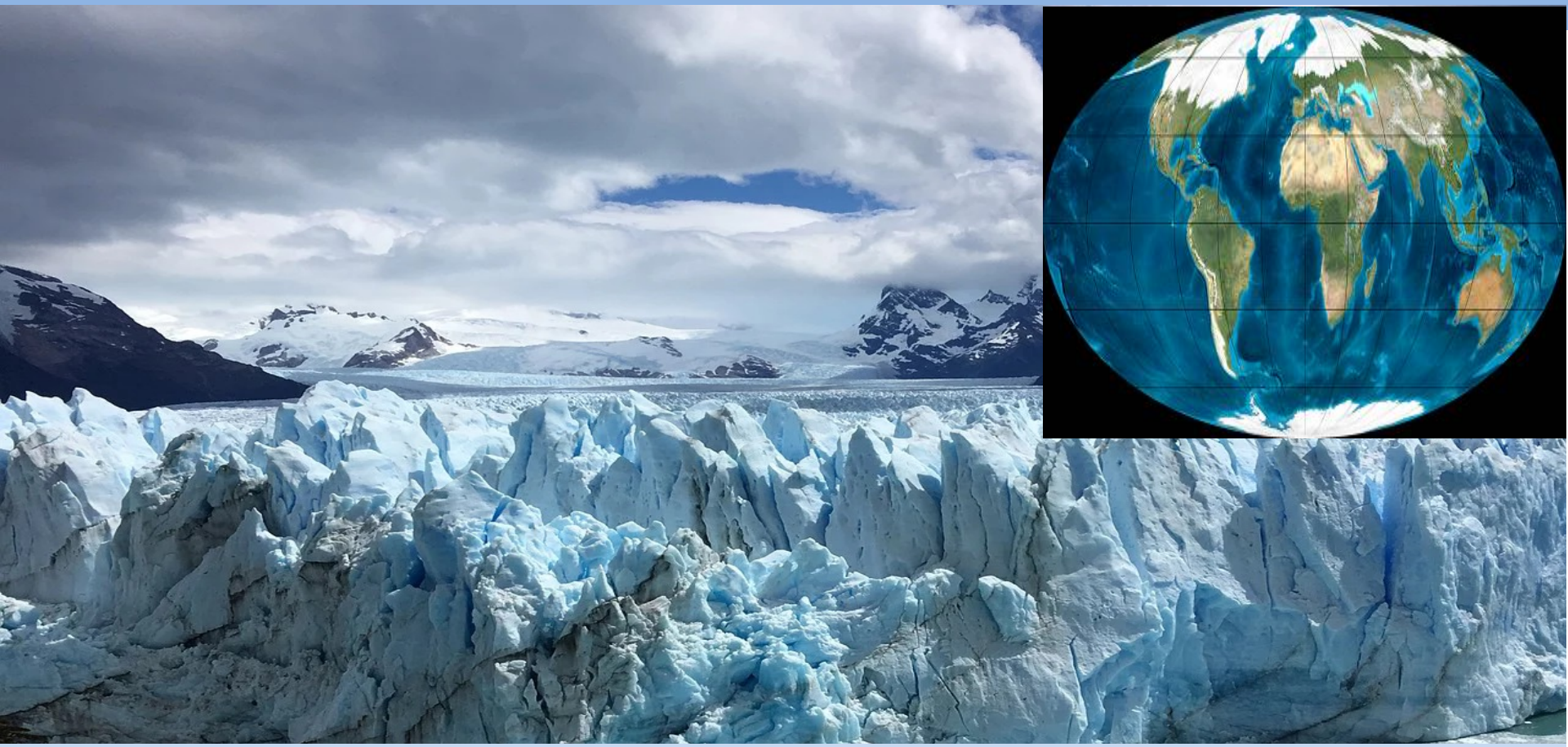
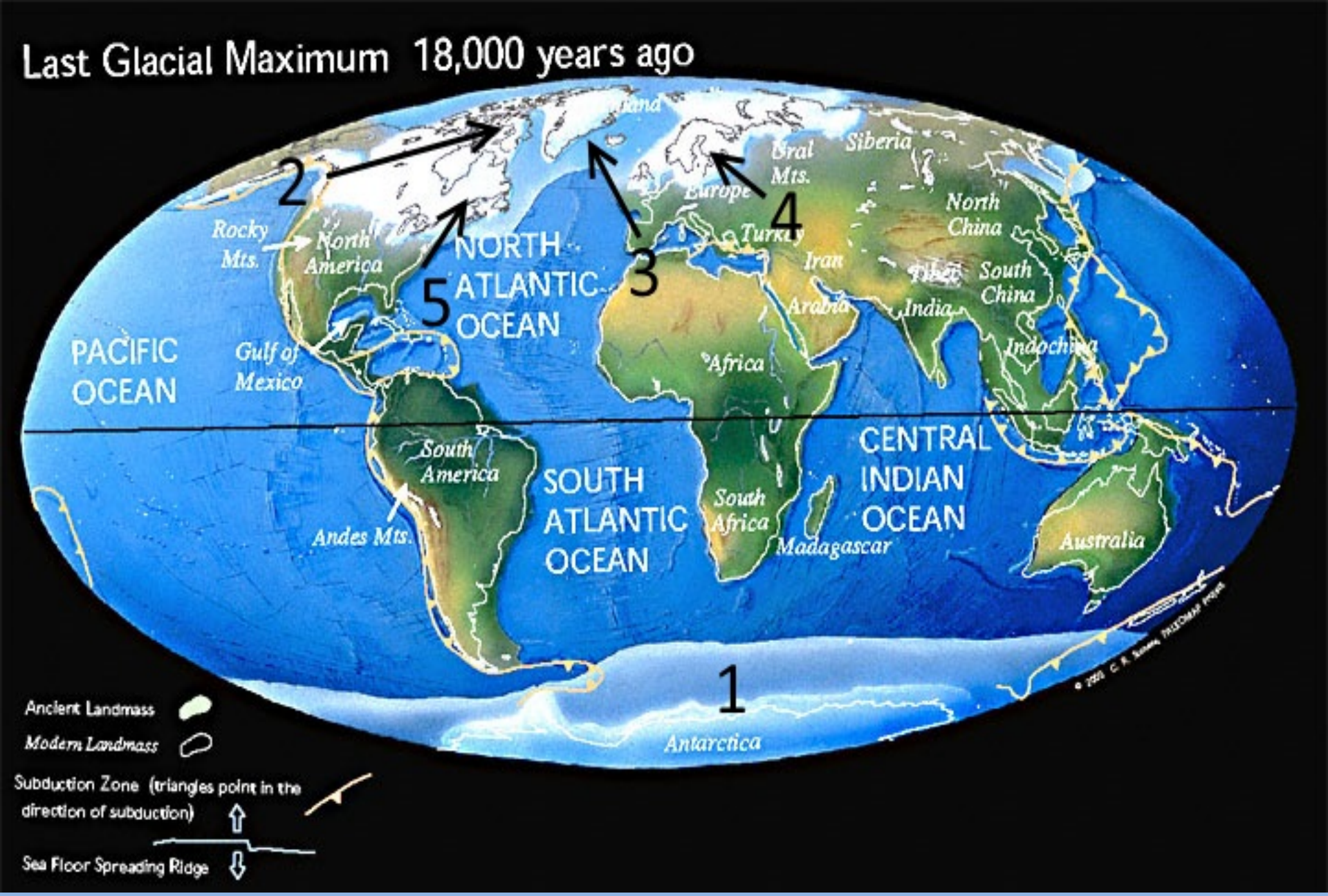
THE SCIENTISTS HAVE NOT YET COME TO AN AGREEMENT ABOUT THE PRESENCE, DURATION, AND TERRITORIAL DISTRIBUTION OF GLACIATION AS WELL AS THE DEVELOPMENT OF FLORA AND FAUNA IN PLEISTOCENE (2.58-0.0117 million years ago)!



"THE IDEAS OF THE GLACIAL THEORY AROSE IN THE EARLY DAYS OF GEOLOGY AND KEEP ON LIVING, ALTHOUGH THEY HAVE LONG BEEN IN CONFLICT WITH THE GEOLOGICAL FACTS AND PHYSICAL LAWS" **N. A. Shilo, 1981**

The transformation of the composition of flora and fauna, changes in the structure of natural ecosystems on vast territories of the Earth at the boundary between the Pleistocene and the Holocene require clarification, which is impossible without adequate modelling of paleogeographic conditions.



PLEISTOCENE PERIODS: GUNZ: 2–0.6 mio years ago; MINDEL: 600–400 tsd years ago; RISS: 400–200 tsd years ago; WURM: 200–10 tsd years ago.

PLEISTOCENE IN NORTHERN EURASIA (2.58 mio –11.7 tsd)

SCIENTISTS ASSUME THAT THE EPOCHS OF COLD SPELLS OCCURRED PERIODICALLY, BUT THEIR CAUSES ARE NOT CLEAR YET.

POSSIBLE CAUSES OF CLIMATE CHANGE:

COSMIC:

1. Change in the tilt of the Earth axis to the ecliptic plane *Ecliptic (from lat. (linea) ecliptica, from ancient Greek ἔκλειψις-eclipse) is a reference circle along which the visible annual movement around the Sun occurs. Accordingly, the ecliptic plane is the plane of the Earth rotation around the Sun (Earth's orbit).
2. 2. Downsun deviation of the orbit of the Earth;
3. 3. Uneven thermal radiation from the Sun.

EARTH-RELATED:

1. Increase in macro-relief contrast due to activation of mountain formation and volcanism;
2. Increased frequency of the World ocean overlap and offlap, changes in the shape and ratio of ocean and lands;
3. Increased zonal and regional climate gradients;
4. Changes (increase or decrease) in the transparency of the atmosphere (volcanism), changes in the content of carbon dioxide, etc.

