Short communication

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Late Pleistocene Lakes of the Manych Depression (Caspian and Azov-Black Sea basins, Russia)

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ABSTRACT. The first geochronological data have been obtained for the lacustrine deposits of the Manych Depression, discovered by a borehole. It was found that two horizons (burtass and gudilovsky) of sedimentation were distinguished in the lacustrine deposits separated by an erosion gap. The age of the Burtass Lake deposits is estimated at 78-100 ka years ago (MIS 5), Gudilovsky Lake — 25-64 ka years ago (MIS 3).

Keywords: palaeogeography, Manych Depression, malacofaunistic analysis, OSL dating, geochronology, biostratigraphy

1. Introduction

The Manych Depression is a vast, weakly dissected low lying plain, stretching from the northwest from the mouth of the Don River to the southeast to the Northern Caspian for more than 500 km.

Based on the analysis of lake sediments filling the valleys of the Western and Eastern Manych Rivers in the Late Pleistocene history of the depression a huge lake was reconstructed, which formed after the closure of the Hyrcanian Strait and was named Burtass.

A large number of researchers have been studying the burtass (gudilovsky) deposits (Goretsky, 1958; Popov, 1983; Svitoch et al., 2011; Badukova, 2015, etc.), however, there is still no consensus on the duration of the existence of the lake, the factors of its formation, how the time of its existence correlates with the states of the Caspian and Azov-Black Sea basins. Many questions have not yet been answered, largely due to the lack of geochronological data.

Here we present the first dates obtained for lacustrine deposits of the Manych Depression using the OSL method.

2. Materials and methods

Borehole MN-1 (N46°26′52,7 E42°41′19,6) with depth 42,0 m, was drilled near Gruzskoe Lake (Fig. 1) at a height of 19.2 m.

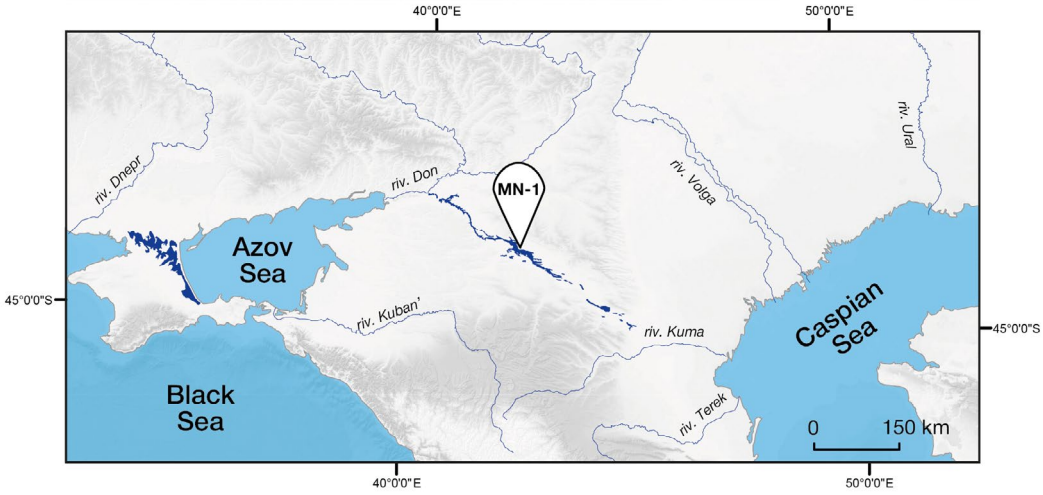

Fig.1. Location of the MN-1 drilling site in the Manych Depression.

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The sediments of the borehole were studied by the malacofaunistic method in order to provide a biostratigraphic substantiation of the highlighted sediments. Geochronological data were obtained using the OSL dating method.

3. Results

In the MN-1 borehole core (Fig. 2), the following deposits are exposed from top to bottom: (1) modern soil 1.2 m thick, transition to the underlying sequence is gradual; (2) light brown loam in the range of 1.2–15.0 m from light at the top to heavy at the base with inclusions of gypsum and silt interlayers, the boundary with the underlying layer is clear; (3) bluish-dark gray clay at a depth of 15.0–18.0 m with inclusions rare crystals of gypsum, interlayers with mollusc shells, manganese stains, and ferruginous spots; accumulation of shell detritus is observed in the roof; silt interbeds, gradual transition to the underlying sequence; (4) dark gray clay at a depth of 18.0–20.4 m with inclusions of carbonates and ferrugination spots, gradual transition to the underlying sequence; (5) bluish-gray light to medium silty loam at a depth of 20.4–27.6 m with inclusions of ferruginous and manganese spots, interlayers of silt occur, in the interval of 25.8–26.0 m a darker gray interlayer is observed, enriched in detritus, small fragments of thin mollusk shells, at the bottom of the layer there is a sandy interlayer with inclusions of mollusk shells, the boundary with the underlying layer is clear.

Malacofaunal analysis of the core showed that at a depth of 27.6–25.8 m there are shells of freshwater and slightly brackish mollusks (*Dreissena polymorpha*, *Unio* sp., *Viviparus* sp., *Valvata* sp.), which indicates the existence of a calm freshwater basin.

Three samples were taken for geochronological analysis by the OSL dating method. During the study, three dating protocols were used (Kurbanov et al., 2019): for quartz (OSL) and for feldspar (IR_{50} and $pIRIR_{290}$). The samples showed the presence of a fast component in the samples of quartz (OSL), in connection with this, the absolute age was obtained from quartz.

