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# HUMANS AND CLIMATE PULSATION

*László Szathmáry*

Department of Evolutionary Zoology and Human Biology, Debrecen University, Debrecen, Hungary

**Abstract:** *The historical diversity of the genus Homo is given a possible new interpretation in correlation with the recent elaboration of a so-called climatefluctuation model. This paleoecological model highlights the significance of a continuous generative equatorial gene pool in the evolution of the genus Homo. It is assumed that different variants of the recent Homo may have evolved parallelly from the early hominid gene pools in Australasia and Africa, while in the peripheries of Pleistocene Eurasia and Africa, in consonance with the cyclicism of climate pulsations, opportunities may have been provided for various anatomically archaic Homo formations: Homo erectus, several types of Ante-Neandertals (Presapiens, Preneandertals) anatomically archaic and modern Homo sapiens and classic Neandertal Man to develop. There is considerable obvious evidence that these latter processes took a direction towards neandertalisation starting from the Holsteinian interglacial.*

*The summation of genetic and osteological data conveys the suggestion that the development of anatomically modern Homo sapiens may be brought into connection with a new equatorial impulse: this modern formation may have developed, at the time of the Eemian interglacial, like an expansion of the generalized Homo gene pool which survived equatorially.*

*The paleoecological approach, which is proposed at present appears to reconcile the so-called Eve hypothesis and the multiregional hypothesis, which is based on classical anatomical evidence.*

**Keywords:** *Climate pulsation; Human evolution.*

## Introduction

Historical diversity of the genus Homo has long been made the subject of various explanations. During the past decades two main approaches have crystallized: the so-called Eve hypothesis and a multiregional hypothesis, which is based on classical anatomical evidence. The present approximation introduces the ecological factor in the investigations and makes an attempt at summing up the contribution of the ecological factors to the development of Homo sapiens. Indeed, as the main object is to analyse this complex of divergent problems, it is necessary to review the spread of the respective forms of the genus Homo parallel with the changes of the most important factor: the climate pulsation.

## Material and Method

Two basic groups of information are required: first, on the taxonomical phylogenetical evaluation of the Homo finds; secondly, on the examination of how the arrangement of the Homo finds corresponds to the system of Pleistocene temperature pulsations. Nevertheless, it should be remembered that both of these aspects may meet with numerous counterarguments. First, an objective taxonomical evaluation can only be carried out in rough outlines. The second field of examinations also requires objective data and can only be explored if the continuous connection between characteristics of the fauna waves is kept in view.

Unfortunately, there are very few reliable pieces of information available, therefore we can only speak about probabilities. However, certain skeletal remains which otherwise appear to be important may be excluded from the constitution of the model by the common application of the above-mentioned two aspects. The model is only based on skeletal finds which are well determined both chronologically and taxonomically, while skeletal finds of uncertain position are omitted so that we can avoid making the conclusions even more questionable.

It has been known that the development of the genus Homo fell into the period of the differentiation of the living structures in the Pleistocene at a time when the significant temperature pulsations exerted a great influence on the changes in gene pools. Hence the rhythm of the glaciation is taken as authentic and the Homo finds of the old world are attempted to be synchronized with this pattern.

The catalogue edited by Oakley, Campbell and Molleson (Oakley and Campbell 1967, Oakley at al. 1971, 1975) was the greatest help with the formation of a typological and chronological database. Knussmann's study (1980), Day's (1977) and Wolpoff's (1996–1997) monographies, Bräuer's (1989) as well as Xu and Bräuer's (1992) studies presented a relevant basis for answering the questions of typology in numerous cases (Table 1). The various temperature pulsation zones were determined on the basis of data measured in the 20th century (Hann and Süring 1940, Kendrew 1953), since these zones may also have taken up very similar positions in periods when the mean temperature was different from that of this century (World Survey of Climatology 1969-1972, Fig. 1). The paleoclimatological arrangement of human finds accomplished by using the Northern and Western European Quaternary subdivision (Woldstedt 1947, 1954).