In the Pleistocene, abyssal troughs formed in the Arctic Ocean, large mountain systems appeared; the flora and fauna of extratropical areas within the Old World steadily changed, which began naturally and continued until the end of the Middle Stone Age (about 45–35 tsd years ago or even earlier), and in the Western hemisphere – until the appearance of man (15–12 tsd years ago).

SCIENTIFIC DISPUTE: GLACIAL OR DRIFT HYPOTHESIS?

The **GLACIAL HYPOTHESIS** was put forward by *L. Agassiz in 1837* (according to observations in the Alps) to explain the distant separation of wandering (erratic), alien boulders and the striation of their surface. He claimed that such boulders "represent one of the main proofs of the past glaciation of the mountains, and of the "ice age" in the history of the Earth".

The **DRIFT HYPOTHESIS** was put forward by *M. V. Lomonosov, I. I. Lepyokhin, Ch. Lyell*; they believed icebergs, sea, river, and lake seasonal ice to be the main factor of boulders dispersal. **The starting point of these hypotheses is a different interpretation of the formation and spreading of erratic boulders** (and other erratic material: moraines, tillites) and of the appearance of striation on them**: according to the drift hypothesis, icebergs, sea, lake and river ice was the main factor of the dispersal (or drift)**; **according to the glacial hypothesis, dispersal was explained by glaciers, both from mountains and from covers, which in the past delivered erratic material up to the south of the Russian plain, i.e. hundreds of km away from the Scandinavian shield** (*Markov et al., 1965) or even many hundreds of kilometers from Novaya Zemlya (Velichko, 1980; Gribchenko, 1980; Groswald, 1983, 1999*).

The glacial hypothesis has become globally widespread and still prevails. As a result, the natural environment of not only the Pleistocene, but also more distant times is reconstructed on the basis of ideas about catastrophic climate changes due to giant cover glaciations, the formation and collapse of which in turn depend on the offlap and overlap of the ocean. However, since no strict synchronization has been discoveres between the climate change-dependant processes and, in particular, those dependant on the interchange of glacial and interglacial periods, it is quite natural to doubt that the latter exist at all. This is largely facilitated by the increasing body of paleodata.4

AS THERE AN ICE-AGE IN THE END OF THE CENOZOIC? **Kalyakin V. N.RJEE Vol. 2 (4). 2017**

REVISION OF THE PROVISIONS OF THE GLACIAL THEORY:
origin of exaration-glacial types of terrain

The most important features of glaciation are considered to be "exaration-glacial" types of terrain: fjords, skerries, lake basins, roches moutonnees, small roches moutonnees, polished crystalline rocks, striation and grooves on them. Extensive use of aerial and space images combined with detailed ground work showed paragenetic relationship of the exaration relief with neotectonic faults and zones of recent tectonic activation. ***Exaration (lat. exaratio - plowing) is an exogenous process of destruction by a glacier of the rocks composing its bed with the subsequent removal of the products of destruction: boulders, gravel, pebbles, sand***

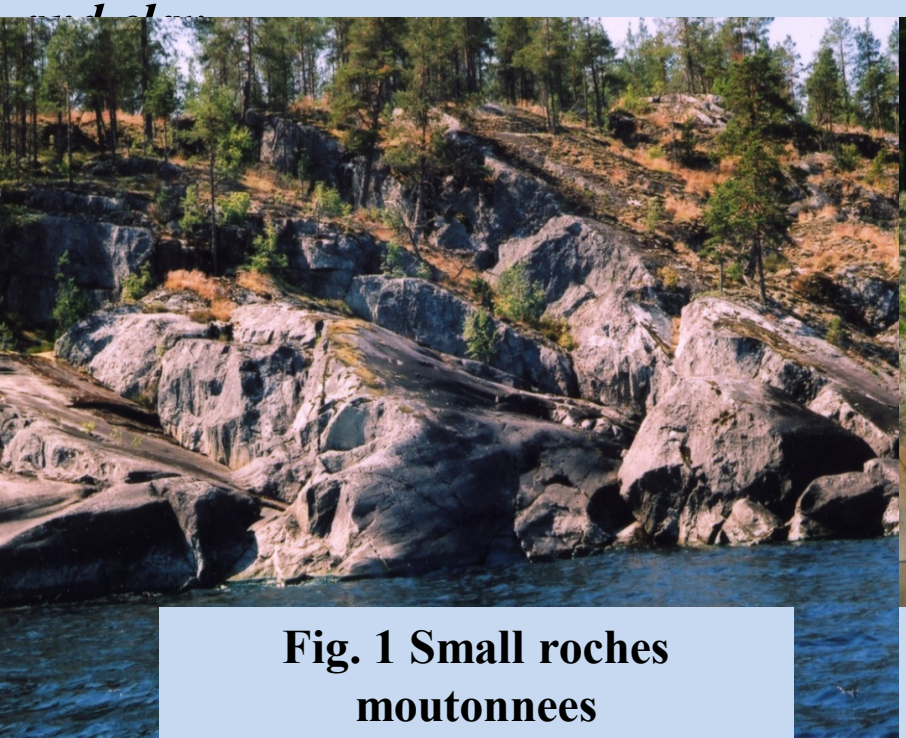


Fig. 1 Small roches moutonnees

Fig. 2 ***Slickenside: general view and zones of tectonic fragmentation***

WHAT IS HIDDEN BENEATH THE ICE SHEETS OF ANTARCTICA AND GREENLAND?

Fig. 3. "Layers of moraine-containing ice" in an Antarctic iceberg

Fig. 4. Natural tunnel in part of the Alaskan mountain valley glacier

To date, glaciologists, geologists, drillers and geophysicists have studied the dynamics and patterns of movement of the cover glaciers of Antarctica and Greenland. Instead of thick debris-laden ice with huge blocks and boulders, **which glaciologists consider the main sign of glaciation**, continental ice only contains inclusions of sandy loam and fine-grained matter, spores and pollen of plants.

WHY IS THE MYTH OF THE "ICE AGE" NOT THE ONE DETERMINING BIOLOGICAL VIEWS ANYMORE?

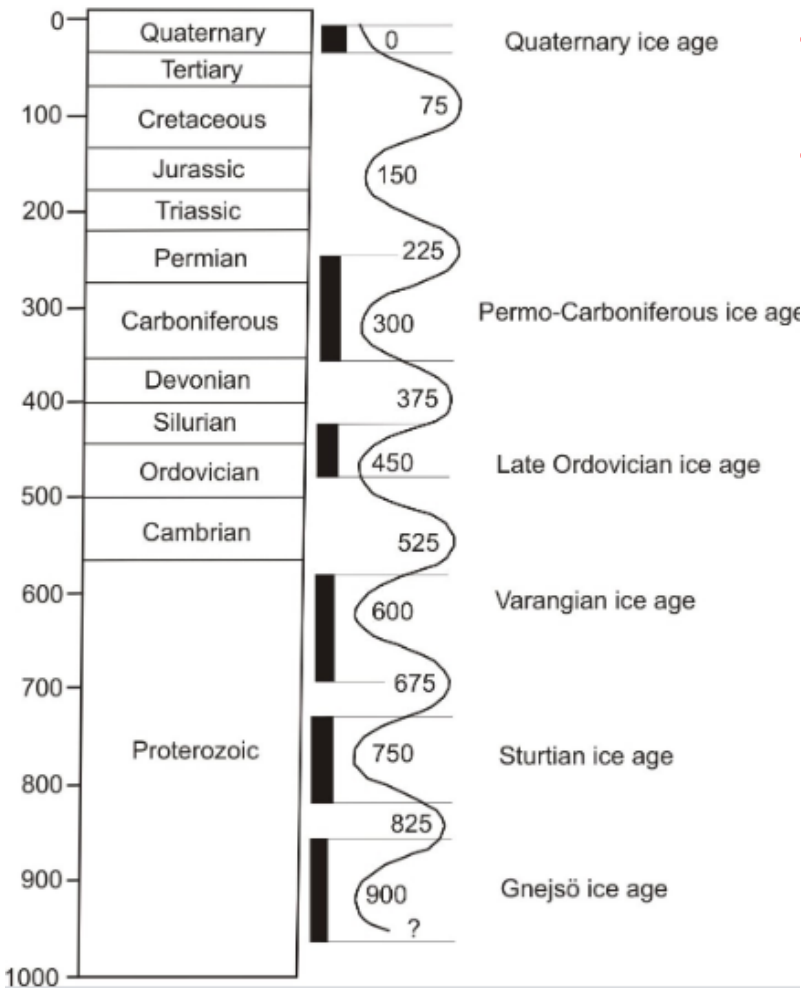
The great achievements of paleontology, starting with the classic works of **I. G. Pidoplichko (1946, 1951, 1956, 1965),** his colleagues and followers supported by modern dating of paleodata **(Levi, 2009, 2010, 2011)** documented the composition and structure of prehistoric landscapes of the Pleistocene of Northern Eurasia. Here is an example of the research findings by famous paleontologists who found that the productivity of "mammoth" ecosystems that supported the megafauna during the so-called ice age was completely similar to that of modern Africa **(*Puchkov, 1991, 1992, 1993, Vereshchagin et al.).*** Since glaciologists were not able to explain these data, they did not try to find the true reasons for the discrepancy between Pleistocene glaciations and the stable existence of huge herds of herbivorous animals, but instead they designated this discrepancy which was beyond their comprehension as the **PREHISTORIC PASTURE PARADOX**.