The accumulation of the Burtass lake deposits began after the closure of the Hyrcanian Strait about 100 ka years ago (Kurbanov et al., 2018), and ended no earlier than 78 ka years ago. The overlying light brown loam accumulated in the interval 25–64 ka years ago.

4. Discussion and conclusions

In the central part of the Manych Depression after the closure of the Hyrcanian Strait sediments of the freshwater Lake Burtass began to accumulate. The results of OSL dating showed that the lake existed here up to 78 ka years ago, i.e. before MIS-4. It is possible that Lake Burtass was a relic of the Hyrcanian Strait, which quickly desalinated under the influence of local watercourses. The climate still remained interstadial at the end of MIS-5 (Kurbanov et al., 2018) and, apparently, the lake had a positive water balance,

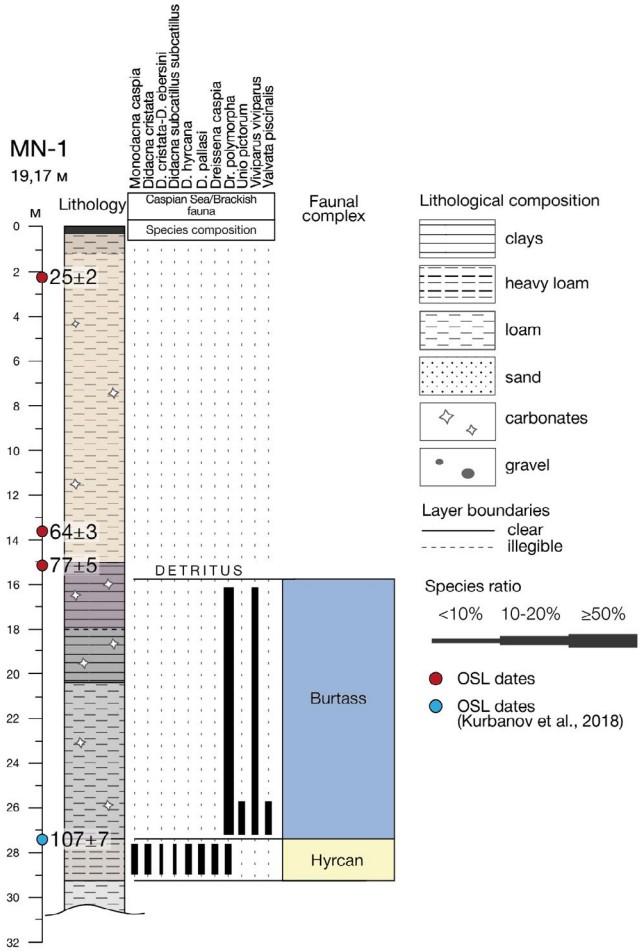

Fig. 2. Lithology, biostratigraphy and geochronology of deposits from the MN-1 borehole.

which led to the existence of a full-flowing freshwater Lake Burtass within the Manych Depression for MIS-5.

As a result of climate warming during MIS-3, a river flow into the Manych Depression was apparently increased. According to the high concentration of gypsum in the composition of the sediments, shallow water body that dried up from time to time — Lake Gudilovsky — reappeared on the site of the once existing Lake Burtass. The period of accumulation of sediments in these water bodies according to the results of OSL dating is estimated at 25–64 ka years ago.

Acknowledgments

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Conflict of interest

The authors declare no conflict of interest.

References

Badukova E.N. 2015. The history of fluctuations in the level of the Caspian in the Pleistocene (was there a great Khvalynian transgression?). Bulleten' Komissii po Izucheniyu Chetvertichnogo Perioda [Bulletin of the Commission for the Study of the Quaternary Period] 74: 111-120. (in Russian)

Goretsky G.I. 1958. Burtas middle anthropogenic lake and the problem of fluctuations in the level of the world ocean in connection with glaciations. Bulleten' MOIP. Otdel Geologii [Bulletin MOIP. Department of Geology] 2. (in Russian)

Kurbanov R.N., Yanina T.A., Murray A.S. et al. 2019. The age of the Karangatian (Late Pleistocene) transgression of the Black Sea. Vestnik Moskovskogo universiteta. Seriya 5. Geografiya [Bulletin of Moscow State University. Series 5. Geography] 6: 29-39. (in Russian)

Kurbanov R.N., Yanina T.A., Murray A.S. et al. 2018. The Hyrcanian Stage in the Late Pleistocene History of the Manych Depression. Vestnik Moskovskogo universiteta. Seriya 5. Geografiya [Bulletin of Moscow State University. Series 5. Geography] 3: 77-88. (in Russian)

Popov G.I. 1983. Pleystotsen Chernomorsko-Kaspiyskikh prolivov (stratigrafiya, korrelyatsiya, paleofaunistika, geologicheskaya istoriya) [Pleistocene of the Black Sea-Caspian straits (stratigraphy, correlation, paleofaunal studies, geological history)]. Moscow: Nauka. (in Russian)

Svitoch A.A., Novokova N.G., Berezner O.S. et al. 2011. Lithology and facies of the Burtassian and Khvalynian deposits of the Manych. Litologiya i Poleznye Iskopaemye [Lithology and minerals] 4: 428-438. (in Russian)