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ORAL

Paleogeographical mapping of the Caspian Sea Late Quaternary basins

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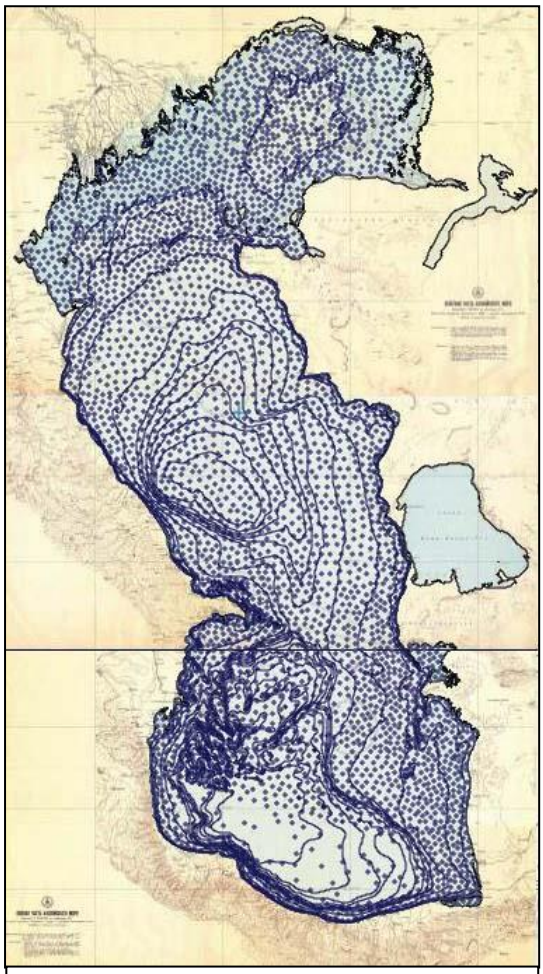

Fig. 1. Points used for constructing the bathymetric model

Introduction

The Caspian Sea coasts are one of the most developed economically and recreationally. The coast and shelf are of great interest for oil and gas exploration, as well as the ways of their transportation. Therefore, the Caspian region attracts increased attention of researchers, including its paleogeography [1]. The observed global climate changes in the current century have determined an increase in interest in predicting the stability of sea coasts [2]. Information about extreme processes on the coast, as a rule, does not go beyond the period of instrumental observations, which are limited to the last century. The expansion of such data is of great interest not only for increasing the reliability of the forecast of extreme processes risk, but also for identifying features of the violation of the slow, evolutionary development of coastal systems. Assessing and forecasting the possible negative consequences of fluctuations in the level of the Caspian Sea requires the creation of a series of maps.

Methodology

The cartographic method was used in this study to assess the area of distribution of various stages of evolution of the ancient basins of the Caspian Sea (starting from 150 thousand years ago), as well as to assess possible threats to the economy and infrastructure of the coast. The aim of this work is to create a local geographic information system and study, within its framework, the dynamics of the level of the Caspian Sea for different stages of large transgressions (sea level rise) over the past 120 thousand years.

As part of the study, we considered the largest transgressions of the Caspian Sea over the past 120 thousand years (Late Neopleistocene). Currently, the following major transgressive stages in the history of the Caspian are universally recognized in the literature: the Novocaspian, Khvalynian

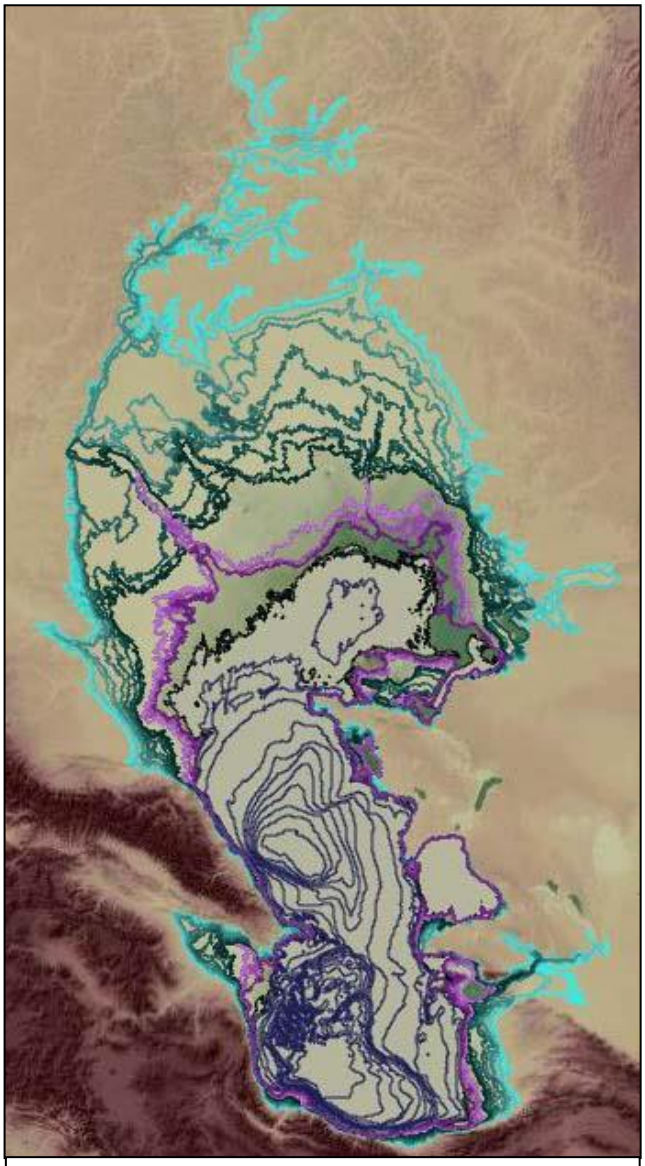

Fig. 2. Position of the coastline for various stages of transgressions during Late Quaternary

and Late Khazarian. Within each transgression, terrace levels in meters of absolute height from [3], [4], [5] corresponding to them for the Caspian Sea were determined.