A similar arrangement of the zones can be observed if we only consider the temperature values which are measured under 500 feet above sea-level (Szathmáry 1982).

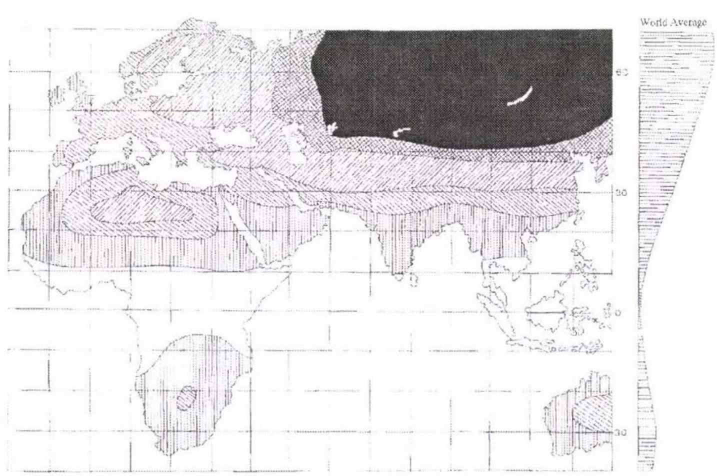


*Figure1:* Climate fluctuation zones (°C) on the continents calculated by the author on the evidence published in World Survey of Cimatology (1969–1972).

*Table 1.* Homo formations from Homo erectus to anatomically modern Homo sapiens.

| Sequence Corresponding Northern and Western European Quaternary Subdivision | Locality | Climatic Conditions | Taxonomic Alternatives |
|---|---|---|---|
| | Africa and Near-East | | |
| Waalian | Olduvai OH-9 | arid | HE |
| | OH-36 | | |
| Waalian | Swartkrans 847 | arid | HE |
| Waalian | ER - 2598 | arid | HE |
| | ER - 164 | arid | HE |
| | ER - 3733 | arid | HE |
| Waalian | Gomboré II | arid | HE |
| Waalian | Koro-Toro | arid | HE |
| Cromerian | Ubeidiya | arid | HE |
| Elsterian | Eyasi | humid | EAHS |
| Elsterian | Salé | humid | EAHS |
| Elsterian | Sidi Abderrahman | humid | EAHS |
| Elsterian | Thomas Quarries I, III | humid | EAHS |
| Elsterian | Tighenif=Ternifine | humid | HE |
| Elsterian interstadial | Olduvai OH-12 | arid | HE |
| Holsteinian | Bodo | arid | EAHS |
| Holsteinian | East Turkana 999 | arid | LAHS |
| Holsteinian | East Turkana 3884 | arid | LAHS |
| Holsteinian | Elandfontsein=Saldanha | arid | EAHS |
| Holsteinian | Kabwe=Broken Hill | arid | AN~NF~EAHS |
| Holsteinian | Mumba XXI | arid | EAHS~AN |
| Holsteinian | Hopefield | arid | NF~LAHS |
| Saalian | Cave of Hearths | humid | EAHS |
| Saalian | Ellye Springs | humid | LAHS |
| Saalian | Florisbad | humid | LAHS~NF |
| Saalian | Laetoli (Ngaloba) H 18 | humid | LAHS |
| Saalian | Rabat | humid | LAHS |
| Saalian | Singa | humid | LAHS~MHS |
| Eemian | Jebel Irhoud 4 | arid | LAHS |
| Eemian | Klasies River Mouth LBS | arid | MHS, PS |
| Eemian | Ndutu | arid | MHS~AN |
| Eemian | Omo 1 | arid | MHS |
| Eemian | Omo 2 | arid | LAHS~PS |
| Eemian | Témara I | warm | AN |
| Eemian | Zuttiyeh 1 | arid | LAHS |
| Eemian | Tabūn E | arid | LAHS~NF |
| Eemian | Tabūn C, D | arid | LAHS |
| Weichselian stadial | Lukenya Hill | humid | MHS |
| Weichselian stadial | Ishango | humid | MHS |
| Weichselian interstadial | Kanjera | arid | PS~LAHS |
| Weichselian interstadial | Mugharet el' Aliya | warm | AN+ ~CN |
| Weichselian interstadial | Haua Fteah | warm | CN |

