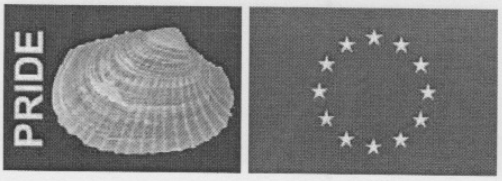

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EU Horizon 2020-ITN "PRIDE" (Drivers of Pontocaspian Biodiversity Rise and Demise)

WHERE EAST MEETS WEST: Pontocaspia, the historical dimension of the evolution of a unique biodiversity

Abstracts
of the International youth school-conference

Rostov-on-Don / Kagal'nik, Astrakhan', Russia
August 21 – September 02, 2017

Rostov-on-Don
SSC RAS Publishers
2017

PROBLEMS OF GEOLOGY AND DEVELOPMENT HISTORY OF THE KERCH STRAIT

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ПРОБЛЕМЫ ГЕОЛОГИИ И ИСТОРИИ РАЗВИТИЯ КЕРЧЕНСКОГО ПРОЛИВА

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The zone of the Kerch Strait refers to the relatively young Kerch-Taman folded region. A feature of this area is the intersection of folds of two directions: Crimean – latitudinal, and Caucasian – northwest. With the interference of the uplifts of these two directions, numerous manifestations of diapirism and mud volcanism can be associated. A fairly simple folding, represented by a successive alternation of anticlines and synclines, is quite confidently traced through the water area of the strait from the Kerch Peninsula to the Taman Peninsula. This was already evidenced by the researchers of the first half of the twentieth century. Gradual rejuvenation of folding from west to east was noted. In the zone of the strait – the Crimean orientation of the folds (latitudinal or even northeastern) prevails. The pre-Pleistocene deposits that appear here on the surface are represented by a significant set of sedimentary formations of the Oligocene, Miocene, and Pliocene, typical of the eastern Paratatis region. Various dense layered clays, formed in conditions of marginal shallow, mostly desalinated seas, predominate in them lithologically. The subordinate development includes sandstones, siltstones, limestones, and also sands, which are particularly noticeable in the Upper Pliocene part of the section.

The study of the Neopleistocene deposits of the bottom of the Kerch Strait has a century-old history, the beginning of which is associated with the work of N.I. Andrusov (1918 and others) according to the results of drilling operations in 1916-1918. It must be said that the study of bottom sediments was always confined to drilling. In connection with attempts to build bridges, several of drilling campaigns were performed. A significant amount of drilling was performed in 1945. Large and detailed survey work was carried out by the Moscow Institute "Hydroproject" in 1972-1975 in connection with the design of the bridge in the narrowest northern part of the water area. Almost simultaneously with this North Caucasian geological

department, drilling operations were carried out on the east coast of the strait, including the Chushka Spit and other accumulative forms. The last two organizations produced a coordinated, massive study of biostratigraphic material from the cores. At the same time, the processing of materials was carried out by G.I. Goretsky (1982), P.V. Fedorov (1978), G.I. Popov (1983), A.B. Ostrovsky, Ya.A. Izmailov (1977), etc. Beginning in the 70-s of the last century, large-scale drilling campaigns was carried out by the Institute of Geological Sciences of the Academy of Sciences of the Ukrainian SSR and other organizations of Ukraine [Shnyukov et al., 1981]. In the following years, many publications appeared on the geochronology and biostratigraphy of the sediments of the Neo-Pleistocene terraces located on the eastern and western shores of the Strait [Arslanov et al., 1983; Izmailov, Arslanov, 2007; and others]. Currently, the next cycle of works related to the construction of a new bridge is being conducted, but these materials are not considered here. Many of the discussion problems on the geology and history of the development of the Strait, which were revealed during the 20th century, are still relevant at present.

The first cores drilled in the northern part of the strait showed that the basis of the strait, composed of Neogene deposits, is located substantially below the modern bottom, at absolute elevations of about -60 m. At one core, the mark was even -70 m. This figure requires confirmation by additional materials. In general, the deepening of the strait has a trough-like shape with a flat bottom and rather steep sides. Talveg depression has a slight slope in the south direction [Shnyukov et al., 1981]. In the thick layer of sediments filling this depression, at least three uneven-aged complexes, corresponding in our opinion to MIS 2-1, MIS 4-3 and MIS 6-5 and to the last glacial cycles, can be distinguished. The structure of these complexes is similar: they begin with a deep erosion cut and coarse alluvial deposits, passing higher into the sediments of the gradually mineralized lagoons and seas (Fig. 1). Their brief description is given below.

1. Sediments of the last glacial cycle – Neoeuxine-Black Sea (IIA 2-1). They fill the maximum deepening of the strait and are distributed in the central-most part of the strait. The bottom of this depression deposits (Chushka layers) up to 15 m thick is represented by sands with gravel, alternating upwards in the section with light gray aleurites, which, in turn, are crowned by a layer of peat bogs. Paleontological remains in them (mainly associated with sands), are presented everywhere as a mixture of marine, brackish and freshwater elements. Despite of this, there is reason to believe that their genesis is alluvial, with an age oflate Pleistocene (pre-Holocene). Remains of fauna, in addition to freshwater ones, are redeposited from older layers in our opinion. The frequently occurring re-depositing of paleontological material in the region is worth noting here. The view about the more ancient mid-Pleistocene age of Chushka layers and their marine genesis has been expressed [Goretsky, 1982; Popov, 1983]. The lagoon clay deposits with a thickness of up to 30-35 m lie above

the alluvium, the orectocoenoses of which indicate a successive change in the salinity of the basin from freshwater conditions (the Yenikalian layers) to the conditions of the sea lagoon (Neoeuxinian, Bugazian, Vityazevian and Kalamitian layers according to [Neveskaya, 1965]). At the same time, in the coastal part of the Strait, the facies of the lagoon beaches, inter-bedded with peat bogs, indicate the reciprocal development of the transgressive basin. Finally, this complex ends with shell sands (up to 20 m) containing marine fauna of the modern type (the Dzhemetinian and Nymphaean layers). Thus, in the development of the Strait in this cycle of sedimentation, three stages were distinguished: a) the stage of the river valley, b) the stage of the lagoon, the salinity of which increases with sea level rise, and c) the stage of the marine strait.

