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North Pacific molluscan assemblages and paleogeography in the early Paleogene

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Abstract

New geological and paleontological data from a high latitude stratigraphic section in the northwestern Kamchatka Peninsula indicate that the Late Paleocene to Early Eocene interval in the high latitude North Pacific region was characterized by a specific "paratropical" climate, i.e. resembles to subtropical climates. This is evidenced in the shallow shelf benthic molluscan faunas from Kamchatka and western North America that contained up to 60% of common species.

1. Introduction

Benthic organisms comprise the largest proportion (~98%) in marine ecosystems. These organisms, particularly mollusks and foraminifera, are therefore of eminent significance for the study of the early Paleogene biotic assemblages in the North Pacific. These groups are especially useful for reconstructing the geological and paleobiogeographical history of ancient shelf basins (Gladenkov, 2004).

Some of the most complete Paleogene sedimentary sections in the North Pacific region are located at the Kamchatka Peninsula. There are two different types of Paleogene sections exposed in western and eastern Kamchatka. Eastern Kamchatka is generally characterized by deep-water (frequently flysch-type) strata, whereas western Kamchatka is dominated by shallow- to marginal-marine deposits, frequently containing coals and interrupted by regional gaps and hiatuses. Because of a regional gap corresponding to the Lower Eocene-early Middle Eocene interval, the biota of this age was very poorly studied until recently. The gap and associated unconformities were a result of the Early Eocene tectonic episode in Kamchatka (Gladenkov et al., 2005).

2. Materials and analysis of molluscan assemblages

Paleocene-Eocene stratigraphic sections in Kamchatka were intensely studied during the past few years. One of these sections is located in the northeastern Kamchatka, the Il'pinskii Peninsula (Fig. 1). Planktonic and benthic foraminiferal zonations were established in flysch deposits up to 2,500-3,500 m thick with scarce mollusks (Volobueva et al., 1994; Gladenkov et al., 2005).

We present now data from another section which is located in northwestern Kamchatka, along the Mametchinsky Gulf (Fig. 1). The section is mainly composed of sandstones, siltstones, or coarser-grained flysch clastics, comprising the Unelskaya (~1,700 m) and Ommaiskaya (~2,000 m) formations. These rocks were previously studied by A.D. Devyatilova and V.I. Volobueva, who, regretfully, have identified only a minor part of mollusks found there. Their collections were transferred to the Geological Institute of Russian Academy of Sciences, Moscow, and were studied in details by us (V.N. Sinel'nikova and myself).

The distribution of molluscan assemblages in the Mametchinsky section was used as a base to establish 7 successive beds with mollusks: 1) *Acesta perrinu* Waring-*Modiolus napanensis* Sinel'nikova, 2) *Venericardia mulleri* Verastegu-*Pseudoperissolax tricamatus* Weaver, 3) *Dacridium penjicus* Sinel'ni-