*Table 1* continued.

| Sequence Corresponding Northern and Western European Quaternary Subdivision | Locality | Climatic Conditions | Taxonomic Alternatives |
|---|---|---|---|
| Weichselian interstadial | Jebel Irhoud | warm | CN |
| Weichselian interstadial | Témara I | warm | CN |
| Weichselian interstadial | Bisitun | humid | AN~NF |
| Weichselian interstadial | Dar-es-Soltan | arid | AN~NF |
| Weichselian interstadial | Dire Dawa | humid | AN~NF |
| Weichselian interstadial | Djebel Qafzeh | cold | NF~MHS |
| Weichselian interstadial | Tabūn B | warm | LAHS~NF~MHS |
| Weichselian interstadial | Ksar Akil | warm | MHS |
| Weichselian interstadial | Amud 1 | cold | CN |
| Weichselian interstadial | Skhūl 5 | warm | MHS~NF |
| | A s i a | | |
| Waalian | Chenjiayao | warm | HE |
| Waalian | Gongwangling | warm | HE |
| Waalian | Yuanmou | warm | HE |
| Cromerian or Menapian | Modjokerto 2 | warm? | HE |
| Cromerian | Zhoukoudian D1, L1 | warm | HE |
| Cromerian | Sangiran 17 | warm | HE |
| Cromerian | Lantian | warm | HE |
| Elsterian | Ardjuna 9 | humid | HE |
| Elsterian | Jianshi | humid | HE |
| Elsterian interstadial | Kedungbrubus | arid | HE |
| Elsterian interstadial | Sangiran 4<br>13a | arid | HE |
| Elsterian interstadial or Holsteinian | Trinil | arid | HE |
| Holsteinian | Hexian | warm | HE |
| Holsteinian | Yungxian 2 | warm | HE |
| Holsteinian | Zhoukoudian H3 | warm | HE |
| Holsteinian | Sambungmachan | arid | HE |
| Holsteinian | Tam Hang | arid | HE |
| Holsteinian | Maba | warm | AHS |
| Saalian | Changyang | cold | AHS |
| Saalian | Chaohu | cold | AHS |
| Saalian | Dingeun | cold | AHS |
| Saalian | Jinnushan | cold | AHS |
| Saalian | Ngandong | arid | HE~AHS |
| Eemian | Dali | warm | AHS |
| Eemian | Maba | warm | AHS |
| Eemian | Narmada | warm | AHS |
| Eemian | Xujiayao | warm | AHS |
| Eemian | Tingstun | warm | AHS~PS |
| Weichselian stadial | Shanidar D | cold | CN |
| Weichselian stadial | Teshik Tash | cold | CN |

*Table 1* continued.

