Analysis of paleoflora families' composition in the bodies of water of Western Siberia in the Pleistocene

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Abstract. The main stages of the bodies of water flora development in the Eopleistocene and the Neopleistocene epochs of the Quaternary period were examined. The research was based on paleobotanical data, the analysis of paleofloras composition, the taphocenosis, and the continuous series of paleocarpological data. It was proved that during the Pleistocene the formation of the modern Western Siberia waterbodies flora was mainly accomplished. Its further evolution was determined to reorganizations of landscape zones, changes of waterbodies areas, and some evolutionary changes of morphologically developed species (this process continues nowadays). In general, the Pleistocene paleoflora of waterbodies is represented by 34 families, 48 genera, and 161 species; 134 (83.2%) of them are the modern ones.

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Introduction

In order to provide reliable biostratigraphic data, when exploring the continental Tertiary deposits of the majority of the continental deposits (the presence of orthofauna (mammals residues) is very rare there), the methods of paleobotany, particularly paleocarpology, are used. The main object of paleocarpology is diasporidium fossils (seeds, fruits, and other remnants of generative sphere) [1-3].

The most difficult stage of any region flora studying is to restore the historical stages of its development [4-6]. The determination of the main stages of the waterbodies flora development on the certain territory is an important problem of botanical geography. This way the identification of relict species is done. J. Stoller [7] considered that the determination of a species appearance time in certain flora can be done only if based of paleobotanical data. Only these data provide the evidence of a species existence on the certain territory, and also, they determine its relict nature. The important role for understanding the flora and vegetation history of Western Siberia goes to the works and books of the founder of the Soviet paleocarpological school P.A. Nikitin, his son V.P. Nikitin, and P.I. Dorofeyev, as well as many other researchers of the Siberian region paleoflora. The monograph of V.P. Nikitin "The paleocarpology and stratigraphy of Asiatic Russia Paleogene and Neogene" [8] contains analyses of the numerous fossil complexes from hundreds of locations of Asiatic Russia (mainly from Western Siberia); traces the history of the flora and vegetation of Western Siberia and northeastern Russia during the late Paleogene and Neogene. There is also a table of the geochronological spread of over 1,600 species of fossil plants, more than 20% of which (about 360 species) belong to aquatic and shoreline aquatic plants.

Methodology

In this article, all the dating of fossil paleoflora are given according to the schemes used by O.M. Adamenko in "Mesozoic and Cenozoic eras of Steppe Altai" [9]. Also the datings done by V.P. Nikitin and mentioned in his book "Paleocarpology and stratigraphy of Paleogene and Neogene of Asiatic Russia" are used when describing the data of Western Siberia [8]. The research is based on the materials of the richest in Russia collection fund of the paleocarpological laboratory of the Open Joint-Stock Company "Novosibirskgeologiya" (Novosibirsk). The foundation of the collection dates back to the 20s of the last century by the first Russian paleocarpologist – P.A.Nikitin. The data of dozens of wells cores, numerous cuts outcrops along the Om, the Tom, the Vakh, the Ishim, the Uy, the Shish, the Demianka Rivers and other ones in Western Siberia.

Main part

The Pleistocene is represented by the Krasnodubrov suite formation (Upper Neopleistocene), the Veseloyarsk, the Bobkovsk, the Burlin, the Karasuk, and the Kasmalinsk suite formations (Middle Neopleistocene). Aeolian deposits of the Late Pleistocene are widespread in ancient stream flow of the Kulundinsk alluvial plain (and partially, are in Baraba lowland). During a long time period, covering the Late Neopleistocene and entire Holocene, there were certainly some epochs of maximum and minimum of aeolian processes. First ones were arid, semi-arid epochs of interglacials, and the second ones coincided with wetter epochs of glaciations. The climate of the Eopleistocene epoch in Western Siberia was generally similar to the modern one.

During the Pleistocene the formation of the modern Western Siberia bodies of water flora was mainly accomplished. Its further evolution was determined to reorganizations of landscape zones, changes of waterbodies areas, and some evolutionary changes of morphologically developed species (this process continues nowadays).

The spectrum of 10 leading families of the Pleistocene waterbodies paleoflora of Western Siberia is presented in Table 1.