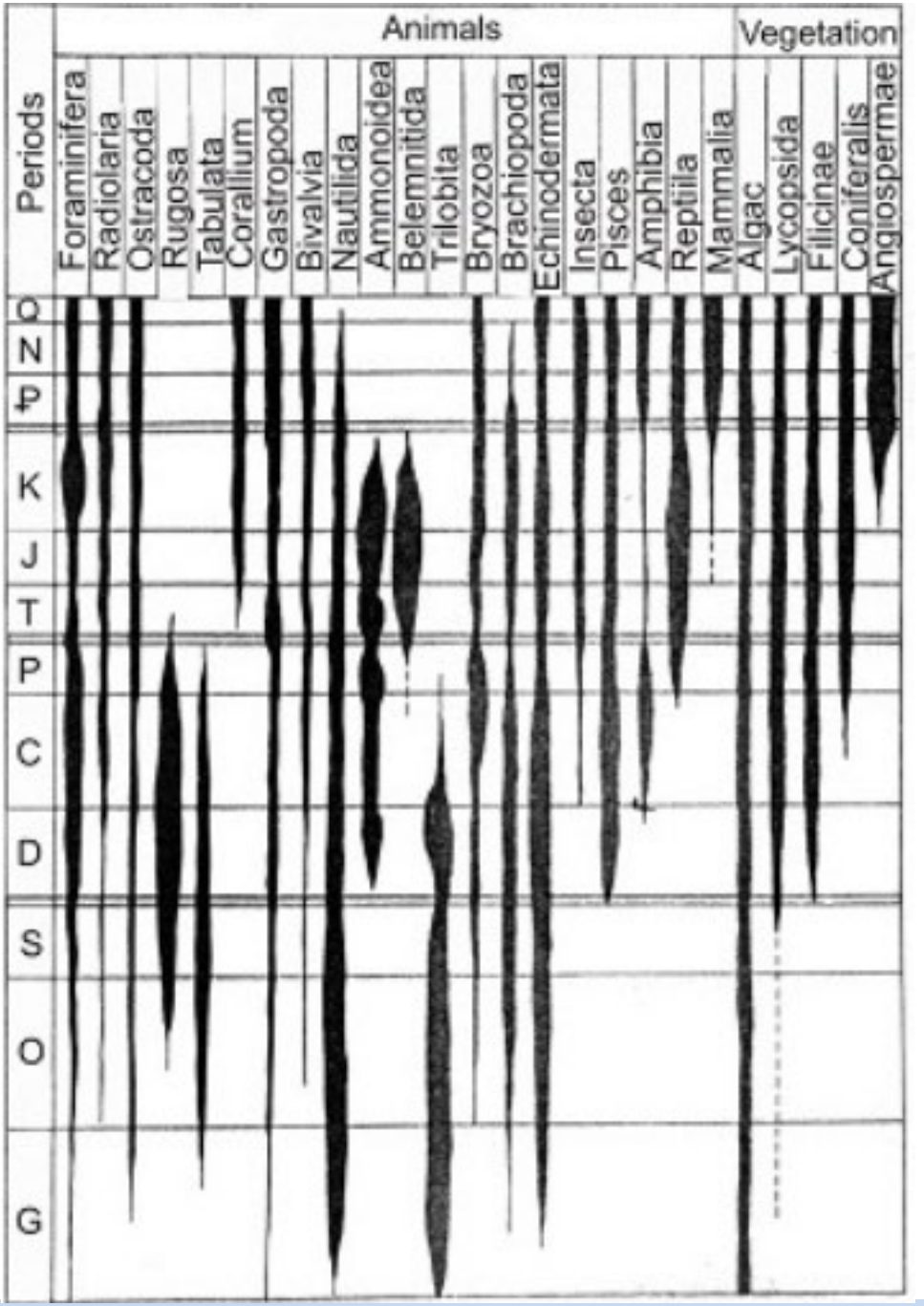
To date, great accomplishments of the natural sciences and, first and foremost, of paleontology, gave proof that the extant giant herbivores of African savannas and giant herbivores of the mammoth complex completely destroyed in Northern Eurasia were fully ecologically similar and through their environment-transforming activities supported ecologically similar complementary systems of species including full complementary sets of species from herbivores to predators.

WHOM ? TO BELIEVE ?

In the Carboniferous period, 27% of the world's coal reserves were formed. "The climate was the warmest in the Paleozoic Era". (Геологический словарь, 1973)

There were 4 or more ice ages in the Carboniferous period ?