2. Sediments of the Tuzla-Surozh cycle (MIS 4-3). Within the eastern side of the depression when drilling on the Chushka spit, a separate valley-like depression to a -45 m mark, filled with a 30-m thickness of precipitation was found. The section repeated the late Pleistocene-Holocene section of the near-strait part of the Strait, but was a reflection of the earlier, older regressive-transgressive cycle. Alluvial sands and sandy loam lying at the base, upwards along the section, pass here into the liman-sea clays. The change in the orientocoenoses in the latter also resembles the younger complex, with the only difference being that the beds of the Neoeuxinian layers with Monodacna are occupied by layers with very small and sharply keeled trigonoid Didacna, very reminiscent of those described by N.I. Andrusov (1918) as *Didacna moribunda* (the Tuzla layers). The upper part of the section is characterized by a Mediterranean fauna, more halophylic than the Holocene fauna, with large *Paphia senescens* and others (the Surozh layers). Uranium-ionium datings in the interval 40.7-41.25 kyr (LU-449, 488), as well as radiocarbon dating of more than 30.5 kyr (LU-366V) were obtained in the laboratory of the St. Petersburg University.

3. Sediments of the Chokrak-Karangat cycle (MIS 6-5). On the eastern side of the depression, sand-clay sediments, representing the ancient-most sedimentation cycle, constructed similarly to the previous ones, were encountered in cores up to –23 m. The upper part of them is blurred. The final stages of this cycle seem to be met by sediments of the Karangat terraces with characteristic fauna, described both on the western and eastern shores of the Strait, in particular at the base of the Chushka spit. It is not completely clear whether the deposits, which are described in detail within the western side of the depression at elevations from -15 to -42 m, should be attributed to the Karangat or Surozh cycle. According to the hypsometric position, they are closer to the Surozhian, and according to the fauna of mollusks – to the Karangat. This does not limit the list of discussion problems of the geology of the Neopleistocene and the history of the development of the Strait [Izmailov, 2015].

In conclusion, we note that in general the zone of the Strait is closer to the eastern part of the Kerch-Taman folded region, where folded deformations in the

Neopleistocene were replaced by common tectonic uplifts [Milanovsky, 1968]. In this regard, it seems quite logical that the deepest part of it is composed precisely of the young sediments of the last glacial cycles, i.e. there is an embedded, and not superimposed, character of the structure of sedimentary complexes. The older Pleistocene deposits were preserved mainly above sea level, both on the western and eastern shores of the strait.

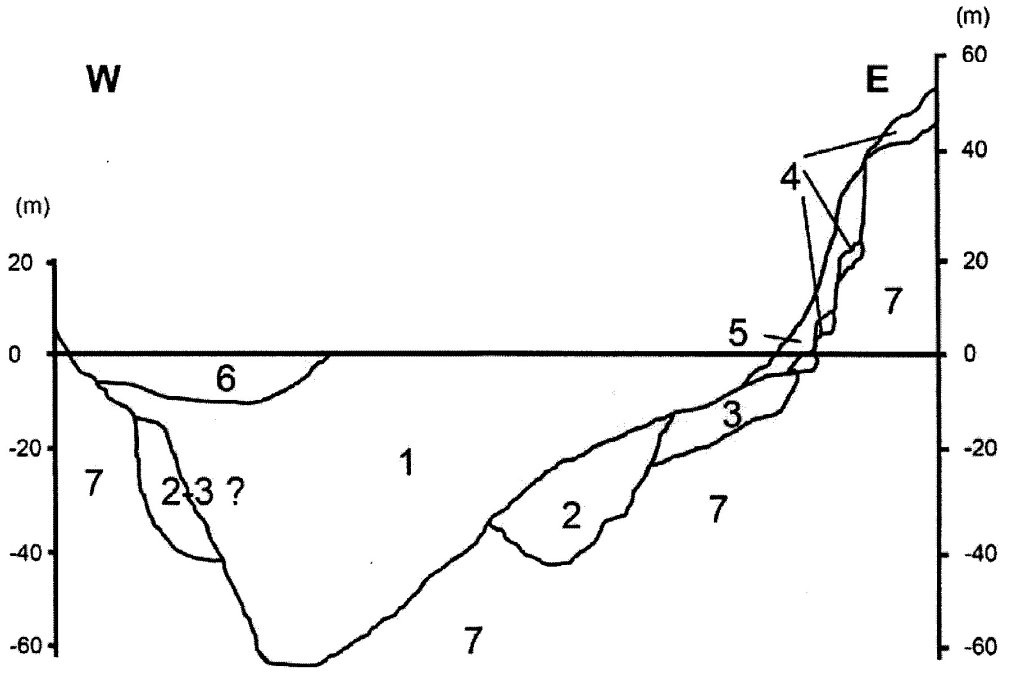

Fig. 1. Schematic diagram of the relationship of sedimentary complexes in the northern part of the Kerch Strait (Spit Chushka – the water area of the Strait): 1 – Neoeuxine-Black Sea complex, 2 – Tuzla-Surozh complex, 3 – Chokrak-karangat complex, 4 – Neoplestocene marine terraces, 5 – subaerial deposits, 6 – water, 7 – pre-Pleistocene deposits