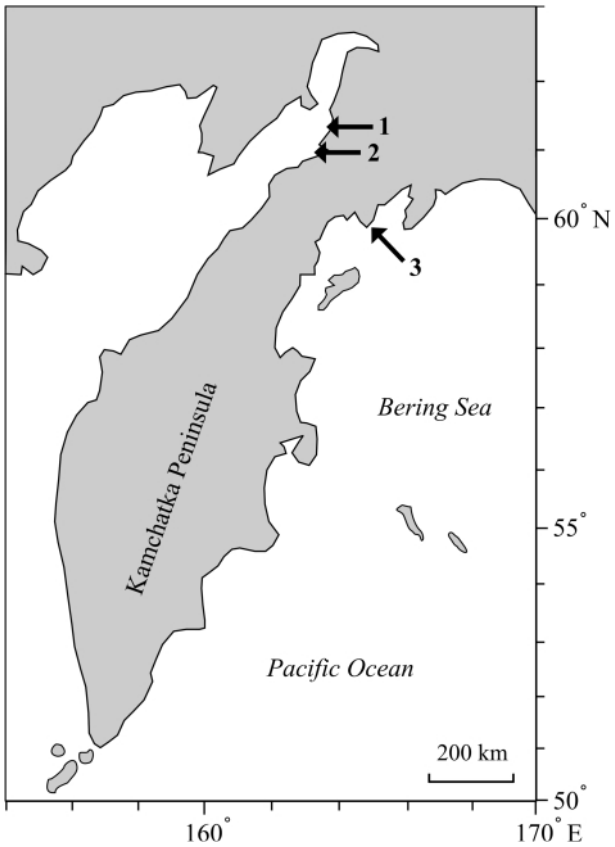

Figure 1: Location of the Paleogene stratigraphic key sections (shown by arrows) in North Kamchatka: 1 - the Mametchinsky Bay, 2 – the Chemurnaut Bay, 3 - the Il'pinskii Peninsula.

kova-*Glycymeris rosecanyonensis* Hanna, 4) *Periploma efimovae* Devyatilova-*Thyasira baca* Devyatilova, 5) *Eucrassatella lincolnensis* Weaver-*Nemocardium linteum* (Conrad), 6) *Turcicula praesakhalinensis* Krishtofovich et Devyatilova, 7) *Portlandella kilanskiensis* Gladenkov. The age of beds 1-3 was assigned to the Paleocene, beds 4-7 to the Early Eocene. Nearly 80 species of of mollusks mostly represented by subtidal (partly bathyal) forms were identified from the section. The paleowaterdepth of the Mametchinsky section was estimated to range from 0-40 to 400-500 m. The majority of genera comprises warm-water forms like *Eucrassatella*, *Pitar*, *Crepidula*, *Bathybembix*, *Molopophorus*, and *Turcicula*, in addition *Glycymeris* and *Ostrea* are common.

Comparison of the Paleogene assemblages of the Mametchinsky Gulf with the Chemurnaut Bay, located some 80 km to the south along the coast of the northwestern Kamchatka (Fig. 1) and other regions of the North Pacific, particularly Washington, Oregon and California - the Crescent, Santa Susana and other formations (Turner, 1938; Zinsmeister, 1983; Squires and Goederi, 1994; Squires, 1999), revealed their great species level similarity (up to 50-57% of common species). High similarity between benthic faunas clearly indicates close biogeographic affinities in the northern Circum-Pacific at that time. At the same time, molluscan assemblages of Kamchatka contain up to 40-50% endemics that are absent from the North American shelf. Highest endemism occurs within the Thane-

