

# The knowledge of the Pleistocene - an assumption for the differentiation of natural regularities and human interventions (syllabus of lecture)

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1. For a long time the division of the Pleistocene into 4 classical glacials and between them the corresponding interglacials has no longer been valid. There are many more glacials and interglacials, there are also many more climatic second order oscillations, both within the glacials and the interglacials. Climatic oscillations of that period, not only as far as the mean temperature is concerned, but also as to humidity and aridity, reached unprecedented rate.

This fact is, of course, also linked up with the migration of plant and animal associations. As long as we knew only few glacials and interglacials, there was a relatively decent time space available for the explanation of their migration. By their enormous increase in number which, from the time point of view, is situated in the very same period of time of 2 million years, there is a great reduction of the individual oscillations and thus there are certain difficulties in the explanation of migrations on relatively long distances.

2. In the distribution of a number of mammalian species it is possible to observe a different adaptability to the environment in the course of the Pliocene and the Quaternary, but no doubt also earlier. It is so great that I dare to denote it as the alternation of euryecous and stenoecous phases in their phylogenetical evolution.

3. The Pleistocene with its repeating climatic oscillations of different orders is particularly suitable for the study of changes of associations. Not to speak of the fact that it is a period when the pattern of today's fauna and flora was ultimately being formed. To get acquainted with the mechanism of the present changes and all factors affecting them, it is necessary to know thoroughly the preceding time period.

Glacial fauna: Most of the mammalian species are not so stenothermic as we think, but rather eurythermic. But the view of the close adaptation of some species to a markedly warm or cold climate still prevails. Their geographical distribution speaks, however, rather in favor of the oceanic or continental climate and, in connection with that, with the dependence on the plant cover.

Up to now only the meridional shift of floristic and faunistic provinces has been assumed. There were no considerations about the fact that the length of the day and night did not change, the same as the sunshine intensity, etc., so that it is impossible to assume the shift of today's provinces without a change also in our latitudes. The biome typical of this time in the last glacial does not exist in my opinion.

An automatic shift of all vegetation zones and faunistic associations, as appears more and more, is not quite correct. Therefore we find together species of different habitats which are at present allopatric. We can therefore only ask what resulted in the removal of species competition and what factors could impair it and/or completely remove it.

4. The Last Glacial is characterized by a higher number of periodically repeating climatic changes of a much different intensity.

4.1. The end of the Last Interglacial and the beginning of the Last Glacial did not mean any quick climatic change. There was a gradual slow reduction of the mean annual tempera-

ture and rather an alternation of humidity and aridity phases. Therefore a number of mammalian species typical of the Last Interglacial only very slowly disappear (Musil 1988).

This phase of slow changes lasted relatively long, until the end of Interstadial Hengelo which still represents the last optimum period in the Last Glacial.

4.2. The beginning of the subsequent stadial means a very quick climatic change consisting above all in a great reduction of the mean annual temperature. That also evokes a very quick change in the pattern of the association of mammals - all species requiring a different climate immediately disappear from our region.

The two changes are examples of changes in the association of mammals linked up with the changes in the environment. They do not signal the extinction of species, but only their migration to a more suitable environment or only their local extinction in regions unsuitable for their life.

4.3. The changed association remains almost the same until the end of the Last Glacial. At that time climatic oscillations set in again, resembling the period after the Last Interglacial, but in the reverse order. In that period a new phenomenon appears at the same time, globally all over the Earth, no longer connected with the climatic change, but with other factors resulting in the total extinction of some species. It is not yet quite clear why this extinction does not start after Interstadial Hengelo when there begins a rapid and sudden change in the climate, and further, why it did not appear in earlier forms of similar climatic oscillations as the end of the Würm.

There are two stages in the extinction. In the first one the number of individuals of a species drops quickly (in cave bears it is approximately 3000 years) and the area of the original distribution remains preserved. Only in the second stage there follows its quick extinction. With respect to the first stage, the length of the second one is about 7 times longer.

4.4. The beginning of the Holocene means the onset of quite a different climate, in fact the onset of a new interglacial that gradually results in the formation of continuous forests and in vast changes in the association of mammals. Disregarding the preceding stage of extinction, the main role here is that of the environment. Gradually a new forest association arises, the species requiring a different landscape migrate, as long as they have survived. A great species diversity, still typical of the end of the glacial, finishes. The monotonous character of the habitat results in the reduction of the species diversity.