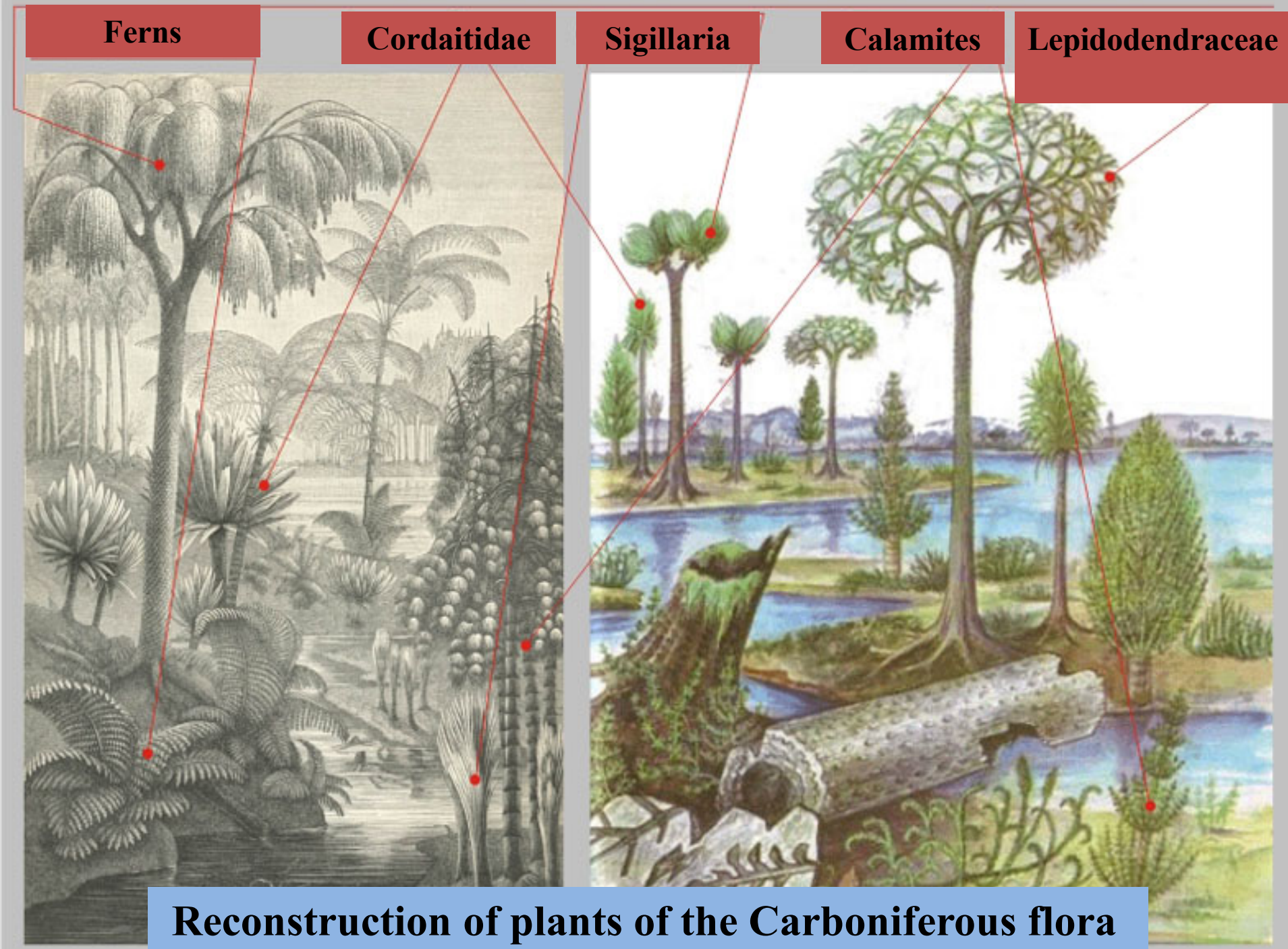




V.G. Chuvardinsky, 2017. RJEE Vol. 2 (3). 2017

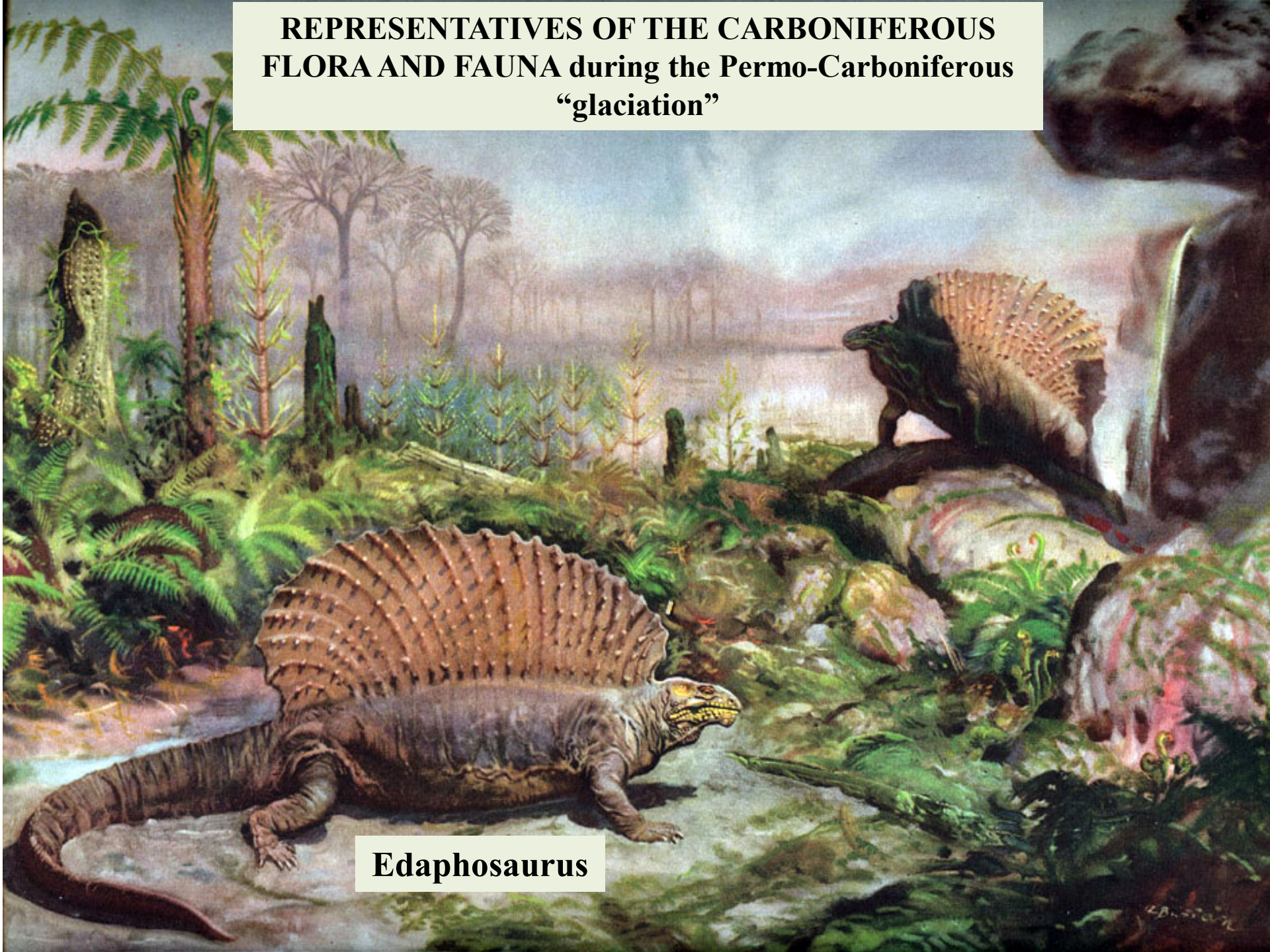
The main feature of the Carboniferous period important for paleoreconstructions is the development of abundant tree flora on all continents. This allows us to reconstruct paleohistory and question the possibility of flora development under the ice.

PRINTS OF PLANTS OF THE CARBONIFEROUS PERIOD



Reconstruction of plants of the Carboniferous flora

REPRESENTATIVES OF THE CARBONIFEROUS FLORA AND FAUNA during the Permo-Carboniferous "glaciation"

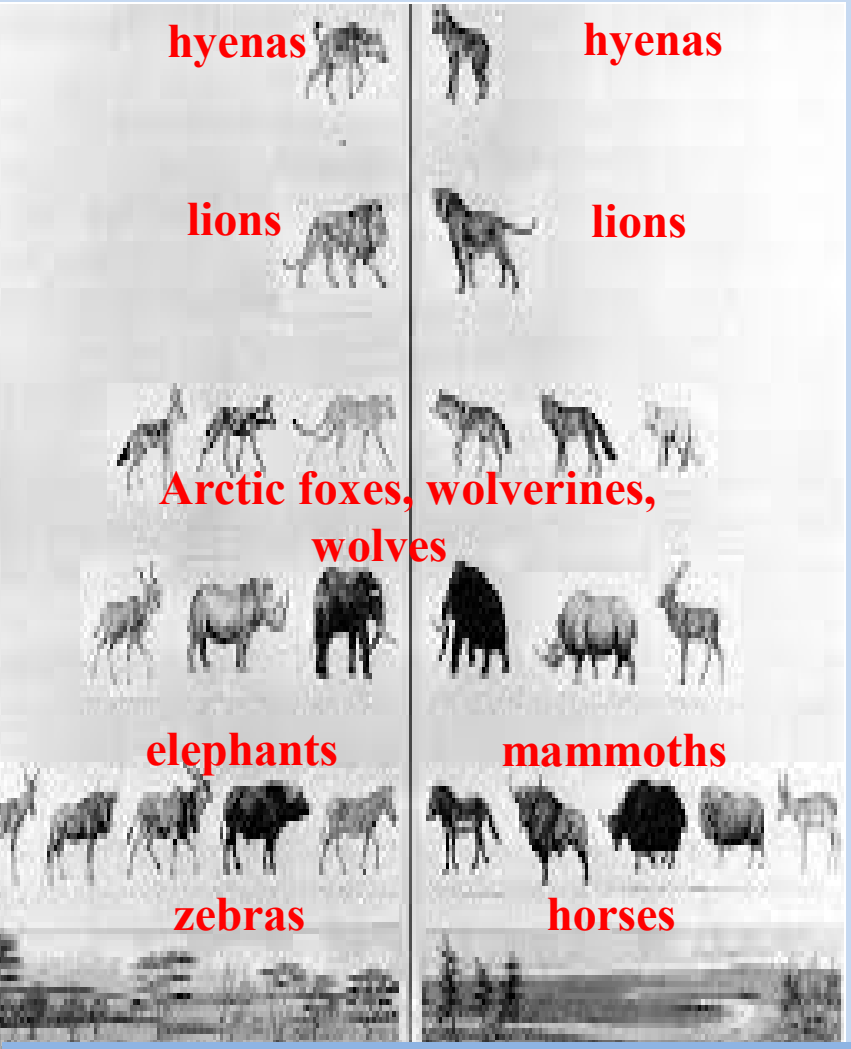


PLEISTOCENE (2.58-0.0117 mio years ago) THE EPOCH OF POWERFUL GLACIATIONS

In Eurasia and North America, the PLEISTOCENE had an incredible variety of fauna; it included mammoths, woolly rhinos, cave lions, bison, yaks, giant deer, horses, camels, bears, cheetahs, hyenas, ostriches, antelopes... and many other creatures.

2. PREHISTORIC PASTURE PARADOX is the ecological parallelism of the fauna of the Pleistocene tundra steppes of Northern Eurasia and African savanna.

The "biotic pyramid" consists of groups of species that prefer similar habitat conditions and a similar type of nutrition (*Vereshchagin, Baryshnikov, 1982).*



The first level contains species of open grass spaces; model **groups in Northern Eurasia include horses, whereas in the African savanna – zebras**.
They mostly feed on grasses that grow back after being bitten off, which makes these animals most important in the evolution for the sustainable existence of pasture ecosystems.
At the second level, there are species of forest-meadow-steppe communities that consume both wood and grass forage. Model species: **mammoths in Northern Eurasia and elephants in the African savanna**.
At the third through fifth level, there are carnivorous animals that live both in open grass communities and in forest-meadow-steppe complexes of communities. These are: **at the third level** – small and medium-sized predators (Arctic foxes, wolverines, wolves, etc.);
at the fourth level, both in Northern Eurasia and in the African savanna, **lions**;
at the fifth level, scavengers – in both territories, **hyena** is the model species.

COHABITATION OF ANIMALS IN THE TUNDRA AND AFRICAN STEPPES INDICATES THE SIMILARITY OF CLIMATIC CONDITIONS! WHAT ABOUT THE

Was the climate of mammoth ecosystems warmer than the modern one?

On the New Siberian Islands, mammoth fauna continuously existed here from 55 tsd years ago to 9 tsd years ago. The main animals here were the horse, the mammoth up to 2.9 tsd years ago, up to 2.4 tsd years ago – the musk ox on the Taymyr Peninsula before the middle ages and a horse in the lower reaches of the Kolyma. Surprisingly, the finds of the remains of the cave lion, saiga, and red deer were so far above the Arctic Circle.

On the island of Spitsbergen, vegetation in the late Wurm did not differ significantly from the modern vegetation. On Severnaya Zemlya, in addition to mammoths and shrubs, in the late Wurm there were species of entomofauna that now live further south, on the mainland.

On Bolshoy Lyakhovsky island in "frozen rocks, under the peat layer, *Alnus fruticosa,* an alder shrub was found. There were entire trunks with roots and leaves on the branches of a tree together with the entire clusters of catkins. These finds indicate that “the area below 74° north latitude a time was dominated by the vegetation the Northern border of which has now moved four degrees to the south".

