Exploration for Oil and Gas Pools of the Non-Dome Type

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Most of the oil and gas discoveries in the Volga-Ural region have been on anticlines. The backlog of such structures is being exhausted, and attention is turning toward lithologic and stratigraphic traps associated with pinchouts on the flanks domal uplifts and along the borders of ancient intra-platform depressions. Several pools of this type are known in the Kuybyshev region. The clastic deposits of the Lower Carboniferous are particularly interesting here.

The Kamsko-Kinel system of downwarps is regarded as the most favorable for non-dome pools in the Lower Carboniferous (Yelkhov and Radayev horizons). These downwarps formed as a result of uncompensated tectonic subsidence during late Frasnian and Tournaisian time, and they were subsequently filled by lower and middle Vizean carbonates and clastics. These clastic sediments contain more than nine permeable strata.

In the Kuybyshev region the Kamsko-Kinel system of downwarps is represented by the Mukhanovo-Yerokhov downwarp. Strata C-IV, C-III, and C-II of the Radayev horizon are very favorable for lithologic pools here. See Fig. 1. These strata are composed of quartz sandstones with average porosities ranging from 21 to 23.6% and average permeability from 640 to 657 md.

The Zapadno-Kabanov area is a good example of facies change from permeable sandy rocks to impermeable clayey rock. See Fig. 2. This is area 3 in Fig. 1. It is located between the Yekaterinov, Kazan, and Kabanov fields. See Fig. 2. On reflection horizon Y and stratum C-II the structure shows up as a nose. The limits of occurrence of strata C-III and C-IV swing out as two festoons.

The thickness of the Lower Carboniferous sediments is reduced from 323 m in the Tolstov area to 64 m at Kazan; this is a reduction of 259 m in 11.5 km. See Fig. 3. The abrupt pinchout of strata C-III and C-IV account for most of this.

The base structure contours, which mark the lowest hypsometric level of possible oil-gas accumulation in a trap, are at -1840 m on the top of stratum C-III and at -1860 m on stratum C-IV for the southeast trap and at -1775 m for stratum C-III for the northwest trap. Boundaries of pinchout are calculated using gradient of change in thickness.