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FORECASTING OF PERSPECTIVE OBJECTS USING GEOPHYSICAL DATA ON THE PALEOZOIC COMPLEX OF WESTERN KAZAKHSTAN

Abstract. Clarification of the internal structure and the deep structure of the Paleozoic deposits of Western Kazakhstan, due to the emergence of new geophysical technologies to identify large promising search objects, acquire topical significance. New data on the south-eastern and eastern margins of the Pre-Caspian basin indicate the possibility of isolating large Paleozoic uplifts at the level of the Upper Devonian and Lower Carboniferous (there flecting horizon P_3). Large uplifts has of a supposedly structure are the massive character and tend to gravitate toward the inner side of the hollow. Inthesouth-east, there are the Guryev-Kulsarin zone and the Matken-Bikjalsky step while in the east of the basin there are the Borzher-Akzhar zone and the Shubarkuduk-Koskol step. The selection of objects of this category is associated with the features of the distribution of magnetic field anomalies, which are located in the contour of the region of its elevated values. In these conditions, an additional factor in matter of optimal delineation of objects of this type is the application of innovative technologies for processing and interpreting of the 2D and 3D seismic data. The substantiation of the forecast of development in the context of major uplifts in the relatively deep parts of the basin is given, in the long term, the important priority tasks of the exploration phase will be to bring the surveys in line with the geological exploration stage and adapt the strategy to the conditions of deep-lying promising zones and objects.

Key words: Paleozoic complex, Pre-Caspian basin, geophysical seismic survey, geological exploration, local features, eastern and south-eastern framing of the basin, sedimentation, oil and gas forecast, structure reflecting the horizon.

The hydrocarbon market of Western Kazakhstan is characterized by the presence of a large number of deposits with a significant period of operation. In these conditions, in order to maintain the planned level of production, it needs to expand prospecting surveys to prepare new large objects in the Paleozoic sediments in the forefront, which is associated with increased depths of occurrence (6.5–8.0 km). The replenishment of the resource base at the expense of large subsalt Paleozoic structures is now becoming important for the entire Pre-Caspian region (Mangyshlak Basin and the Pre-Caspian Basin). This is most relevant, first of all, in the south-eastern and eastern marginal sides of the Caspian basin, according to which new data have obtained in a number of publications recent years [1, 2].

On the side zones of the Pre-Caspian basin, large Paleozoic objects lie on more accessible depths for drilling, about 4.5–5.5 km (figure 1). Mostly are significant hydrocarbon deposits are confined to zones of predominantly carbonate sedimentation, forming high-amplitude structures as platforms and structures, such as Tengiz, Astrakhan, Karachaganak, Kashagan, Korolevskoe (figure 2). The large hydrocarbon deposits in the section of the eastern side (Zhanazhol, Kozhasai, Alibekmola, etc.) are confined to carbonate deposits of a somewhat different formational appearance, in which reservoirs for hydrocarbons of predominantly bedded massive type were developed and formed (figure 3).

The new data on the mode of occurrence of Paleozoic objects have been obtained along the south-eastern and eastern parts of the Pre-Caspian Basin since last few years. As the positive results of drilling shows, along with the adjacent areas (Urikhtau, Alibekmola, Saztobinskaya group), large perspective objects can also be associated with the near-submerged (more "internal") areas of the sedimentation basin (Southeast Tasim, East Akzhar, Kuzbak, Biikzhal, South-West Ulkentobe, Yesekzhal, etc.). Similarly, data on the possible productivity of local uplifts in the Paleozoic were also obtained from the south-western border of the Pre-Caspian basin (Kobyakovskaya, Alga).