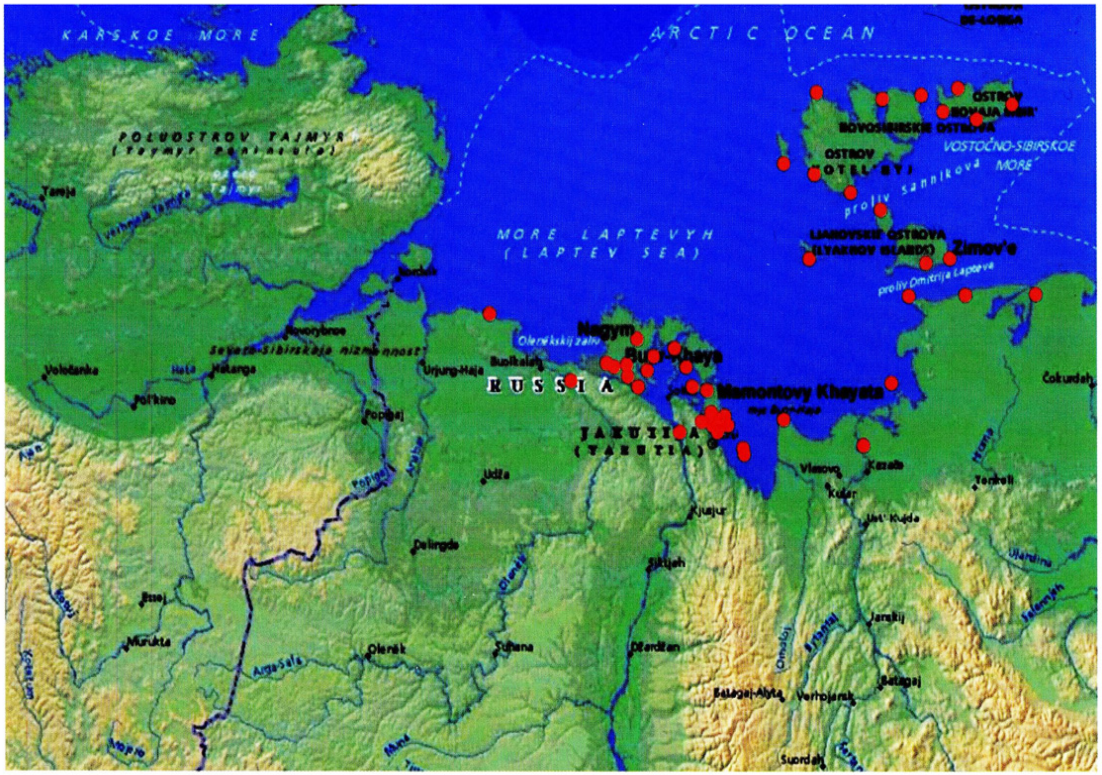
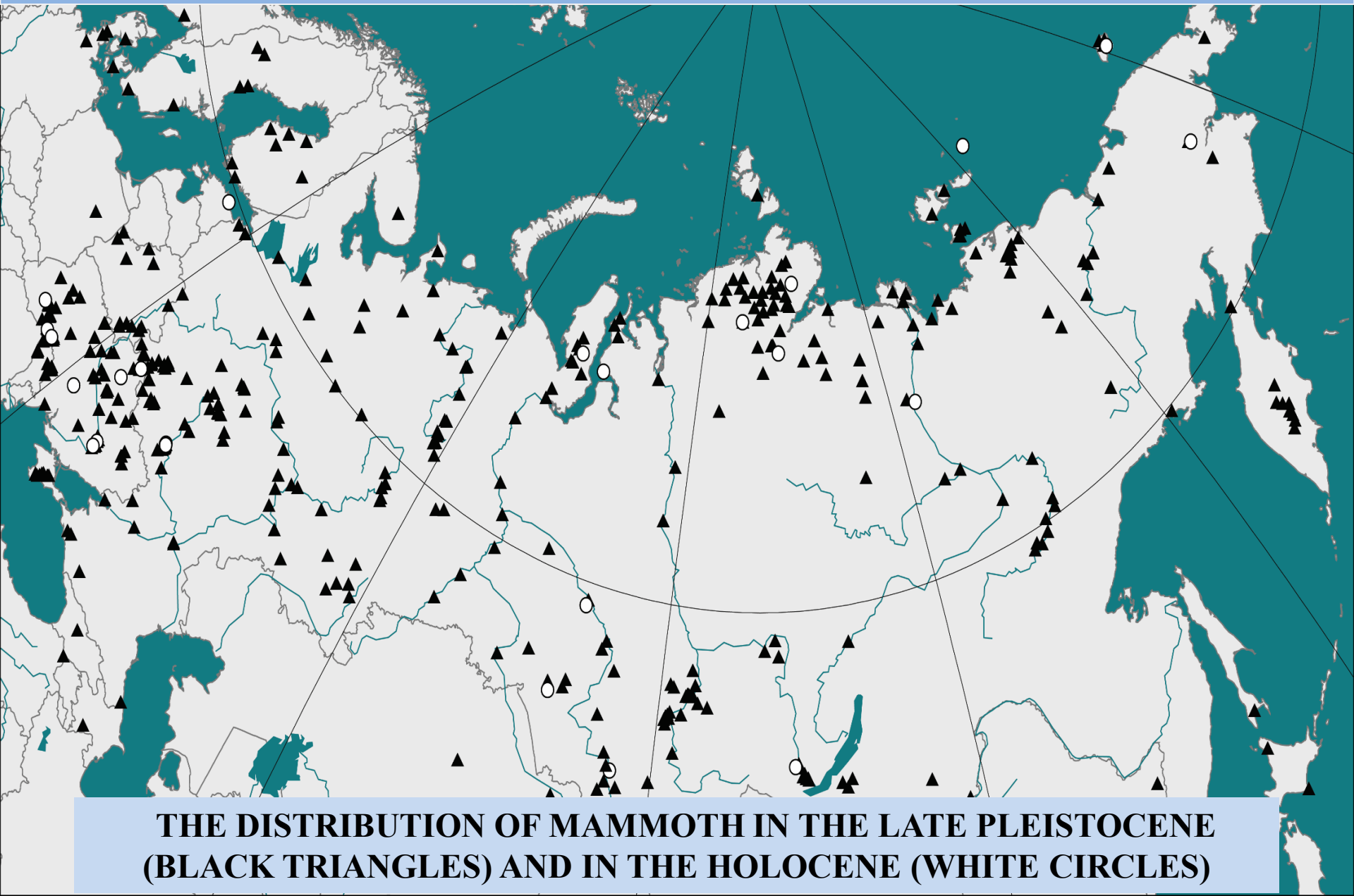


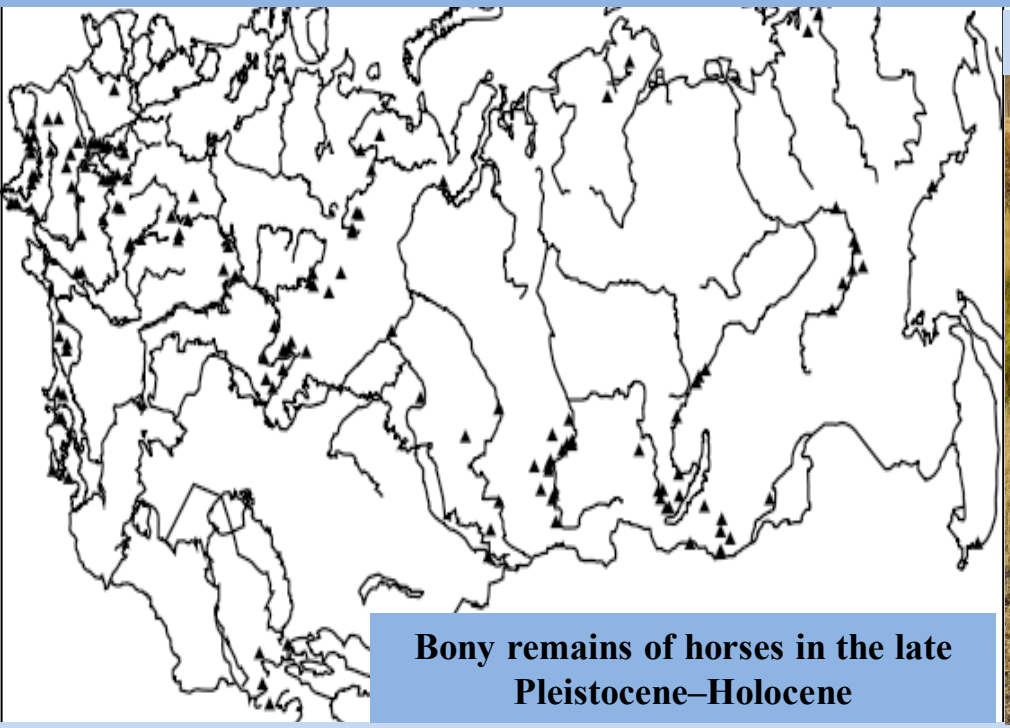
Рис. 4.7.1. Карта района работ комплексной российско-германской экспедиции 1998–2007 гг. по изучению четвертичных оложений

THE PREHISTORIC PASTURE PARADOX – SUSTAINABLE EXISTENCE OF MEGAFAUNA IN CLIMATICALLY DIFFERENT CONDITIONS OF THE NORTHERN HEMISPHERE



THE DISTRIBUTION OF MAMMOTH IN THE LATE PLEISTOCENE (BLACK TRIANGLES) AND IN THE HOLOCENE (WHITE CIRCLES)

EXTINCT KEYSTONE SPECIES OF HERBIVOROUS ANIMALS IN NORTHERN EURASIA



Bony remains of horses in the late Pleistocene–Holocene

DOMESTICATED HORSES

The range of WILD HORSES at the end of the Pleistocene extended from the New Siberian Islands in the north to Transbaikal in the south. Horse remains are found along with the remains of mammoths, woolly rhinos, reindeer and bison. The number of horse remain finds from the early Holocene decreases markedly, but they are found in the Crimea, in the basins of Dniester, Dnieper and Don, along the southern coast of the Gulf of Finland, in the south of the Kola Peninsula and in the southern Urals. In the middle Holocene, they are found in the Baltic States, Ukraine, Voronezh and Saratov Oblasts; in the late Holocene – in Moldova, Moscow and Rostov Oblasts.