| Sequence Corresponding Northern and Western European Quaternary Subdivision | Locality | Climatic Conditions | Taxonomic Alternatives |
|---|---|---|---|
| Weichselian stadial | Salawusu (Ordos) | cold | MHS |
| Weichselian stadial | Ziyang | cold | MHS |
| Weichselian stadial | Chilinshan | cold | MHS |
| Weichselian stadial | Huanglong | cold | MHS |
| Weichselian interstadial | Wadjak 1 | humid | MHS |
| Weichselian interstadial | Niach Cave | humid | MHS |
| Weichselian interstadial | Lake Mungo 1,3 | humid | MHS |
| Weichselian interstadial | Lake Tandon | humid | MHS |
| Weichselian interstadial | Kow Swamp | humid | MHS |
| Weichselian interstadial | Willandra Lakes 50 | humid | MHS |
| Weichselian interstadial | Cossack | humid | MHS |
| Weichselian interstadial | Cohuna | humid | MHS |
| Weichselian interstadial | Zoukoudian, Upper Cave | humid | MHS |
| Weichselian interstadial | Batadomba, Lena | humid | MHS |
| | Europe | | |
| Waalian | Dmanisi | warm | HE |
| Waalian | Atapuerca, Gran Dolina | warm | HA |
| Cromerian | Přezletice | warm | HE |
| Cromerian | Stranské Skála | warm | HE |
| Cromerian | Mauer=Heidelberg | warm | HH |
| Elsterian interstadial or Holsteinian | Vértesszőlős | warm | AN |
| Elsterian interstadial or Holsteinian | Bilzisleben | warm | AN~AHS |
| Holsteinian or Elsterian interstadial | Petralona | warm | AN~EAHS |
| Holsteinian | Atapuerca, Sima de los Hueses | warm | AN~PS |
| Holsteinian | Arago 21 | warm | AN~PS |
| Holsteinian | Fontana, Ranuccio | warm | AN~AHS |
| Holsteinian | Pontnewydd | warm | AN~AHS |
| Holsteinian | Steinheim | warm | AN~PS |
| Holsteinian | Swanscombe | warm | AN~PS |
| Holsteinian | Bañolas | warm | AN~AHS |
| Holsteinian | Pofi-Ceprano | warm | AN |
| Saalian | Lazaret | cold | PS~AHS |
| Saalian | Reilingen | cold | AN~AHS |
| Saalian | Lazaret | cold | PS |
| Saalain interstadial | Grotte du Prince | warm | AN~LAHS |
| Saalian interstadial | Sedia del Diavolo | warm | AN~AHS |
| Eemian | Biache-Saint-Waast | warm | PS~AHS |
| Eemian | Ehringsdorf | warm | AN~PN |
| Eemian | Fontéchevade | warm | AN~PS |
| Eemian | Gánovce | warm | AN~PN |

*Table 1* continued.

| Sequence Corresponding Northern and Western European Quaternary Subdivision | Locality | Climatic Conditions | Taxonomic Alternatives |
|---|---|---|---|
| Eemian | Krapina 1 | warm | AHS~PN |
| Eemian | Montmaurin | warm | AN~PN |
| Eemian | Ochoz | warm | AN~LAHS |
| Eemian | Saccopastore I | warm | PN~AN~AHS |
| Eemian | Quinzano | warm | AN~AHS |
| Weichselian stadial | Gibraltar 1, Forbes Querry | cold | PN |
| Weichselian stadial | Guattari, Circeo | cold | AN~PN |
| Weichselian stadial | Krapina C3 | cold | CN~NF |
| Weichselian stadial | Arcy-Sur-Cure | cold | CN |
| Weichselian stadial | Azykhskaya | cold | CN |
| Weichselian stadial | Carigüele | cold | CN |
| Weichselian stadial | Combe Grenal | cold | CN |
| Weichselian stadial | La Chapelle | cold | CN |
| Weichselian stadial | Cova Negra | cold | CN |
| Weichselian stadial | Ca'Verde | cold | CN |
| Weichselian stadial | Engis | cold | CN |
| Weichselian stadial | La Ferrasie | cold | CN |
| Weichselian stadial | Gibraltar 2, Devil's Tower | cold | CN |
| Weichselian stadial | Hortus | cold | CN |
| Weichselian stadial | Kiik Koba | cold | CN |
| Weichselian stadial | Lahn | cold | CN |
| Weichselian stadial | Lenca | cold | CN |
| Weichselian stadial | Lezetxiki | cold | CN |
| Weichselian stadial | Malarnaud | cold | CN |
| Weichselian stadial | Monsepton | cold | CN |
| Weichselian stadial | Le Moustier | cold | CN |
| Weichselian stadial | Neandertal | cold | CN |
| Weichselian stadial | Neuessing | cold | CN |
| Weichselian stadial | La Naulette | cold | CN |
| Weichselian stadial | Pech de l'Azé | cold | CN |
| Weichselian stadial | Pinar | cold | CN |
| Weichselian stadial | La Quina | cold | CN |
| Weichselian stadial | Regourdon | cold | CN |
| Weichselian stadial | Roc de Marsal | cold | CN |
| Weichselian stadial | Salemans | cold | CN |
| Weichselian stadial | St. Brelade | cold | CN |
| Weichselian stadial | Spy | cold | CN |
| Weichselian stadial | Starosele | cold | CN |
| Weichselian stadial | Stetten | cold | CN |
| Weichselian stadial | Subalyuk | cold | CN |
| Weichselian stadial | Vindija (Moust.) | cold | CN |
| Weichselian stadial | Zaskalnaya | cold | CN |
| Weichselian stadial | Hahnöfersand | cold | NF |
| Weichselian stadial | Saint Césaire | cold | NF |
| Weichselian stadial | Mladeč 1 | cold | MHS~AN |

