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Biostratigraphy of the Marine Holocene on the Iranian coasts of the Caspian Sea



A.A. Svitoch, E.N. Badyukova*, T.A. Yanina, B. Sheikhi

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ABSTRACT

Marine Holocene deposits of the coast of Iran are represented by the Upper Khvalinian and New Caspian beds. Upper Khvalinian sediments are faunistically barren, whereas the New Caspian beds contain abundant fossil molluscs that allow subdivision into the Daghestan, New Caspian and modern layers. The only fossil species found in the Daghestan layer is *Didacna cristata*. The New Caspian sediment layer is characterized by a taxonomically diverse molluscan assemblage dominated by *Cerastoderma glaucum*. It is subdivided into the Upper and Lower New Caspian sub-layers. Modern sediments are lithologically diverse. Besides the New Caspian fauna, they also contain the valves of the species *Mytilaster lineatus* which is known to have immigrated from the Black Sea.

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1. Introduction

The Iranian coast of the Caspian Sea lies within the limits of the South Caspian lowland bounded by the Elburz Range on the south (Fig. 1). Structurally, the plain corresponds to the Pre-Elburz Foredeep filled with Neogene-Quaternary deposits and separated by a deep-seated fault from the Elburz folded zone. Geomorphologically, it is a vast lowland gently sloping towards the sea from 20 to –27 m a.s.l. The surface of the coastal plain forms a series of poorly developed terraces separated from the modern beach by a series of beach ridges. Some of the ridges separate lagoons from the sea. The largest of the lagoons are Anzali and Gorgan Bay. The rear part of the lowland adjoins a narrow zone of low foothills.

The surface of the coastal plain is composed of diversified marine deposits dated to the Holocene. Biostratigraphy of the marine sediments has not been adequately studied as yet on the Caspian coast of Iran. In particular, there is no paleontological data (specifically, those on mollusks) to serve as a basis for subdivision of the sequence and its correlation with other coasts. That may be due to the fact that mollusk shells are scarce in the marine sediments in the region, and their collections are scanty and insufficiently studied. There are no works on the Iranian coast giving detailed layer-by-layer descriptions of sediments exposed in marine terrace scarps or in river valleys; the only exception is Ehlers (1971). Practically no key sections, necessary objects for stratigraphic studies, are known at present. In searching for such sections, it is essential that the natural exposures were accessible for repeated studies.

Recently, investigations of the Caspian coast in Iran have been conducted using palynological, lithological, and geochronological methods. A series of studies has been performed on the characteristics and facies type of sedimentation, as well as on vegetation and climatic events during the Holocene (Kazanci et al., 2004; Lahijani et al., 2005, 2009; Leroy et al., 2011). Some significant data have been obtained on the recent sea level fluctuations and their chronology, on the development of the Sefidrud River delta and surrounding low-lying plain through the Holocene (Richards et al., 2011; Kakrodi et al., 2012; Kazanci et al., 2013). All those studies, however, are lacking a biostratigraphic basis to support the subdivision of sedimentary sequence.

2. Material and methods of the studies

The studies were based on field surveys performed on the Iranian coast of the Caspian Sea in 2005 and 2011. In 2005, the authors participated in the international conference “Rapid Sea Level Change: a Caspian Perspective” (Rasht, Iran). A reconnaissance survey of the Quaternary sections on the Mazandaran and Golestan coasts was performed during the field excursions as a part of the conference work (Svitoch and Yanina, 2006). In 2011, the coastal sections and river valleys on the Gilan and Mazandaran plains were studied in more detail (Svitoch et al., 2013), along with a comprehensive analysis of the literature. We applied the multidisciplinary approach, including biostratigraphic (malacological) analysis, as well as a systematic layer-by-layer description of natural sections exposed by marine and fluvial erosion. Another method that could be really effective in studies of the Iranian coast stratigraphy is a layer-by-layer description of the most complete natural exposures

* Corresponding author. Krasny Kazanez, 19-1-228, Moscow, Russian Federation.
E-mail addresses: Badyukova@yandex.ru, elefant1981@mail.ru (E.N. Badyukova).

