Comparative Estimate of the Oil-Gas Prospects of the Siberian Platform Adjacent to the Yenisei River

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That portion of the Siberian platform adjacent to the Yenisei River is part of the large, as yet little studied Tunguska oil-gas basin. The historical geological features of this territory indicate that it can be regarded as an independent oil-gas area that is separated from the rest of the basin by a zone of deep faulting, which is expressed in the Paleozoic cover of the platform in the form of flexures and a series of faults of small displacement with intensive development of trap intrusions.

A comparative evaluation of oil-gas prospects is based primarily on analysis of the conditions that are favorable for oil-gas formation and accumulation. Present in the sedimentary cover of this territory are lower and middle Paleozoic sediments, prominent among which are various types of carbonate rocks that are enriched in varying degree by bituminous matter.

In the Lower and Middle Cambrian sediments, bitumen showings are present throughout the entire territory. In the Igar region are referred to them the upper part of the Sukharikhin formation of the Aldan stage, and also the Kallaktin and Ingin formations of the Lena and Amgin stages. The very high content of organic matter (up to 2%) and of disseminated bitumen (up to 1%) in the sediments of this formation, a low bitumen coefficient (2-5%), and also the chemical composition indicate that the bitumen is syngenetic. The bituminous matter is obviously a residual product and under-reduced (20% hetero-atoms), if the ancient age and great depth of occurrence (more than 2000 m) of these formations are taken into account. The redistribution of bitumens within these units is indicated by data of luminescence-bituminological analysis which shows an uneven content of disseminated bitumens in a very uniform rock unit (Kalliktin formation). Further, in the Krasnoporozh formation, which occurs between the Sukharikhin and Kallaktin formations, there is a higher content of bituminous matter, which is not characteristic of the rocks (redbeds) of this formation. In this case it can be supposed that migration of bitumens took place into the redbeds of the Krasnoporozh formation from the underlying and overlying formations.

In the Turukhan region bitumen showings occur in the Severorechen and Voronov sub-formations of the Kostin formation; these sediments are comprised of dolomites that contain a greater amount (several tenths, sometimes units of percent) of organic matter and disseminated bitumen. Along with layers containing apparently syngenetic bitumen (0.02-0.04%) there are varieties that are enriched in secondary bitumen - up to macroscopic inclusions (more than 2.5% of the rock). These rocks generally have good reservoir properties due to micro- and macro-cavities. The content of residual organic carbon in them is only hundredths of a percent. These facts indicate that this unit was oil-generating. Also indicative of this is the fact that in the past it subsided to a depth not less than 1500-2000 m.

An analog of this unit in the basin of the Podkamennaya Tunguska River is the Lebyazhin formation, which is similar lithologically. The sediments of the middle part of the Lebyazhin formation have a higher content of disseminated bitumen (0.02-0.6%) and organic matter (0.4-0.7%) with a bitumen coefficient of 2-8% and can be regarded as a bitumen forming complex. The chloroform bitumen from these rocks has the following component composition (in %): oils 96-98; tar 3-1.2; asphaltenes 0.5-0.7. The thickness of the syngenetic-bituminous rocks in the Lebyazhin formation is approximately 600 m.

In the Upper Cambrian sediments of the Noril’sk and Igarka regions, clayey-silty limestones and silty marls of the Serotsvet unit are possibly oil generating. These rocks are enriched in organic matter, the content of which, particularly in the lower part of the unit, reaches 2-3%. The content of disseminated bitumen A (free and semi-combined) is generally in hundredths or tenths of a percent. The bitumen coefficient is 1.8-5% in the lower part of the unit and 15-25% in the upper. In the upper part of the Serotsvet is observed a superposition of epigenetic bituminosity on the overall syngenetic background. Also indicative of redistribution of bitumen are the numerous bitumen films and sometimes bitumen inclusions along fractures.

In the Ordovician section to the bitumen-generating rocks can be referred to as the dolomites of the Kulgakhtakh formation of the Chun’sk stage and the limestones of the Krivoluts stage, which contain a rather high content of organic matter (to 0.5%) and disseminated bitumens (0.02-0.15%).

In the Silurian sediments a regionally distributed unit is the “graptolite shale” - limey argillites and marls of middle Llandovery age with a thickness of about 100 m. The “graptolite shales” proper, which comprise 20-50 m at the very base of the section, contain up to 8-9% organic carbon and 0.005-0.20% bitumen. The bitumen occupies an intermediate position between oily and tarry. The bitumen coefficient is generally 1-3%, and in more limey varieties it sometimes reaches 5%. On a basis of chemical