*Table 1* continued.

| Sequence Corresponding Northern and Western European Quaternary Subdivision | Locality | Climatic Conditions | Taxonomic Alternatives |
|---|---|---|---|
| Weichselian stadial | Bacho Kiro | cold | CN~AN |
| Weichselian stadial | Miesslingtal | cold | MHS |
| Weichselian stadial | Dolní Věstonice | cold | MHS |
| Weichselian stadial | Předmostí | cold | MHS |
| Weichselian stadial | Pavlov | cold | MHS |
| Weichselian stadial | Cro-Magnon | cold | MHS |
| Weichselian stadial | Combe Capelle | cold | MHS |
| Weichselian stadial | Zlaty Kůň | cold | NF |
| Weichselian stadial | Sungir | cold | MHS |
| Weichselian interstadial | Velika Pećina | warm | NF |
| Weichselian interstadial | Veternica | warm | NF |
| Weichselian interstadial | Cioclovina | warm | MHS |

***Abbreviations:*** HE = Homo erectus, HH = Homo heidelbergensis, HA = Homo antecessor, AHS = Anatomically archaic Homo sapiens, EAHS = Early archaic Homo sapiens, LAHS = Late archaic Homo sapiens, AN = Ante – Neandertals PS = Presapiens, PN = Preneandertals, CN = Classic Neandertals, NF = Neandertal –like form, MHS = Anatomically modern Homo sapiens

## Results and Discussion

The influence which the temperature pulsations exerted on the dynamics of populations made itself felt in a way that the zones of the amplitudes had a pulling effect from equatorial direction, at the times of warming up and a pushing effect in equatorial direction at the times of cooling down. In the peripheries, at the time of cooling down, sharp selection effects rarely allowed the populations to be able to adapt there.

Central and Western Europe belonged to the same zones as the northern coast of Africa. In the eastern part of Asia the pulsation-zones altered more closely, i.e. the pulsation gradient rose more abruptly than in Europe. Consequently, at the times of warming up, Europe constituted a larger territory and exerted a less attractive force for the populations, which expanded from Africa than Asia did for those populations which rolled in from the equatorial archipelago of the present day. On the other hand, at the times of cooling down, the latter populations moved out in a southern direction more quickly than those in Europe. It can be assumed that the Western-Central European pulsation zone developed the most numerous typical variations of the differentiating genus Homo, such as the most typical formations of Presapiens, Preneandertal Man and classic Neandertal Man, for the simple reason that this constituted the largest area of all peripheral zones. Whereas, the more abrupt fluctuation gradient in East Asia may have kept the gene pool in the population area in continual movement, i.e. in a more exogamous condition. As a result, this region may not have provided so easy conditions for the development of extreme variants as Europe did.

It can be added that amphiboreal and bipolar fauna areas could also develop as a consequence of pulsation.