In the far north of Siberia, wild horses have survived for much longer than in the rest of the territory of Northern Eurasia. So, according to archaeological data, the bone remains of a wild horse were found 70 km east of the mouth of the Kolyma river, and their age was about 1 tsd years

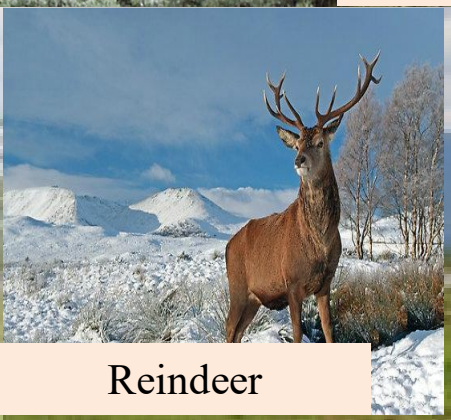
(Восточноевропейские леса…, 2004)

FAUNA DIVERSITY OF THE UPPER REACHES OF THE PECHORA IN THE PLEISTOCENE AND EARLY HOLOCENE


Musk ox


Cave lion


Bison


Reindeer


Horse


Beaver


Red deer


Saiga


Woolly rhinoceros

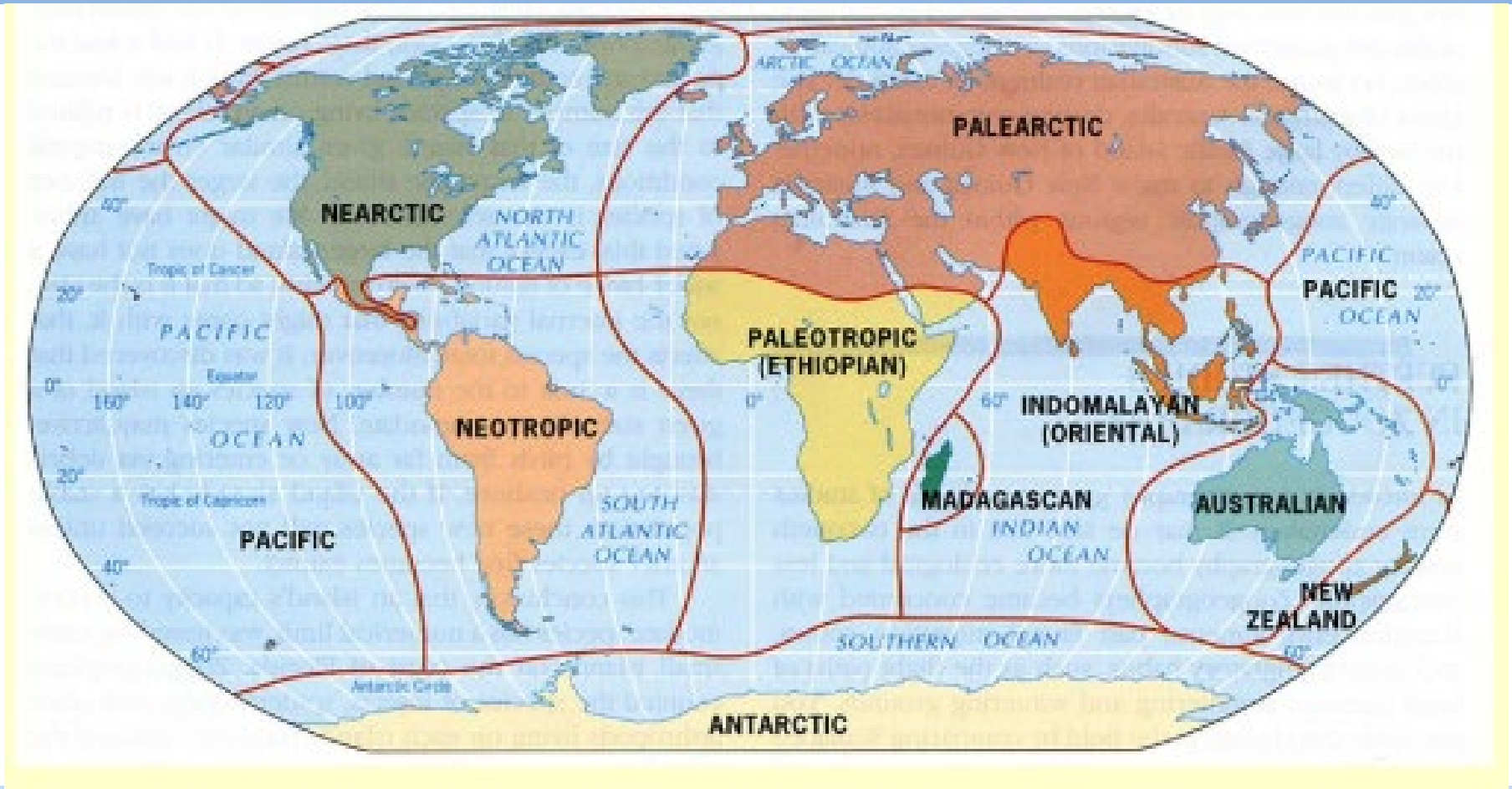
4. PARADOX – MIXED FLORA IN THE UPPER REACHES OF THE PECHORA IN THE EARLY HOLOCENE

UNCOMPENSATED WURM EXTINCTIONS

In the previous stages of life on Earth some species, i. e. proboscideans, ungulates, and carnivores died out and were replaced by other, more adapted species. For example, mastodons were displaced by elephants. At late Wurm, no one replaced the elephants, rhinos, or many large animals of other continents. The North American mastodons became extinct at the same time as the mammoths, and the South American ones later. At the same time, almost all the small Pleistocene mammals of the mainland faunas have been preserved. They are represented by the same or similar species (Пучков, 1992–1993).

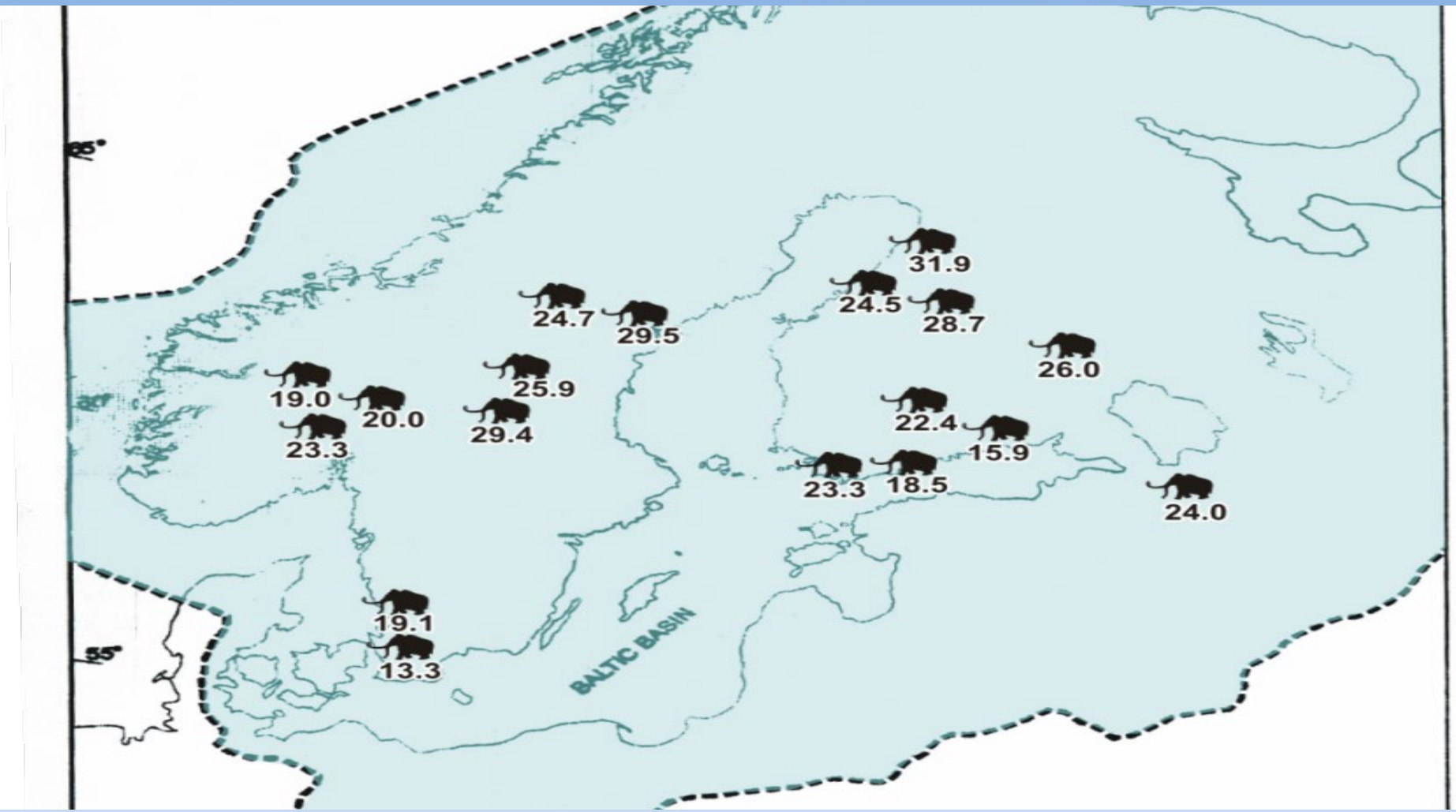
Zoogeographic regions	Giants >1 t	Semi-giants > 400–1,000 kg	Large > 150–400 kg	Moderately large 50–150 kg	Medium-sized 10–50 kg
Ethiopian	20	20	12	0	2.9
Indomalayan	40	16.7	10	15	1.8
Palearctic	100	50	35.7	7.7	2.4
Nearctic	100	80	84.6	65	36
Neotropic	100	100	82	55	14.3
Australian	100	100	100	72.8	54.1

THE PERCENTAGE OF EXTINCTIONS OF LARGE AND MEDIUM-SIZED MAMMALS OF DIFFERENT ZOOGEOGRAPHIC REGIONS IN THE PERIOD 40–4 THOUSAND YEARS AGO IN % OF THE TOTAL POPULATION.