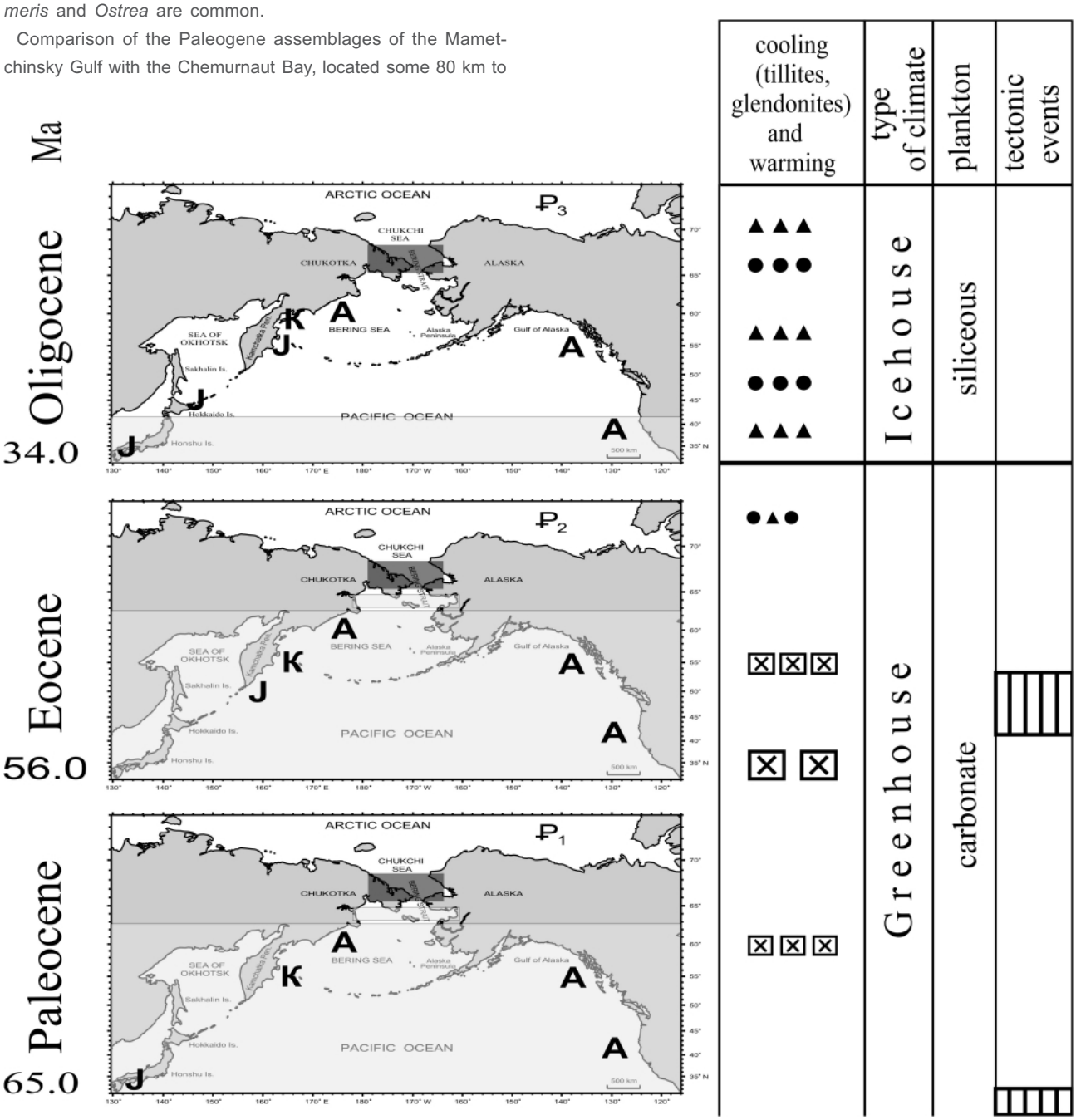

Figure 2: Paleogeography and environments in the Paleogene of the North Pacific (based on data from Gladenkov et al., 1997, 2005) Light-grey colour indicates zones of paratropical climate, and dark grey colour the Bering Land; rectangles with vertical lines show times of tectonic events; black triangles indicate stratigraphic position of tillites in sections, and black circles the position of glendonites; rectangles with crosses show periods of warming; A, J, K – the types of molluscan assemblages (A - North American, J - Japanese, K - Kamchatka).

tian-Ypresian time interval. The molluscan beds of the Mametchinsky section are well correlated with more precisely dated horizons containing planktonic and benthic foraminifera (according to Benyamovskiy and Fregatova, personal communication). Based on these correlations, the Paleocene/Eocene boundary is placed within the Unelskaya Formation and the occurrence of Lower Lutetian beds is suggested for the upper part of the Ommaiskaya Formation. The Paleocene/Eocene boundary is provisionally placed between the *Reticulophragmium garilassoi* (Frizzel) and *Plectothrochammina poronaiensis* (Asano) beds (benthos) and defined by the appearance of *Acarinina soldadoensis* (Bronniman), *Morozovella subbotinae* (Morozova) and other planktonic forms. The boundary coincides with the base of bed 4 with mollusks. These interpretations were also supported by paleomagnetic records obtained by Minyuk (2004) from the Mametchinsky section.

3. Discussion and conclusions

Two conclusions can be drawn from the data presented above. The first conclusion concerns stratigraphy. The distribution of the Late Paleocene-Early Eocene molluscan and foraminiferal assemblages of Kamchatka was used as a base to establish a new “Ommai” regional stage of the Ypresian (possibly, the early Lutetian) age and thus closing a gap in the Paleogene regional stratigraphic scheme of western Kamchatka. The new Ommai regional stage is located between the Tkapravayam (Upper Paleocene) and Snatol (Upper Lutetian) regional stages.