Disregarding the unsettled question whether the genus Homo is of mono- or polyphyletic origin, we can establish that this genus is of equatorial origin. Taking two moments into consideration – the average pulsation gradient of the Earth and its manifestation during the glacials, on one hand, and the well established assumption that alongside the Equator climatic changes exerted very slight effect, on the other hand – we can conclude that all these as well as the polar and equatorial migrations which were impulsed by the pulsation may have kept the starting gene pool of the Homo in a generative status.

In the Waalian and Menapian period Homo erectus may still have lived in the equatorial region and may only have migrated into bipolar directions in the Cromerian interglacial and later, in the Elsterian interstadial. It looks as if humans were not able to adapt to cold climate in the peripheries for a long time (until the Weichselian glacial). The climatic arrangement of the erectus finds reveals that polar directed radiations always took place in the warm period: in the Cromerian interglacial and in the Elsterian interstadial (Figure 2).

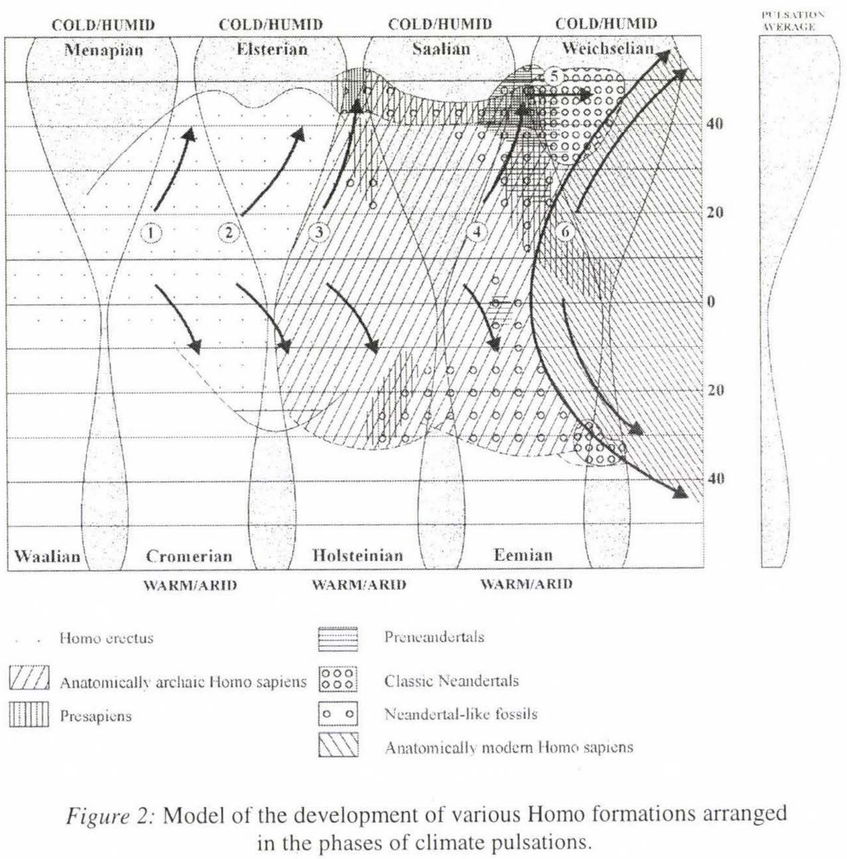


*Figure 2:* Model of the development of various Homo formations arranged in the phases of climate pulsations.

Thus the Homo areas show amphiboreal characteristics of Pre-Elsterian origin and a bipolar character at the same time, though in the equatorial region the early generative gene pool remained. Consequently, it is suggested that four isolated formations developed in the equatorial territories of Africa and Asia as well as in the continental regions of Europe and East Asia. This may explain the fact that at least four variations of Homo erectus or Ante-Neandertal fossils have been known and that they are well differentiated morphologically.