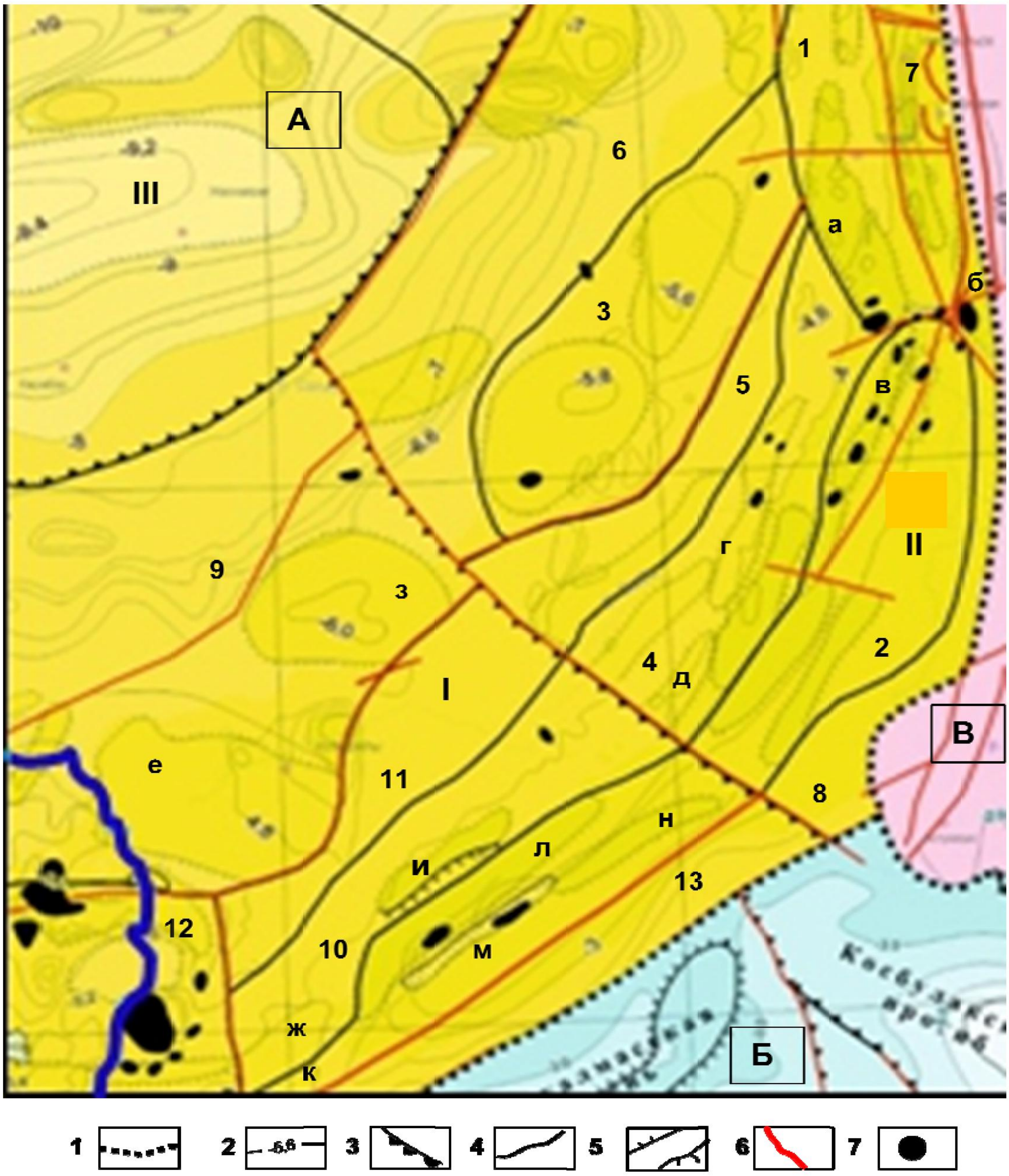

Figure 1 – East and South-eastern sides of the Pre-Caspian basin.
Tectonic scheme of the Paleozoic complex (according to Akchulakov U. A. et.al, 2012).

1. Geological structures of the I order: A – Pre-Caspian Basin, B – Ustyurt-Bozashi, C – Ural folded system; 2. Isohypses along the Paleozoic roof, km; 3. Contours of geological blocks and marginal zones of the Pre-Caspian basin: I – South-East, II – East, III – Central); 4. Elements of the II order: Eastern side (uplifts zones: 1 – Temir, 2 – Zhanazhol-Tortkol, 3 – Shubar-kuduk-Koskol steps, 4 – Borzher-Akzhar, 5 – Baiganinskaya, 6 – Yegendy-Sarykumak, deflections, 7 – Ostansuk, 8 – Teresken). Southeast side (steps: 9 – Guryev-Kulsary, 10 – Matken-Biikjal, 11 – Namaztakyr, 12 – Karaton-Tengiz uplifts zones, 13 – South Emba uplift). 5. Lower order structures: East side (shafts: a – Kenkiyak-Akkuduk, b – Alibekmola, c – Zhanazhol-Sinelnikov, d – Urikhtau-Kozhasai, e – Tuzkum). The south-eastern side (zones: f – Kulsary, g – Arman-Elemes, h – Saryniyaz uplift, shafts: i – Kumsheti, j – Saztobe, k – Sholkara-Ravnina, l – Tortay, m – Urtatau-Sarybulak). 6. Faults; 7. Hydrocarbon fields.

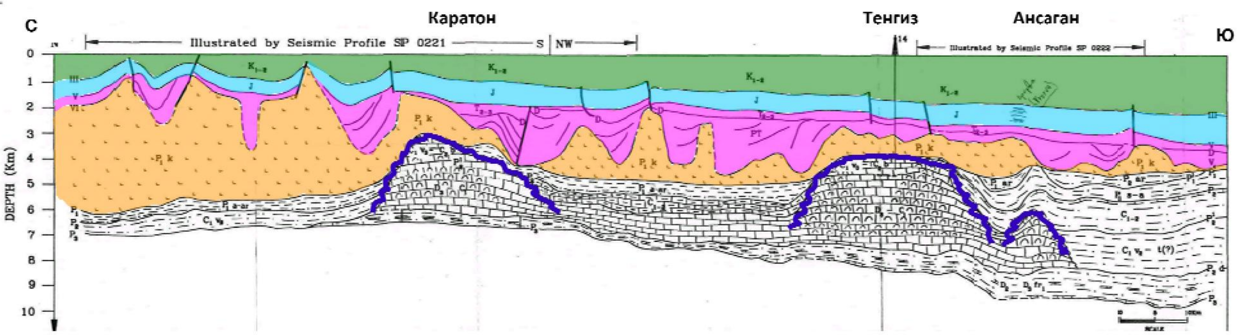

Figure 2 – South-east of the Pre-Caspian basin. Karaton-Tengiz carbonate platform

