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Sediment Waves and Other Forms as Evidence of Geohazards in Caspian Sea

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The Caspian Sea is a hydrocarbon basin of great value. Its most remarkable geohazards are: shallow gas accumulation, seismicity, gravity mass transport, and near-bottom sediment transport (both water and turbidity currents). Every natural process is responsible for some geological forms, which can be seen on seismic sections. High-resolution seismic data show distinct zonality: shelf plains with bright spots (gas-saturated layers) and numerous shelf valleys; the bottom of the Central depression with uncomplicated sedimentation; between them, the Mangyshlak Threshold with paleodelta complexes inside, creep on the bottom and several canyon-channel systems; and the steep slope with its vast field of sediment waves of mixed origin. All structures show rhythmicity in seismic sections. The map of geohazards is presented.

INTRODUCTION

The Caspian Sea is a hydrocarbon basin of great value, but with a great variety of exploration problems as well. Its most remarkable geohazards are: shallow gas accumulation, seismicity, gravity mass transport, and near-bottom sediment transport (both water and turbidity currents). All these issues are in close interrelationship: seismicity triggering causes slides and occasional turbidities, while slides may occur on weak zones of shallow gas layers. Every natural process is responsible for some geological forms, which can be seen on seismic sections. The North and Central Caspian Sea (Russian sector) shows distinct zones of different geological environments, which are connected with different geohazards. The aim of this paper is to establish already-known sedimentary forms as indicators of processes that can be considered to be geohazards, so that future investigations will focus on the most dangerous parts.

BACKGROUND

The Caspian is a vast inland depression. It has no connection with any oceans but at 1200 km × 300 km it is too large to be called a lake. Morphologically, the Caspian can be divided into 3 regions: Northern (vast and long shelf plains); Central (depression, 300-m average depth, 700-m maximum depth); and South (depression, 500-m average depth, 1000-m maximum depth). The natural borders of these regions are the Mangyshlak Threshold (bow-shaped sediment body) between the North and Central parts, and the Apsheron Threshold (linear tectonic elevation) between the Central and South parts (Fig. 1). This paper focuses on the structure of the Pleistocene and Holocene sediments of the Central and partly Northern regions, especially of the Mangyshlak Threshold. The main peculiarity of the Caspian Sea is its rapid level change, which forms rhythmic sedimentary formations of different scales.

In general, sedimentation processes in the Central Caspian are controlled by bottom topography, especially the morphology of the continental slopes and the sources of sedimentary material (rivers' runoff, first of all). The eastern slope is gentle (fractions of a degree), and there are no abundant material sources (rivers) at all. The Mangyshlak Threshold is on the north. It is a huge body of sediment, consisting of several paleo fans and paleo-deltaic complexes of the Volga, Ural and several smaller rivers. The steep western slope (first degrees) is a pathway for sediment input from numerous mountain rivers of the Great Caucasus (Terek, Samur, Sulak and others), which are the main source of suspended matter

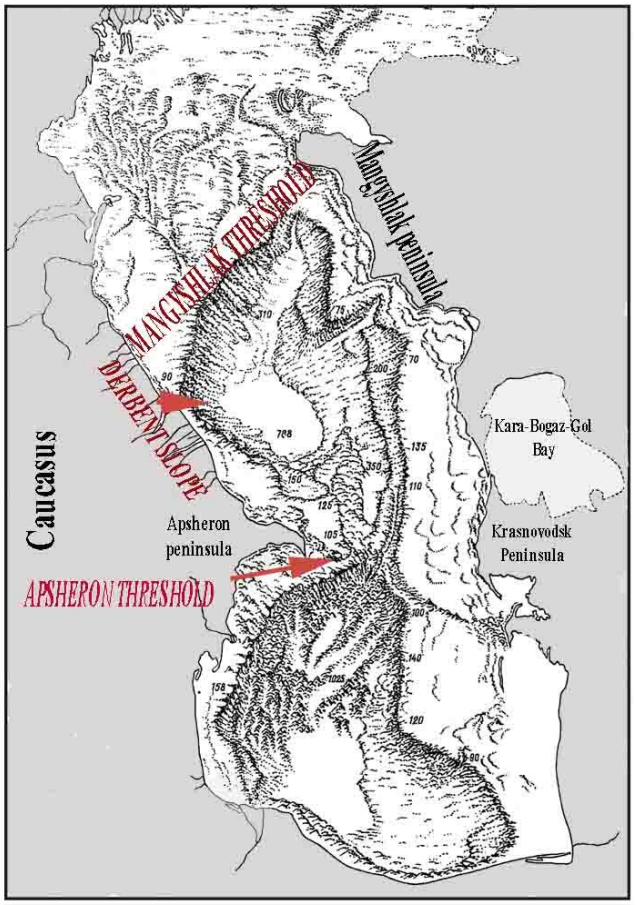

Fig. 1 Physiography of Caspian Sea

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