After the first two polar-directed adaptation attempts a third attempt occured in the Holsteinian interglacial for the occupation of the periphery. In Europe this was manifested in the so-called Presapiens formations. In the Saalian glacial the population somewhat drew back, while in the Eemian interglacial a Presapiens radiation, as a fourth adaptation attempt took place. On the southern hemisphere, on the contrary, it was rather Holsteinian radiation that is worthy of note. According to the pulsation zones there was a slighter possibility of special adaptation here than in Europe. Observably, less specialized forms of archaic Homo sapiens, which emerged from the gene pool of Homo erectus, developed here.

However, in the Saalian glacial Preneandertal variations can also be identified in the northern periphery. Although the roots of Preneandertals may have reached back as far as the interglacial before the Saalian, their probable multitudinous appearance may only have attached to the fourth peripheric adaptation attempt. In the terrestrial parts of the southern hemisphere the pulsation gradient was not abrupt, i.e. the pulsation zones may not have lasted long enough for these anatomically distinguishable forms to develop. The typical Presapiens and Preneandertal variations only developed on the northern hemisphere, especially in the warm periods. The ecological impulses of this fourth adaptation attempt may give an explanation for the fact that, even today, we cannot systematize numerous samples of Presapiens and Preneandertal variants unambiguously.
It is noteworthy that, from the Holsteinian interglacial on, the Neandertal-like characteristic features were gradually getting dominant both in the northern and in the southern peripheries, whilst in the equatorial region archaic Homo sapiens was not exposed to similar adaptation and selection influences. Undoubtedly, this is a phenomenon that resembles bipolarity.

The final occupation of the peripheric regions took place in connection with the development of classic Neandertals and of modern Homo sapiens in the Weichselian glacial. The attempt of classic Neandertal for a continual peripheric settling was the fifth in the row. At the same time this was the first successful trial for the development of populations which could properly adapt to the cold and humid periods in the peripheries. However, the influence of the local precedents cannot be completely excluded either. Neandertal-like characteristics can be traced back to the Holsteinian interglacial: primarily in the northern periphery, they may have evolved gradually, because such a degree of cold adaptation might not have ensued without any local antecedents.

The increase in the number of populations, i.e. the uneven effectiveness of demogenetical factors, on the northern hemisphere from the end of the Weichselian glacial made the radiation of modern Homo sapiens stemless, moreover, its selection advantage appears to have hardly been dependent on the climate. This sixth adaptation attempt for the occupation of the peripheries proved to be a success eventually. Anatomically modern Homo sapiens initially emerged in the Eemian interglacial from the subequatorial zones, later in the Weichselian interstadial in the peripheries. Hereafter, owing to its effective technoculture, its position became stable.

It may not be mere chance that the time of the sixth moment in this climate pulsation model, i.e. the beginning of anatomically modern Homo's development of equatorial-subequatorial origin, coincides with the time which is already suggested by the earliest mitochondrial DNA examinations: the Eemian interglacial, ca 130-200 thousand years ago (cf. Wilson and Cann 1992, Stringer 1993). This expansion only reached the vast territories of Europe, Asia and Northern America 40-50 thousand years ago.

Therefore this climate pulsation model appears to reconcile some of the contradictions between the Eve hypothesis and the multiregional model. Besides Homo erectus, it was only the modern Homo sapiens that proved to date back to direct equatorial origin. All the other Homo variants could be interpreted as peripheric adaptation attempts. Consequently, the connecting link between Homo erectus and Homo sapiens may only have been provided by that certain gene pool, which continuously existed in the equatorial-subequatorial area even in the transition period between the development of the two Homo species. Whereas the emerging of Presapiens, Preneandertal Man and classic Neandertal Man may be considered as the subsequent peripheric attempts of human evolution. The Homo gene pool, which was moving undulating among the bipolar, the amphiboreal and the homogeneous areas, was formed depending on the existing climate conditions. Changes in the climate could either help on or hinder the genetic connections of the formations with a potencial of specialization.

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*Mailing address:* László Szathmáry
Department of Evolutionary Zoology and Human Biology
Debrecen University
H-4010 Debrecen, Pf. 6.
Hungary
e-mail: szathmary@tigris.klte.hu