

LOWER KHALVALYNIAN SEDIMENT RECORD OF THE MIDDLE AND LOWER VOLGA REGION

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Introduction

The Great Khvalynian (Early Khvalynian) transgression occurred in the second half of the Late Pleistocene. This transgression reached the maximum sea area extension (about 872,000 km²) (Aladin and Plotnikov, 2006) and the highest sea level +50 m asl (Zhukov, 1945). In that period, the Late Valdai ice sheet and widespread areas of periglacial territory with permafrost extended to the periphery of the North European Plain. Degradation of the Late Valdai ice sheet and permafrost provided incoming melt water containing glacio-fluviatile and cryo-suspension deposits to the Volga River basin, and the dynamic sea-level rise created the maximum area of the Caspian Sea in Pleistocene history. Significant environmental changes of this period have been found in key sections of the North Caspian Sea region.

Study region and methods

During the last 5 years, more than 25 key sections located in the Middle and Lower Volga River basin, Ergeni bench, and Kalmykia have been investigated. The key northern section (Chapaevsk) is located in the Middle Volga River basin with a level at +28 m asl. The Lenino key section (Baer mound at -15 m asl) lies at the border between the Lower and Upper Khvalynian sediments, and thus this is the southernmost area of the Early Khvalynian deposits in the Lower Volga region. On the west side of the North Caspian Sea Lowland, the Lower Khvalynian deposits extended along the Ergeni bench and Sarpa lakes with a level at +30 to 0 m asl, respectively. Comprehensive methods including lithological, mineralogical, palynological, malacofaunistic, geomorphologic, OSL, and radiocarbon analyses (to each component) were used for paleoenvironmental reconstruction of the Early Khvalynian basin. Also collected were samples of mollusks, lithology, mineralogy, and palynology, and these were added to the data bank.

First Results

Key sections of the Lower Khvalynian deposits were divided by lithofacies and classified by their structure and position. In the Middle Volga Region from Chapaevsk (+28 m asl) to Bykovo (+18 m asl), sections contained clays basically in the lower part, clay loams and sparse sands in the middle. Molluscan fauna were concentrated only in the Torgun (+15 m asl) and Bykovo sections in the upper part of a thin sand layer and included *Didacna protracta*, *Dreissena distincta*, *Monodacna caspia*, and *Adacna vitrea*.

The sections of the Lower Volga region are characterized by a dynamic stage of evolution of the Early Khvalynian basin. One of the most representative key sections of the Lower Volga region is Svetly Yar (+7 m asl), which contains the greatest thickness of clays (more than 10 m). This is the typical area of widespread chocolate clays with their specific features (such as color and structure). To the south of Svetly Yar, gradual replacement of clays by sands and clay loams occurs. The Tsagan-Aman (-9 m asl) section is characterized by interbedded clays and sands and the group of *Didacna parallella*,

Dreissena distincta, and *Monodacna caspia* assemblages. Sporadic Lower Khvalynian deposits are also concentrated in the bottom part of the Baer Mounds near Enotaevka (-14 m asl) and Lenino. This deposit contains thin layers of clays (thickness within 1 m) and small numbers of mollusk shells.

On the western side of the North Caspian Sea lowland, the Lower Khvalynian deposits are widespread between Ergeni bench and the group of salt water lakes named Sarpa. Investigated sections at Tundutovo (+ 30 m asl), Yalmata (+28 m asl), Arshan-Zelmen' (+28 m asl), Ulan-Erge (+26 m asl), and Yalmta (+32 m asl) differ significantly from the Volga River sections. The first three sections are located near Ergeni bench and are characterized by interbedded lagoon sands and clays with a thickness of 1.5 m. The next two sections (south part of Kalmykia) contain poor Lower Khvalynian deposits and consist of thin sands and clay loam with sporadic mollusk shells of *Monodacna caspia*.

Most of the key sections were dated by ¹⁴C (Figure and Table), and *Didacna* shells were collected *in situ*. The Svetly Yar section was chosen for its representative values. Three levels (+3, 0, -2 m asl) of this section that contain the mollusks *Didacna protracta* were dated. The dates of this section showed calibrated ages from 13,730 ± 270 to 13,340 ± 210. The Cherny Yar (-5 m asl) section was also dated for correlation with Svetly Yar. The dates obtained from elevations at -7.2 to 11.5 m asl show almost equivalent values (from 14,510 ± 260 to 13,290 ± 210). These results demonstrate an extensive process of sedimentation (more than 1 m over the course of 100 years).

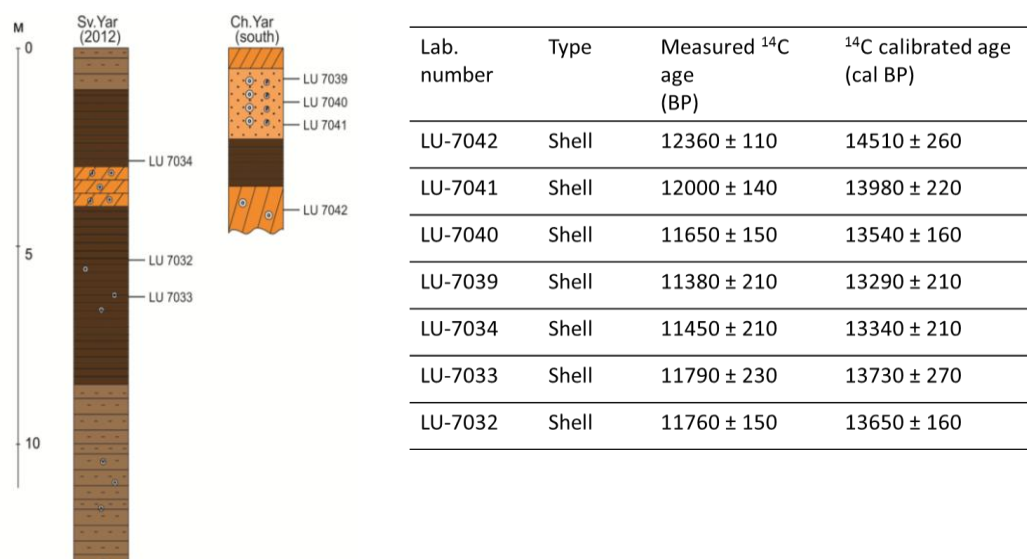


Figure and Table . Svetly Yar and Cherny Yar key sections and radiocarbon age determinations. (Calibration date set: "CalPal" B. Weninger, O. Joris, U. Danzeglocke, 2006 (www.calpal.de))

Conclusion

Results obtained from the key sections that were investigated show different structures within the Lower Khvalynian deposits. In the Middle Volga region, key sections are characterized by dominant clays in the bottom part and sporadic mollusk shells in thin sand layers in the upper part. The Lower Volga region is the typical area for chocolate clays, which are located in the middle part of the sections. Mollusk fauna are mainly represented by *Didacna protracta*, *D. trigonoides*, *Dreissena distincta*, *Monodacna caspia*, and *Adacna vitrea*. In the Ergeni bench and Kalmykia sections, the Lower Khvalynian deposits developed under coastal and occasional lagoon conditions. Lower Khvalynian deposits are characterized by record processes of sedimentation (more than 1 m in 100 years) that is confirmed by radiocarbon dating.

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