Structures of deformations of the platform cover, caused by shear displacement in the basement

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In this paper, the shear displacement in the basement and its reflection in the sedimentary cover on the example of the Aral-Kyzylkum shaft located in the north of the Turan plate are presented.

The history of evolution of ideas of the geological structure and tectonic position of the shaft is very interesting. At the beginning of the 20th century, many researchers believed that the studied shaft is an inherited structure, in other words, underneath there is the Paleozoic basement outshot. In the second half of the 20th century, N. Ya. Kunin supplied the first seismic work in the Aral Sea area. Then, it was found that the shaft has the form "biconvex lens", in other words in its structure the uplift of the upper horizons of the Mesozoic and Cenozoic strata and the deflection of Triassic and older rocks can be observed. In petroleum geology these structures are often called inversion.

In 2010 the company "Lukoil Overseas" provided us with "fresh" 2D-seismic data along the southern segment of the Aral-Kizilkum shaft. Based on the detailed analysis of the seismic data, a three-dimensional model of the deep geological structure was created, consistent with the phases of the development. The interpretation of the tectonic structures was led by modern tectonophysical ideas about the laws of development of shear deformation in the sedimentary cover. Creating a geologic model included the following stages of analysis of the geological situation:

First, the allocation of structural-material complexes was done. With this step, the basement, an intermediate complex and a sedimentary cover were received. The allocated systems met consistent tectonic regimes in the region's history: a difficult, eformed Hercynian basement, Late Cimmerian (Triassic-Early Jurassic) rifting and Alpine (Late Cenozoic) deformations. This multilevel structure is a typical characteristic of the Scythian-Turan platform.

Then in the seismic massif the main reflectors were isolated and correlated: Lower Cretaceous (K1nc) and Upper Jurassic (J3). A correlating horizon was also related to the Upper Permian – Triassic (P3?-T). The last horizon is not stratigraphical, and bears in itself purely structural sense, separating a sedimentary cover and an intermediate complex from the basement. Also it should be noted that within this horizon, the most ancient Cimmerian deformations are connected with relatively young Alpine K1nc and J3 horizons.

The next correlating horizons are J3 and P3?-Tm which build a structural surface, the combination of which is considered as three-dimensional model of the southern segment of the Aral-Kyzylkum shaft (Fig. 1.). The figure shows that the surface of P3?-T revealed graben structure, located directly under the shaft, a dedicated J3 surface. This confirms that the considered regional structure really looks like "biconvex lens", in other words the inversion of the structure occurs.

Secondly, tracing of faults was satisfied with the formation of the three-dimensional fault unit frame crust. It can be found that the faults within the roof of the Aral-Kyzylkum shaft are grouped into positive "flowering structure" characteristic manifestations namely shear deformation in the sedimentary cover associated with shifts in the underlying folded basement.

On the seismic profiles it was also noted that the board Early Cimmerian graben and uplift in the central part are stress concentrators, of which "grow flowering structures" occur. Other features are the faulting of the sedimentary cover, which is general characteristic for the manifestation of shear strain. The regional Aral-Kyzylkum shift belongs to a late stage of development of the main fault plane, dissecting the entire profile of the sedimentary cover. Other marked characteristic of the various changes is the amplitude of displacement along faults at different depth levels of the mine. The bottom of the offset is almost not observed (mainly lateral shear displacements), and the top is also the same - they are quite clearly seen. Height also varies penetration gaps in the sedimentary cover. This fact can not mark the time of faulting, it just shows their rank.

Fig.1.: Three -dimensional structural model of a segment of the Aral-Kyzylkum shaft

Morphology of discontinuous fans indicates that the tectonic uplift of the Aral-Kyzylkum shaft is positive alpine structure formed directly above Early Cimmerian graben system.

Consideration of the segment Aral-Kyzylkum shaft like structures caused the regional shear deformation, which led to changes in views on the structure of such oil and gas shafts. Earlier this shaft was seen as anticline, but now we see it is a complicated block structure.