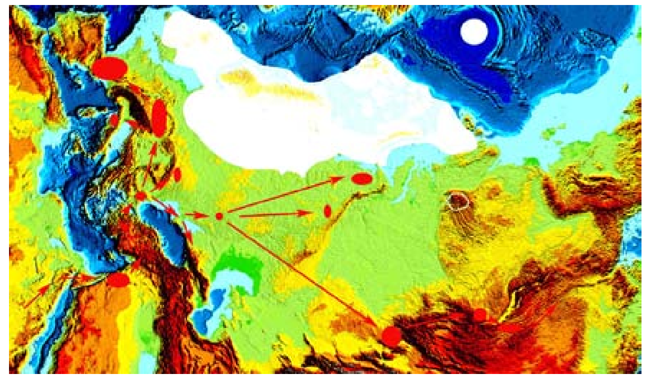

Fig. (7). Trajectories of early AMH dispersal.

Key: white area: ice-sheet, after [5]; red arrows: migratory routes; red ellipses: clusters of sites.

CONCLUSIONS

Early modern humans initially emerged in Africa during a hyperarid event that occurred 135-75 ka.

Large-scale AMH expansion in northern Eurasia occurred during Middle Weichselian glacial maximum, and the subsequent mild interstadial (60-40 ka ago);

The expanding human populations culturally and genetically interbred with autochthonous Neanderthal groups, which archaeologically became conspicuous as 'transitional industries'.

The final demise of Neanderthals resulted from their geographical isolation and vulnerability to genetic diseases.

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