

ON THE PALEO GEOGRAPHY OF THE LOWER VOLGA RIVER AREA DURING THE LATE PLEISTOCENE

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The upper Pleistocene deposits of the Lower Volga River region consist of the upper Khazarian, Akhtubian, Atelian, lower Khvalynian, Enotaevian, and upper Khvalynian sediments, which are represented by different facies—from marine to continental ones (Svitoch and Yanina, 1997). Paleogeographic analyses of them have allowed us to reconstruct the history of the Lower Volga region during the late Pleistocene.

The upper Khazarian deposits are represented by marine, alluvial-marine, limano-lagoonal sediments reflecting two stages of accumulation, with erosion during the regressive stage of the late Khazarian basin. Waters of the sea reached a level below the zero mark (-10 m). The delta of the Volga River was situated near the village of Kopanovka. Above it, in the Volga valley, we observed the different alluvial deposits topped by a fossil soil. The marine deposits contain *Didacna* mollusk assemblages belonging to the “*crassa*” group. The species-composition of assemblages and habitus of the mollusk shells testify that the salinity of the late Khazarian Sea was higher in comparison with the modern one, and the conditions under which deposits accumulated were warm. The assemblages of microfauna also testify to the same conditions. The alluvial-marine and lacustrine sediments differ in the domination of slightly brackish-water mollusks, *Didacna* of the “*trigonoides*” group, the presence of freshwater species, and the abundance among them of thermophilic mollusks; these findings confirm warm climatic conditions. We correlate the late Khazarian transgression with the Karangatian transgression of the Pontian basin, the Eemian period of Western Europe, and Mikulino interglacial of the Russian Plain. The waters of the second transgression stage (Hirkanian?) had a short-term drain into the Black Sea basin through the Manych after regression of the Karangatian Sea.

The post-Khazarian period is characterized by the accumulation of the Akhtubian sands in the Volga River valley. Ice “wedges,” evidence of cryoturbation, and periglacial vegetative spectra form the evidence of glacial conditions during the formation of these deposits. Akhtubian sands are changed by Atelian formation. These continental deposits were either alluvial or sub-aerial in origin. They are mainly represented by loess-like loamy sands and loams, rarely sands with traces of fossil automorphic and hydromorphic soils. The fossil mollusks, pollen of taiga vegetation (Grichuk, 1954; Moskvitin, 1962), and a complex of mammals with reindeer are paleontologic arguments for a cold period. The capacity of deposits and the formation of three horizons of soils indicate that there was a long interval, apparently, covering most of the Valdai Glacial. The Caspian Sea was characterized by a regressive condition during most of the Akhtubian-Atelian.

The Khvalynian Caspian deposits in the Lower Volga sections were formed during the second half of the Valdai, under conditions of higher humidity and heavy flow of water. The transgression developed with two stages divided by the Enotaevsk regressive episode. The early Khvalynian transgressive stage was the maximal one. Caspian Sea researchers have identified stadial coastlines that were formed by the Early Khvalynian basin: maximum, 34-36 m (Talgin'sk), 28-30 m, 20-22 m (Buinak'sk), 14-15 m (Turkmenian), and 4-6 m (Fedorov, 1978; Rychagov, 1997). The valley of the Volga River became an estuarine basin, which reached almost 600 km upriver at the maximum of the transgression (when the mouth lay at the confluence of the modern Eruslan River). Deposits are represented by sands, “chocolate” clays, loams, and loamy sands. The thickness of these deposits usually does not exceed several meters. The sea fauna advanced into the Volga-estuarine basin but not farther than 100-150

km. It was a relatively poor faunal assemblage consisting of *Didacna* of the “*trigonoides*” and “*catillus*” groups (*D. parallella*, *D. protracta*, *D. ebersini*), and numerous slightly brackish-water mollusks of the *Monodacna*, *Adacna*, *Dreissena* genera. According to the taxonomic composition of mollusk assemblages and their figures, the basin was characterized by cold and freshened waters in the northern areas. This is confirmed by the microfauna (Yanko, 1989). According to the fossil pollen, this was a cold period with taiga vegetation that was later replaced by steppe herbaceous vegetation (Moskvitin, 1962). The early Khvalynian waters drained into the Black Sea basin, where the Neoeuxinian basin with its level at a negative mark existed at the time. According to our reconstruction, development of the Khvalynian transgression was gradual and had no catastrophic character.

The level of the late Khvalynian basin did not exceed the zero mark. The Volga River flowed into it through two basic arms, each of which possessed a branched delta. Marine deposits are represented basically by sands, sometimes with prolayers of loam and sandy loam. The specific facies of the upper Khvalynian sediments is the formation of the Baer knolls. The origin of these sediments remains under discussion. Analysis of their structure indicates they accumulated in high-energy hydrodynamic settings, while finds of brackish-water ostracods imply salinity close to that of the present-day Caspian Sea. Researchers have proposed many hypotheses to solve this contradiction. However, the paleohydrological setting of their formation remains controversial.

The upper Khvalynian deposits are characterized by a fossil assemblage that differs from the Early Khvalynian in the abundance of *D. praetrigonoides*. The water of the basin must have been somewhat freshened, but shells of the mollusks lived in it, obviously, indicating a rise in temperature of the water by comparison with the Early Khvalynian stage. Palynological data (Grichuk, 1954; Moskvitin, 1962) indicate a general warming in the region. The regressive tendency of the Late Khvalynian Sea was characterized by a series of minor secondary transgressive phases (Rychagov, 1997). The Late Khvalynian regression coincided with increasing aridity in the Caspian region. In our data, the Late Khvalynian transgressive stage developed at the end of the Valdai Glacial, the beginning of the postglacial period. All cycles of the paleoevents (Akhtubian-Atelian-Late Khvalynian) took place during the Valdai.

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