That means that the living conditions for the existence of mammals were much more favorable at the end of the glacial than at any time in the Holocene.

5. Why in fact does a large number of species disappear in a relative short period of time?

Changes in the association (not extinction) are caused above all by two factors independent on each other:

5.1. The global change of climate. That leads to migrations of the individual species, to their disappearance from certain regions. This group includes e.g. the saiga, the polar fox, the reindeer, the chamois, the polar hare, the marmot - the area of

their distribution was previously much larger, the main factor being the change of the climate.

5.2. The extinction of species in a part of the area of their distribution or globally. The area of their habitat is - from the point of view of the climate and that of its corresponding environment - differentiated. This second fact will now be the focus of our interest.

5.3. The extinction of a species in only one or several regions.

5.4. Total global extinction.

5.3.1. From the point of view of the study of factors of extinction the most important group. There is extinction in an area where living conditions were satisfactory, and despite that extinction occurred, whereas in other areas, with identical conditions, the species survives.

5.3.1.1. The horse: North America, extinction about 6,500 BP ago, different course in America and in Eurasia, despite similar conditions. In America they die out suddenly - not due to lack of food, due to new carnivores. Other animals linked up with the same habitat live longer.

5.3.1.2. The bison: Siberia, still in the 7th century AD. Different situation in Europe and in America. Towards the end of the Pleistocene disappears almost completely in Eurasia, and in the Holocene playing a minor role. In America optimum development at that time.

5.4. Here there belong the cave hyena, the woolly rhinoceros, the cave bear, the cave lion, the giant stag - megaloceros. What does a brief overview of the length of duration of the individual genera look like?

5.4.1. The genera living from the Pliocene via the Pleistocene up to the Holocene:

*Sus*, *Cervus*, *Castor*, *Vulpes*, *Ursus*

5.4.2. Genera dying out in the course of the Pleistocene or migrating to other regions:

5.4.2.1. Villafranchium. *Zygodon*, *Anancus*, *Leptobos*, *Mastodon*, *Libralces*, *Tapirus*

5.4.2.2. Biharium. *Homotherium*, *Trogontherium*, *Hypolagus*, *Macaca*, *Xenocyon*, *Archidiskodon*.

5.4.2.3. Holstein. *Buffelus*.

5.4.2.4. Eemian. *Dicerorhinus*, *Palaeoloxodon*, *Hystrix*.

5.4.2.5. Würm. *Crocota*, *Megaloceros*, *Mammuthus*, *Coelodonta*.

5.4.2.6. Beginning of the Holocene. *Panthera*, *Rangifer*, *Gulo*, *Alopex*, *Equus*.

5.4.2.7. In the course of the Holocene. *Bos*, *Bison*, *Alces*.

The number of stable genera is thus relatively small.

6. Conclusions

6.1. Extinction is not due to a mere change in the environment (thus, the cave bears are highly euryecous, in the stadial after Hengelo they die out practically in the course of 3000 years, independently on the climate).

Extinction is a generally valid law anchored in all organisms, so that the main question is only when the species will die out and why there is acceleration in certain time periods in different ways in different groups of organisms.

6.2. The factors causing extinction are of a comprehensive character, it is a complex system of biotic and abiotic components in mutual relations.

6.3. Associations form an open system with highly complicated mutual relations. Such a system is never stable, but it always finds itself in an autoregulatory, adaptive dynamical equilibrium which is continually affected by external and internal factors.

6.4. The causes of extinction do not operate absolutely, but they are dynamically stable. By this I want to say that under certain conditions they can change. Generally expressed, extinction is an expression of biological entropy and the rise of new taxa means overcoming it.

6.5. Every association bears in itself a certain element of stability. The degree of this stability is different in different associations (but also taxa), and it is also different in the same association in the course of time. The association exists as long as it is able to overcome the effect of new influences by its mechanisms. The new influences can be of not only external, but also internal origin and their impact may be very different. Only some of them are then dominant, but not in a stable way.

6.6. Without intimate knowledge of changes in associations and reasons why they operated, without the knowledge of the immediately preceding period it is impossible to solve the present problems at the appropriate level, it is impossible to differentiate the intensity of human interventions from processes due to natural regularities and thus differentiate natural processes from those evoked or rather accelerated by people.

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