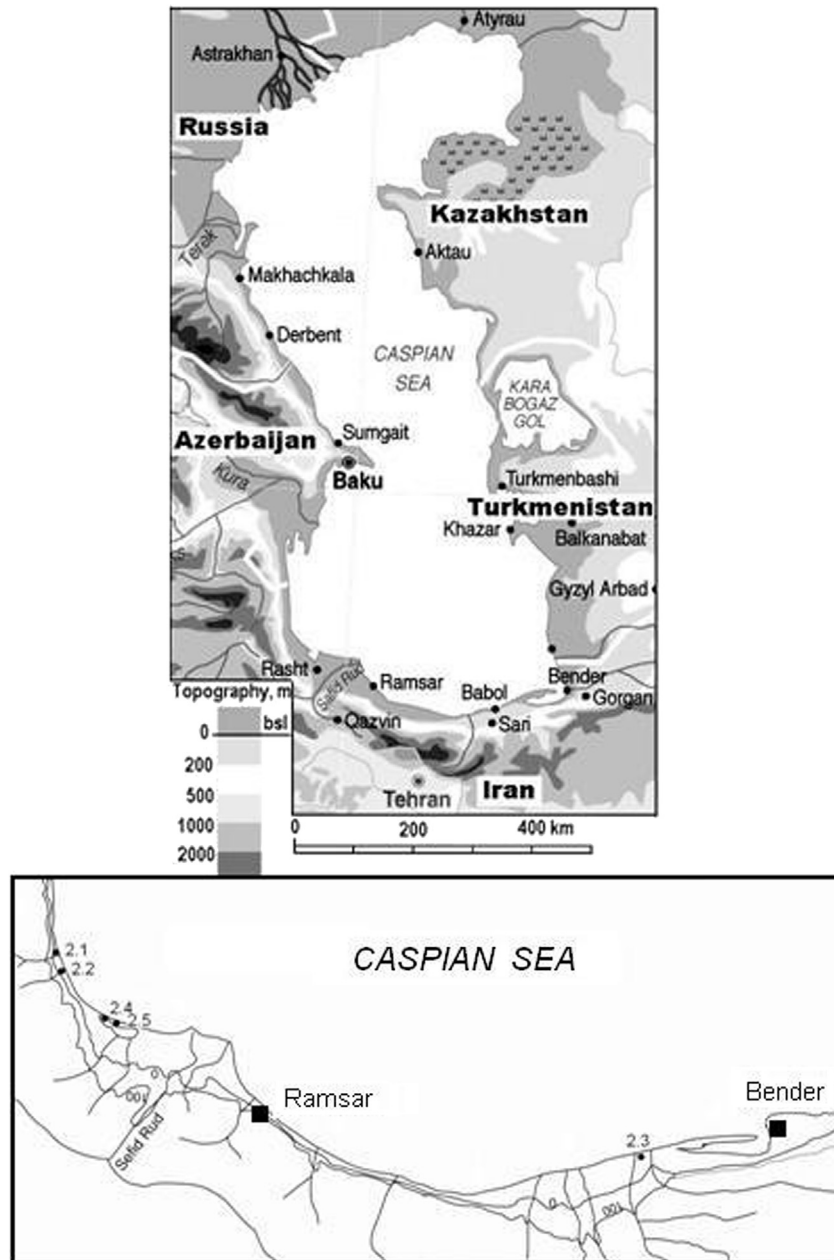


Fig. 1. Iranian coast of the Caspian Sea. Regions: 1 – Astara-Resvanshabr; 2 – Anzali-Rudsar; 3 – Ramsar-Noor; 4 – Noor-Miankalen; 5 – Golestan. Location of key sections: 2.1 – River Khovig mouth; 2.2 – right bank of the Karganrud R; 2.3 – right bank of a channel on the Golestan coast; 2.4 – rear part of the bar separating the Anzali lagoon from the sea; 2.5 – seaside part of the bar.

and tracing characteristic features along the strike from one section to another. In the process, there may be identified some reference horizons rich in materials for analyses. This method is still one of the most effective and reliable in geological investigations and has been widely used in our work, along with radiocarbon dating, as well as lithological and geomorphological data were used, with due consideration for hypsometric position of the studied objects.

3. Results of the studies and discussion

3.1. Paleontological substantiation (analysis of malacofauna)

The Holocene deposits on the Iranian coast are attributed to the Khvalynian (final phase) and New Caspian transgressions, with the

Mangyshlak regressive stage between them. Unlike their analogs on other Caspian coasts, the Khvalynian sediments are practically barren of mollusk shells and are mostly identified on the basis of their hypsometric position, geomorphological, and lithological characteristics. The New Caspian deposits, on the other hand, abound in malacofauna that can form the basis for biostratigraphic subdivision of the sequence.

Eleven mollusk species belonging to 6 genera have been identified in the Holocene sediments (Table 1), with *Cerastoderma glaucum* (*Cardium edule*) being dominant. Quite frequent are *Didacna* shells (*Didacna crassa*, *Didacna praetrigonoides*, *Didacna trigonoides*, *Didacna pyramidata*, *Didacna cristata*), and less common are *Dreissena polymorpha*, *Monodacna caspia*, *Adacna laeviuscula*, and *Mytilaster lineatus* are found occasionally. The

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