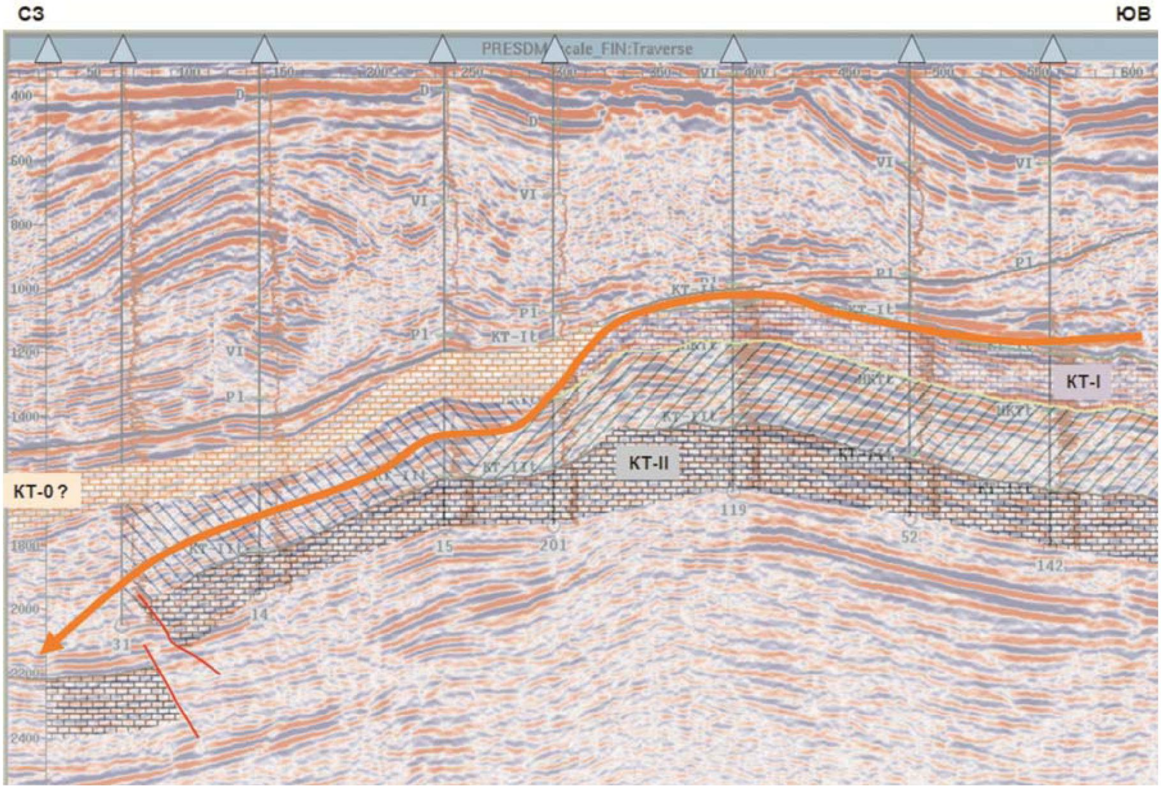

Figure 3 – Eastern side of the Pre-Caspian basin. Principal
Seismic-geological section and characteristics of carbonate strata KT-II and KT-I

Seismic structures and drilling data of a few wells indicate the connection of probable zones of oil and gas accumulation with large local objects as uplifts of the structural and consedimentary development. Major uplifts in the Paleozoic are formed under conditions of extending far to the central deep-water part of the basin of the continental slope. The range of the continental slope is determined by the character and features of the anomalous magnetic field. Thus, the region of development of anomalies with a high value of the magnetic field is associated with a giant “geomagnetic step”, a convex side faces to the southeast. Taking into account possible differences in the composition of the crust and basement, which are characterized by the corresponding behavior of the main magneto-active boundary in the section of the sedimentary cover, this region presumably indicates a relatively elevated position (up to 8.0 km) and the occurrence of the pre-Devonian complex and Devonian strata.

According to [2, 4], suggestion of an alternative option in determining the structural-tectonic and spatial confinement and the position of the continental slope, preference is given to the influence of sedimentation processes and the formation of the Astrakhan-Aktobe system of basement highs or the South Pre-Caspian arch.