As a source for constructing the bathymetric model (fig.1) of the Caspian Sea for the current level position, publicly available information on the position of isobaths of 50, 100, 200, 500 and 1000 m was used according to small-scale physical and geographical maps available in the public domain.

As the main source of mapping the position of the coastal line of the Caspian Sea, depending on the corresponding level of the sea-level during different periods of transgressions, we used a digital terrain model SRTM-90 with a spatial resolution of 90 meters per pixel. For the most correct construction of the corresponding altitude levels (Caspian sea shorelines), the heights of the digital elevation model SRTM-90 were reduced to the 1942 Pulkovo coordinate system. When calculating the metric parameters of the Caspian Sea, this model was assumed to be constant over time.

Results

In order to systematize the used materials and the results of the study, as well as for visualization of the Caspian sea evolution we created a Web-GIS portal on the existing ScanEx Web Geo-Mixer platform.

Currently, the following thematic data blocks are integrated into the Web-GIS portal. (1) Data from a digital elevation model of the study region and derived characteristics based on it (slope steepness, slope exposure, black-and-white washing). (2) Data on the position of the present coastline of the Caspian Sea and position of the coastline for various stages of transgressions (fig. 2). (3) Cartographic materials illustrating the bathymetry of the modern Caspian (including marine navigational maps of 1: 750000 and 1: 200000 scales) and vector isobath cartographic layers based on data from cartographic materials. (4) Paleogeographic maps with position of the reconstructed coastlines of the Caspian Sea during periods of major transgressions.

The Web-GIS (fig. 3) is available using the link:
maps.kosmosnimki.ru/api/index.html?CE3B9FAC613D42908B46280A577F6A28.

Conclusions

We performed calculation of the main parameters of the main stages of the Caspian Sea level evolution during the last 120 thousand years. The calculated characteristics of the area, coastline and water volume are the basis for understanding the paleogeographic characteristics of the basins and analyzing the evolution of the natural environment of the region during Late Quaternary. The developed database is an effective tool for visualizing the history of the Caspian Sea and for

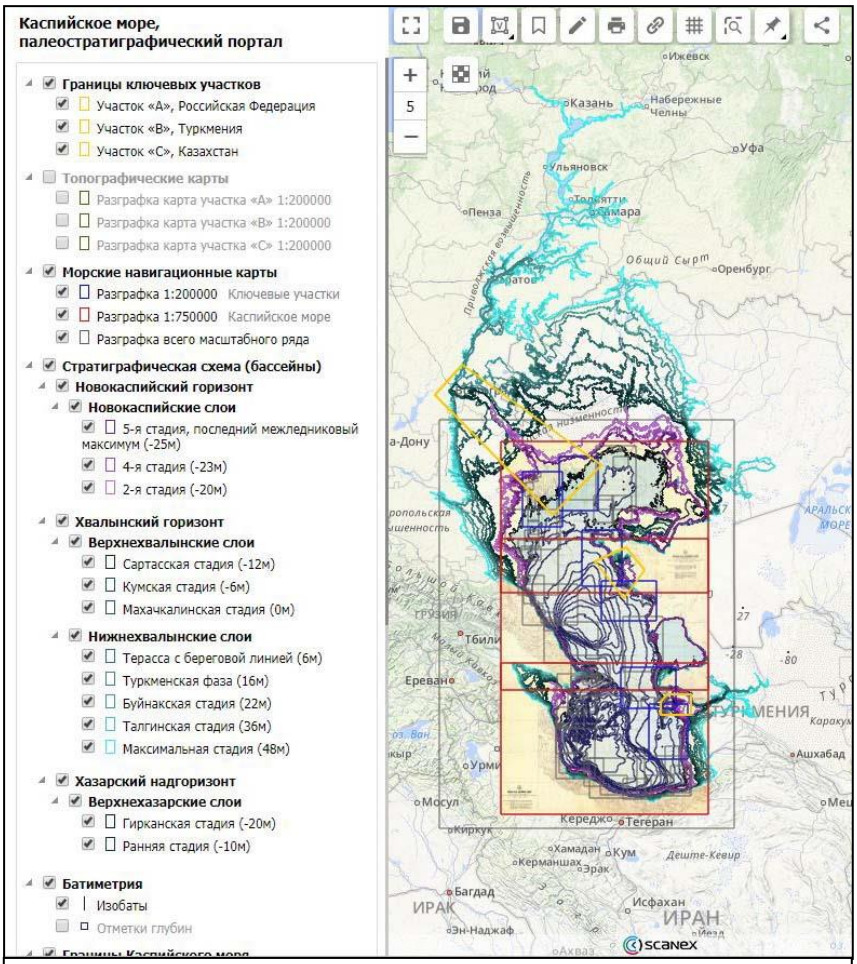

Fig. 3. Interface of the created Web-GIS portal

analyzing the patterns of level fluctuations. The performed work shows the importance of the cartographic method in the analysis of the Caspian Sea level fluctuations, as well as in predicting further fluctuations in the level and assessing their consequences.

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