Prospects for Oil and Gas in the Devonian Sediments in the Tersin Depression and the Conditions of Formation of Oil Deposits in the Klenovka Uplift

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Under the name Tersin depression we distinguish an area limited on the east and southeast by the Medvedits River and on the west by a line extending along the steep east flank of the Ivanov structure to the confluence of the Medvedits River with the Don River.

Several new local structures were revealed by the seismic operations of 1955-57 in the zone of the Tersin depression west of the Bakhmet’evka field. These are the Klenovka, Lemeshtkin, Novo-Kuban, and Melovat.

The first well based on seismic exploration was put down at the crest of an uplift in 1957 in the Klenovka area. The Stalinogorsk horizon composed of uniform sandstone was encountered in the interval 1474-1511 m. On subsequent testing of this horizon a flowing well of oil with water was brought in. All the stratigraphically higher Carboniferous, which is productive in the adjacent Bakhmet’evka area, is water-flooded in the Klenovka area.

Of the nine wells drilled at present in the Klenovka area, only three (no’s 1, 6, and 9) confirm the productivity of the Stalinogorsk horizon according to data of electrical logging and testing.

The water-oil interface slopes to the NE. It occurs at −1348 m in well 1 and at −1363 m in well 6, i.e., there is a difference of 15 m between wells 6 and 1. The distance between these wells is 1825 m.

The deepest well in this area is well 5, which reached basement at a depth of 2858 m. The section of this well is not yet sufficiently studied. But on the basis of comparison of its logs with logs of wells of the Ivanov area it is established that the Mosolov limestones occur in the interval 2730-2794 m.

It is very difficult to refer the unit below the Mosolov limestones to any particular age at present because no core is available. On the character of the electric log, however, it can be correlated with the Bavly unit of the Ivanov section. The higher Givetian sediments, represented by terrestrial rocks, contain a large number of sandstone beds, which under favorable structural conditions can be excellent reservoirs for oil and gas.

Very interesting data have been obtained on the oil-bearing capability of the Devonian rocks. For example, a flowing oil well (no. 6) was brought in from the Evlanov-Liven sediments (interval of perforation, 2056-2066 m) and also from the lower part of the Zadon-Eletsk beds. These horizons were tested earlier in well 4, from which a flow of formation water with but a little oil was obtained (well 4 encountered the top of the Evlanov-Liven beds at 44 m lower than did well 6).

The conditions of formation of oil and gas deposits in the Carboniferous sediments are treated in a paper by A. G. Gabrielyan and S. P. Maksimov (1); regularities in their distribution are revealed. A similar regularity in the distribution of oil and gas fields is noted in a paper by S. F. Fedorov (3).

As the paleostructural analysis shows, the formation of the oil deposits of the Klenovka field is related not so much to the conditions of accumulation of oil in traps as to the formation of the traps themselves. For conformation of this let us examine the paleostructural profiles from the Bakhmet’evka to the Ivanov area, i.e., across the whole Tersin depression. See Figure 1. Late Shchigrov time was characterized by a gradual accumulation of sediments in all the area being studied; there is an increase in thickness of the sediment from 18-13 m in the Ivanov area (wells 5, 4) to 85 m in the Bakhmet’evka area (well 205, Figure 1-a).

Semiluk time was characterized by a sharp subsidence of the Bakhmet’evka area where a huge unit of carbonate sediments (501 m in well 205) accumulated. A sharp decrease in the thickness of the Semiluk sediments is observed to the west. Their thickness is 72 m in well 2 in the Novo-Kuban area and 60 m in the wells of the Ivanov area, where they are represented by terrestrial rocks.

From a step-by-step examination of the paleostructural constructions it is evident that down to the end of the Carboniferous the sediments of Carboniferous and Devonian age had a monoclinal attitude at the places where uplifts now occur. Consequently, conditions were not favorable here for oil accumulation with the exception of the Semiluk sediments which have a sharply