Geology and Oil-Gas Productivity of the Michayu Swell of the Pechora Depression

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The Timano-Pechora oil-gas province is located in the northeast part of the Russian platform. It includes the territory of the Komi ASSR and the Nenets National District of the Arkhangel Region. The total area of the province is about 600,000 sq km. The boundary of the Timano-Pechora province on the west is the Timan Ridge, on the east and northeast—the North and Polar Urals and its continuation the Pay-Khoy, on the north—the Barents (Pechora) Sea, and on the south—the administrative boundary of the Komi ASSR with the Permian Region.

The following main tectonic elements are distinguished in this province: Timan Range, Pechora depression, Pechora tectonic ridge, Denisov downwarp, Bol’shezemel swell, Malozemel dome, and Cis-Ural downwarp. See Fig. 1 and a paper by A. Ya. Krems in this journal, no. 8, 1961.

Within the territory of the Timano-Pechora oil-gas province the Ukhta territorial geological office of the Glavgeologiya USSR has carried out geological exploration for oil and gas. We will review here the results obtained in the south part of the Pechora depression.

The Pechora depression is located between the Timan Range and the Pechora tectonic ridge. It is a large tectonic element with a Rifean (according to N. S. Shatskiy) basement, whereas the basement of the rest of the Russian platform is Archean.

Paleozoic and Mesozoic sediments take part in the make-up of the Pechora depression.

The Paleozoic (from the bottom upward) consists of pre-Devonian–Izhma-Omrin complex (Cambrian-Silurian), and also Devonian, Carboniferous, and Permian Systems. The Mesozoic is represented by Triassic, Jurassic, and Cretaceous Systems.

All these sediments have been deformed by tectonic movements. The Paleozoic sediments have been subjected to the greatest deformation.

In the present geologic structure of the depression, sediments of the Paleozoic and Mesozoic occur in structural forms favorable for accumulation of commercial oil and gas pools. Gentle brachy-anticlines have dips on their flanks of 1 to 2° and rarely 3 to 5°.

In the south part of the Pechora depression (Fig. 2) deep drilling resulted in the discovery in 1959 of the large Zapadno-Tebuk field of light oil. With respect to reserves it exceeds by far all earlier known fields of Devonian oil in the Timano-Pechora province.

Subsequent exploration based on seismic surveys and in part on structural drilling in the south part of the Pechora depression in its east border zone revealed a relatively narrow swell-like structure, which is designated the Michayu swell.

Within the bounds of this swell the sedimentary section encountered by two deep exploration-evaluation wells consists (from the top downward) of the Quaternary, Jurassic, Triassic, Permian, Carboniferous, and Devonian Systems. The wells bottomed in Middle Devonian.

The Quaternary deposits consist of clayey and sandy loams with some inclusions of fine gravels of sedimentary and metamorphic rocks. Their thickness is 50-70 m. The Jurassic rocks, which rest transgressively and unconformably on the rocks of the Triassic, are composed of sandy-clayey sediments. Their thickness is 30-50 m.

The Triassic sediments are represented only by the lower division and rest without visible discordance on the rocks of the Upper Permian. They are composed of alternating red shales, polymict sandstones, and siltstones. The thickness of the Lower Triassic ranges from 170 to 300 m.

The Permian sediments are represented by the upper and lower divisions. The upper division is composed of red-brown shales with inter-beds of sandstone. Its thickness ranges from 440 m in the north part of the -swell to 620 m in the south. The lower unit is expressed in its upper part by alternating shales, marls, and sandstones, and the lower by argillaceous and organociastic limestones. The thickness of the lower division is 150 m.