Table 1. The spectrum of 10 leading families of the Pleistocene waterbodies paleoflora of Western Siberia

Family	Pleistocene		Family	Holocene	
	No. of genera	No. of species		No. of genera	No. of species
1. Cyperaceae	4	38	1.Cyperaceae	7	34
2. Potamogetonaceae	1	21	2. Potamogetonaceae	1	17
3. Ranunculaceae	3	10	3.Ranunculaceae	4	15
4-6. Najadaceae	2	7	4.Poaceae	8	11
4-6. Sparganiaceae	1	7	5.Juncaceae	1	8
4-6. Juncaceae	1	7	6-7.Polygonaceae	2	6
7-10 Azollaceae	1	5	6-7.Alismataceae	2	6
7-10. Alismataceae	2	5	8. Typhaceae	1	5
7-10. Salviniaceae	1	5	9-10. Sparganiaceae	1	4
7-10 Nymphaeaceae	2	5	9-10. Zannicheliaceae	2	4

The Holocene West Siberian waterbodies flora consisted of the Eopleistocene and the Neopleistocene flora elements, which are relatively close to the modern ones. At the top of a ranked list of the Pleistocene flora families of the Ob-Irtysh interfluve reservoirs are placed: *Cyperaceae, Potamogetonaceae, Ranunculaceae, Najadaceae, Sparganiaceae, Juncaceae, Azollaceae, Alismataceae, Salviniaceae,* and *Nymphaeaceae.* These top 10 families combine 69.5% species of waterbodies flora. 3 families are particularly important because of their species composition: *Cyperaceae, Potamogetonaceae* and *Ranunculaceae*, they represent 44.0% of the total Pleistocene waterbodies flora. In the Holocene, the families: *Cyperaceae, Potamogetonaceae, Ranunculaceae* also occupy the leading positions, representing 38.8% of the total waterbodies flora. The fourth place in the Holocene belongs to the family *Poaceae* (11 species, 8 genera).

In the Pleistocene in Western Siberia there were only 3 species coming from the previous periods: *Azolla aspera, A. interglacialica,* and *A. pseudopinnata* P. Nikit. By the way the last species is found abundantly in the Pleistocene sediments. Besides the mentioned species there are the new ones which appear during the Pleistocene: *A. pseudopinnata* P. Nikit., and *A. sibirica* Dorof. The recent discoveries of *Azolla interglacialica* residues found in Western Siberia are dating back the Late Pleistocene (Figure-Wurm – Kazantseva time).

In general, the Pleistocene waterbodies paleoflora is represented by 34 families, 48 genera, and 161 species, 134 (83.2%) of them being the modern ones. 111 taxa of the modern species originating from waterbodies paleoflora grown nowadays in Western Siberia; 23 species grow outside the territory of Siberia. It is important to mention that the number of families from the Oligocene till the Holocene has steadily increased. In the Pliocene-Pleistocene the thermophilic genera *Palaeoeuryale, Irtyshenia, Nikitinella* et al. are disappearing.

Diminution of species (genera) number in the Pleistocene waterbodies paleoflora was apparently provoked by an increase in the competition between aquatic ecosystems species; because of the general arid climate in the region, and the reduction of the number and area of waterbodies. As a result, the most adapted and competitive (reproduction, ecological plasticity, life forms, and strategies of behavior in phytocenoses) taxa were surviving. It is also necessary to mention that the habitats of many paleoflora plants have evolved. In the majority of cases they have split up. [10-11].

Conclusion

The greater or lesser geological antiquity of fossil floras can be defined in several ways. Unfortunately, after the numerous attempts of the continental Cenozoic horizons mapping of Asiatic Russia using the levels of the common scale, the results remain hypothetical. Indeed, even in the Mediterranean the debates are still very tense about the scope and limits of the Paleogene, particularly the Neogene tiers, about the relationship between marine and continental horizons. The correlation of the Cenozoic sediments of the Northern Asia and Europe dramatically hampered because of its weak paleontological study.

Inference

While studying the history of development of the waterbodies flora in the south of Western Siberia, the following conclusions were reached: the development of the reservoirs flora went mostly autochthonous; it means that it has appeared out of the Eocene-Oligocene local flora. The core of reservoirs flora got formed in the Pliocene-Pleistocene based on depleted variants of Pavlodar and Kochkovsk floras, as well as the thermophilic elements of ancient Mediterranean flora. During the Pleistocene the formation of the modern Western Siberia bodies of water flora was mainly accomplished. Its further evolution was determined to reorganizations of landscape zones, changes of waterbodies areas, and some evolutionary changes of morphologically already developed species. The leading families of Western Siberia waterbodies paleoflora are: *Cyperaceae* (38 species), *Potamogetonaceae* (21 species), and *Ranunculaceae* (10 species), which represent 42.8% of total paleoflora.

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