Prospects for Exploration for Non-Anticlinal Oil and Gas Pools in the Vizean Clastic Unit of the Perm Pri-Kama Region

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In the Perm Pri-Kama region have been found the Malousin, Sylven, Luzhiv, and Kislov non-anticlinal pools in Vizean clastics. Completeness of the stratigraphic section decreases up the flank of the Komi-Permyat arch to pinchout. In a large part of the flank the Tula horizon rests on different subdivisions of the Upper Devonian. The greatest thickness and lateral variation of the Vizean is found in the troughs of the Kamsko-Kinel system. In the axial areas there are 7 to 18 permeable strata, whereas on the carbonate reefs of the borders there are 2 to 8. Maximum effective thickness of the sandy-silty rocks is 80 m, and this is in the axial parts of the troughs.

Luminescence-bitumenological studies indicate that the silty-clayey rocks of the Vizean in the study area are characterized by extensive development of allochthonous bitumens, which is a sign of oil generation. The oil-generating capacity of the Vizean is indicated also by the isotopic composition of the oil.

A graph was constructed to determine the length of the main phase of oil generation. See Fig. 1. It shows the variation of the value of the bitumen coefficient ($\beta_{ch}$) of syn-bitumens depending on the modern depth of occurrence. This value is constant down to a depth of 1350 m, below which it increases to a depth of 1500 m, reaching a maximum in the 1500-2100 m interval. There is then a decrease to attenuation at 2500-2600 m.

A map was compiled on a basis of tectonic analysis that shows the successive entry of potential oil source rocks into the oil window. See Fig. 2. The first migration of micro-oil began in the east part of the region in connection with formation of the Cis-Ural downwarp. The potential oil-source rocks here entered the oil window at the beginning of the Kungur stage, and possibly earlier. By the end of Late Permian time the Vizean sediments were in the oil window in almost the entire area. Oil migrated from the Cis-Ural downwarp westward onto the platform and filled all traps both anticlinal and non-anticlinal. Migration extended on to the border zones of the troughs of the Kamsko-Kinel system. At this time the oil-generating units in the Cis-Ural downwarp were beyond the oil window and were into the gas window.

Fig. 3 is a map of favorability for exploration for stratigraphic traps.

Areas with category I favorability are the Sarapul, Shalym, and Kalinin troughs of the Kamsko-Kinel system where optimum facies and paleo-geographic conditions existed for formation of various kinds of stratigraphic traps - river valleys, deltas, fore-deltas, and shallow-water marine basins.

Areas of category II favorability are the Dobryansko-Cherdyn and Yayven downwarps, which correspond with the modern Solikamsk depression. Facies and paleogeographic conditions here are much the same as in the Shalym and Kalinin troughs.

Category III favorability includes the north flank of the Bashkir arch, Kungur monocline, and Sylven and Yuryuzano-Aysk depressions. The units here are not as thick, and reservoir properties not as good.

Category IV areas are the Perm arch, Chermoz saddle, southeast part of the Kama monocline and Verkhne-Kama depression, and north crest of the Tatar arch. Continental facies predominate here.