The second conclusion concerns paleogeographic implications of the assemblages. The North Pacific warm-water biotic assemblages during the Thanetian-Ypresian time existed in a peculiar paratropical (i.e. resembles to recent subtropical) climatic condition (Gladenkov et al., 1997) (Fig. 2). Climatic differentiation and provinciality were not distinctly pronounced. The northern part of the Pacific Ocean can be viewed as a giant “embayment” bounded by land in the North, i.e., there was no connection between the Pacific and Arctic Ocean basins. This paleogeographic situation most likely resulted in relative leveling of water temperature in the North Pacific. The warm-water genera and species of mollusks and foraminifers were spread along the shelf margin of the entire North Pacific, from Japan to North Kamchatka and from California to Washington and Oregon.

The Paleocene and Eocene mollusks apparently descended from Late Cretaceous relatively warm-water assemblages of the Pacific. Biota of boreal type began to establish during the terminal Eocene, and mainly during the Oligocene, and became well developed during the Neogene-Quaternary (Gladenkov et al., 2005). This process was greatly influenced by a global cooling and the appearance of the psychrosphere. The Late Eocene-Oligocene interval is marked by mass appearance of glendonites and ice rafted debris (Fig. 2). The evolution of the boreal biota proceeded for a long time (millions of years) and was accompanied, on the one hand, by migration of some mollusks into the southern latitudes and, on the other hand, by adaptation of individual forms to new environmental conditions. At that time we see the emergence of new boreal genera of mollusks, such as *Neptunea*, *Buccinum*, *Peronidia*, *Periploma*, *Nuculana* and others which quickly became predominant. Boreal molluscan assemblages had prevailed since Oligocene, but their speciation was very gradual during the Neogene and Quaternary (Gladenkov et al., 2005).

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References

Gladenkov, Yu.B., 2004. Biospheric stratigraphy (problems of stratigraphy of the early XXI century). GEOS Publishers, Moscow, 120 pp. (in Russian).

Gladenkov, Yu.B., Sinel’nikova, V.N., Chelebaeva, A.I. and Shantser, A.E., 2005. Biosphere – Ecosystem - Biota in the Earth Past. The North Pacific Cenozoic Ecosystems: Eocene-Oligocene of West Kamchatka and Adjacent Regions (To the centenary of Academician V.V. Menner). GEOS Publishers, Moscow, 480 pp. (in Russian).

Gladenkov, Yu.B., Shantser, A.E., Chelebaeva, A.I. et al., 1997. Lower Paleogene of West Kamchatka (stratigraphy, paleogeography, geological events). GEOS Publishers, Moscow, 367 pp. (in Russian).

Minyuk, P.S., 2004. Magnetostratigraphy of Cenozoic of the North-East of Russia., SVKNII DVO RAN Publishers Magadan, 198 pp. (in Russian).

Squires, R.L., 1999. Upper Paleocene to Lower Eocene (“Meganos Stage”) marine megafossils in the uppermost Santa Susana Formation, Simi Valley, southern California. Natural History Museum of Los Angeles County, Contributions in Science. 479, 1-38.

Squires, R.L. and Goederi, J.L., 1994. Macropaleontology of the Eocene Crescent Formation in the Little River area, southern Olympic Peninsula, Washington. Natural History Museum of Los Angeles County, Contributions in Science, 444, 1-32.

Turner, F.E., 1938. Stratigraphy and mollusks of the Eocene of western Oregon. Geological Society of America Special Paper 10. 130 pp.

Volobueva, V.I., Gladenkov, Yu.B., Benyamovskiy, V.N. et al., 1994. Reference section of the marine Paleogene in the Northern Far East (Il’pinskii Peninsula). Pt. 1. Stratigraphy. SVKNII DVO RAN Publishers, Magadan, 64 pp. (in Russian).

Zinsmeister, W.J., 1983. Late Paleocene ("Martinez provincial Stage") mollscan fauna from the Simi Hills, Ventura County, California. In: R.L. Squires and M.V. Filewich (eds.), Cenozoic Geology of the Simi Valley Area, Southern California. Pacific Section Society of Economic Paleontologists and Mineralogists, Los Angeles, California, pp. 61-71.

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