1 – Nearctic and Palearctic: North America, Europe, North and Central Asia - 78,8%
2 – Neotropic (South America)-66,7%;
3 – Paleotropic (Central and South Africa) - 53,6%,
4 – Indomalayan - 43,2%
5 – Australian - 54%

LATE WURM WAS THE COLDEST PERIOD OF THE PLEISTOCENE, ACCORDING TO GLACIOLOGISTS BUT WHAT DID MAMMOTHS FIND TO EAT UNDER THE KILOMETER-THICK ICE?

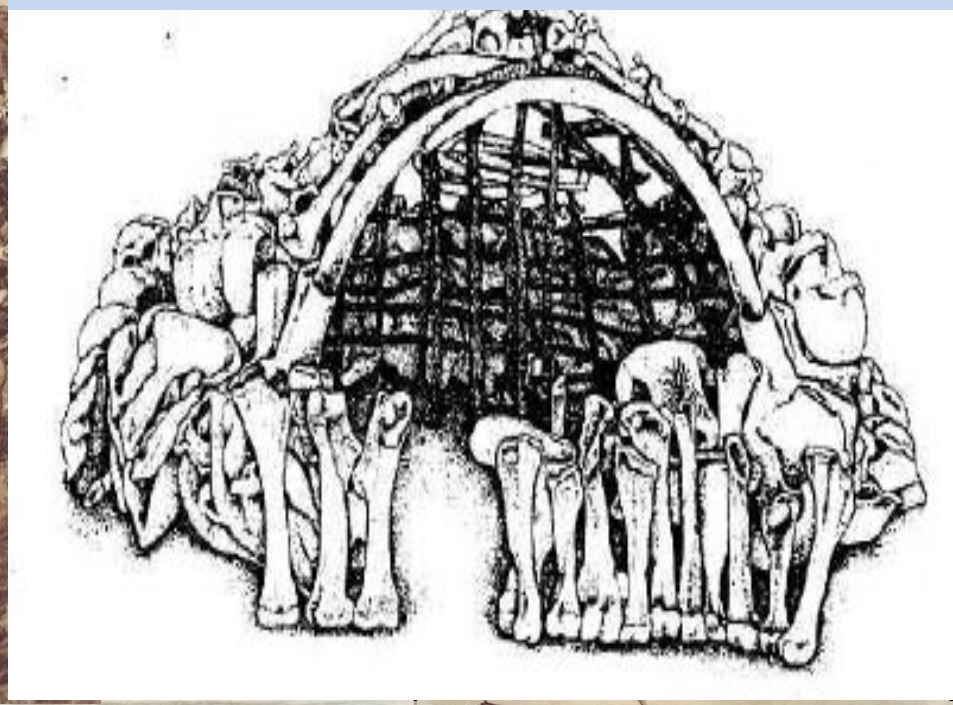


PHENNOSCANDIA: radiocarbon dating of mammoth bone remains (in tsd of years ago): 25.9; 24.7; 24.5; 23.3; 22.4; 22.0; 19.2; 19.1; 18.5; 17.0; 16.9; 14.0; 13.3; 13.0; 12.9; 11.7; 11.0**; (*Ukkonen, at al,* 1999; 2007; *Parducci at al*. 2012; dotted line marks the ice cover area)** (Skuf'in, P. K. et all., 2016)

Locations of animal bone remains in Northern Eurasia

Studied territories	New Siberian Islands	Perm Oblast. Kizel cave	Belarus Bialowieza forest
Cryogenic steppes	**55–2.9 tsd years ago** mammoth, cave lion, woolly rhinoceros, bison, cave lion, musk ox, saiga, horse	**48.5–9.9 tsd years ago** Himalayan bear, porcupine, mammoth, woolly rhinoceros, bison, saiga, horse, cave lion	**61.0–5.6 tsd years ago** trogontherium mammoth, Khazar mammoth, southern mammoth, cave lion, cave bear, Etruscan and woolly rhinoceros, saiga, broad-hoofed horse
Forest-meadow complexes	elk, red deer, wolf, wolverine, brown bear, hare, voles	elk, red deer, wolf, wolverine, brown bear, hare, voles, mole, fox, common shrews, lemming	forest elephant, wolf, brown bear, red deer, bison, beaver
Tundras	reindeer, arctic fox, Siberian and ungulate lemmings	reindeer, arctic fox, Siberian and ungulate lemmings	reindeer, arctic fox, Siberian and ungulate lemmings
Mountains of Southern Europe, Asia Minor, Middle East, India, Ceylon and China.			

A hut made of mammoth bones



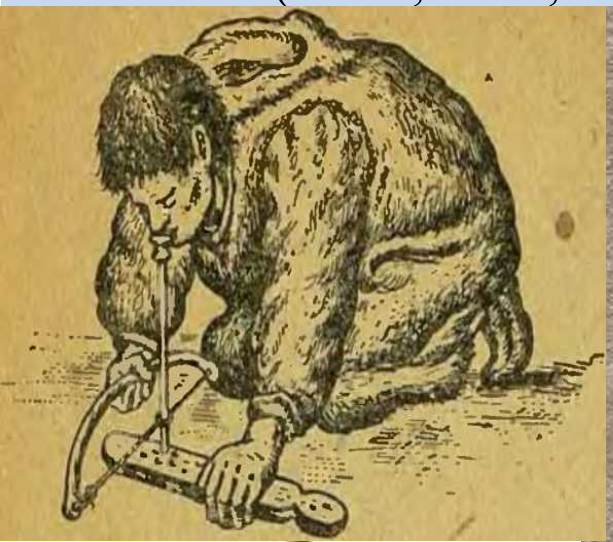
Hunting in the late Paleolithic

Early (Lower) Paleolithic is a period from the **end of the Pliocene**when the ancestors of the modern man began to use stone tools for the first time. These were relatively simple tools, known as cleavers, spheroids (rough ball-shaped stone objects), and flakes. *Homo habilis* started to use stone tools during the Oldowan as bifaces and stone cores. This culture was named after the Olduvai Gorge in Tanzania, where these tools were found. **People living in this era fed mainly on the meat of dead animals and collected wild plants, since hunting was just beginning to spread.**

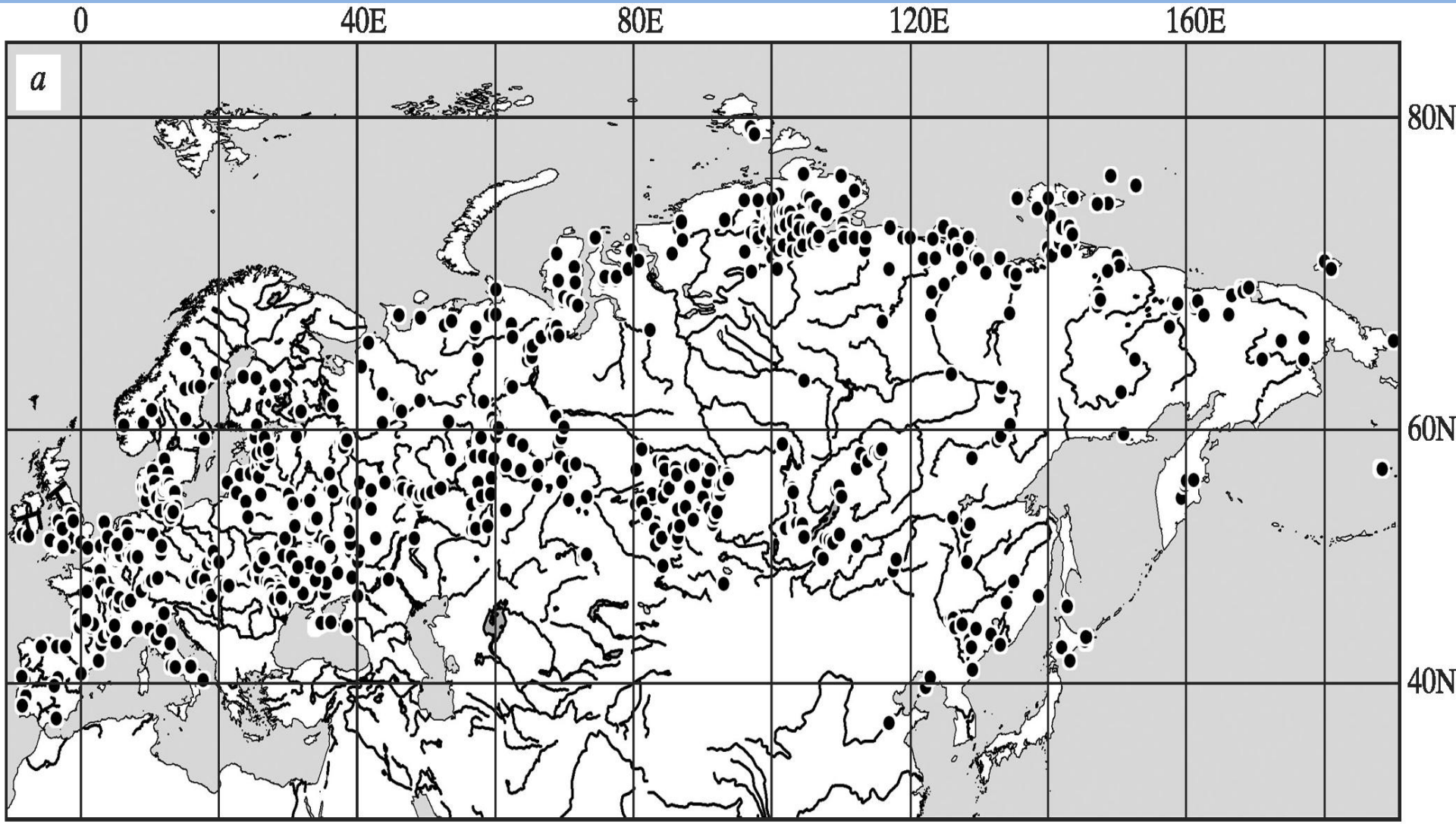
Africa:
Oldowan
2.5–1 mio years ago
Acheulean
1.5 mio–200 tsd years ago
Europe:
Abbevillean 1.5 mio–600 tsd years



At the sites of habilis (Australopithecus habilis) and Australopithecus (A. africanus), which lived 3–1 mio years ago, **split bones of siwateriums, rhinoceroses, hippos, proboscideans, even skeletons of Palaeoloxodon recki** (Elephas recki) **and dinotherium** (Deinotherium bosazi) **were found, their meat had been cut off with stone tools** (Klark, 1977; Brain, 1981).



DOCUMENTED EVIDENCE OF PREHISTORIC PASTURES ARE DATED MAMMOTH BONE REMAINS IN THE BOOM YEARS OF THE ICE AGE IN EURASIA



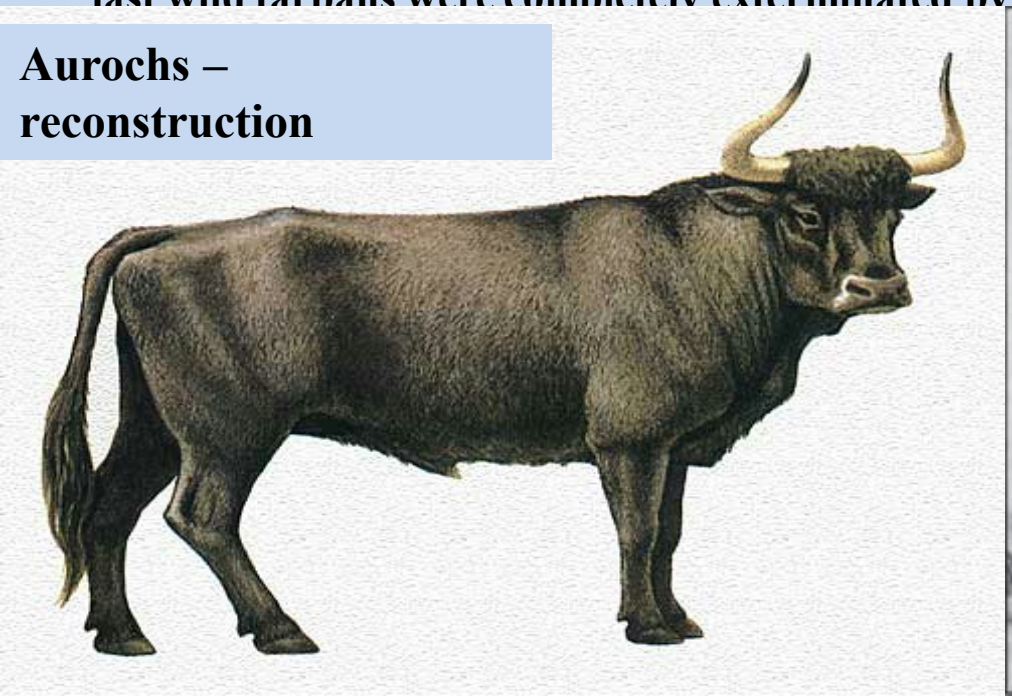
A.K. Markova et al. / Quaternary International 292 (2013) 4-14.

EXTINCT KEYSTONE SPECIES OF HERBIVOROUS ANIMALS IN NORTHERN EURASIA

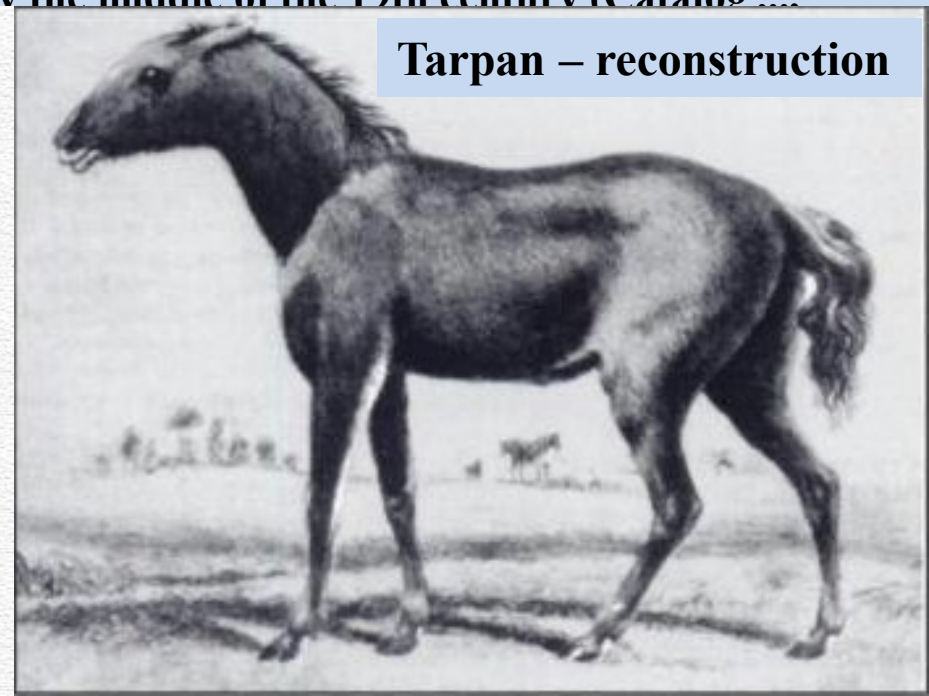
The aurochs is known from the Paleolithic to the 15th century; its range covered Europe, the southern Urals, the Trans-Urals, Transbaikal, some areas of Western Siberia, China and Manchuria, Kazakhstan, the Caucasus, Crimea, Turkmenistan, Asia Minor, Israel, Mesopotamia ..., as well as North Africa from Egypt to Mauritania. By 1400, the aurochs had disappeared in Central and Western Europe, but were still found in Lithuania. The last aurochs was killed in 1627 (Geptner et al., 1961).

The tarpan was known from the Mesolithic to the 19th century; its range covered Europe, Western Siberia and Kazakhstan. The forest tarpan was exterminated in Central Europe in the Middle Ages, and in the east of its range - in the 16th-18th centuries. In the second half of the 18th century, the steppe tarpan still could be found in the steppes along the upper reaches of the Don (Gmelin, 1771), in the southern Cisurals and in the north-west of modern Kazakhstan (Pallas, 1773) ; the last wild tarpans were completely exterminated by the middle of the 19th century (Catalog ...

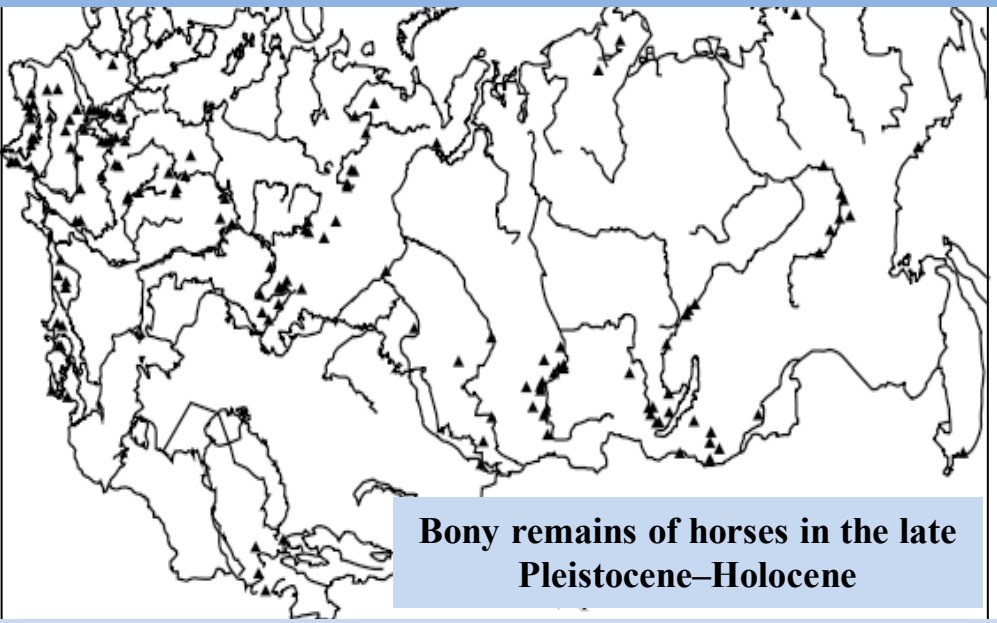
Aurochs – reconstruction



Tarpan – reconstruction



EXTINCT KEYSTONE SPECIES OF HERBIVOROUS ANIMALS IN NORTHERN EURASIA



The range of WILD HORSES at the end of the Pleistocene extended from the New Siberian Islands in the north to Transbaikal in the south. Horse remains are found along with the remains of mammoths, woolly rhinos, reindeer and bison. The number of horse remain finds from the early Holocene decreases markedly, but they are found in the Crimea, in the basins of Dniester, Dnieper and Don, along the southern coast of the Gulf of Finland, in the south of the Kola Peninsula and in the southern Urals. In the middle Holocene, they are found in the Baltic States, Ukraine, Voronezh and Saratov Oblasts; in the late Holocene – in Moldova, Moscow and Rostov Oblasts.

In the far north of Siberia, wild horses have survived for much longer than in the rest of the territory of Northern Eurasia. So, according to archaeological data, the bone remains of a wild horse were found 70 km east of the mouth of the Kolyma river, and their age was about 1 tsd years (Eastern European forests, 2004)

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