

INTERRESERVOIR CROSS-FLOW IN SOUTHWESTERN SIBERIA OILFIELDS (TOMSK REGION)

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Research investigations in the oil and gas fields of the Tomsk region indicated the fact that they are related to with three basic source rocks of Upper and Lower Jurassic and Palaeozoic. The following oil and gas types were found: Bazhenov, Togur and Palaeozoic (Goncharov *et al.*, 2003). Each type has specific differences determined by its different molecular and atom composition.

In view of genetic typification, the GC-MS method was applied to test numerous suggested parameters (Peters *et al.*, 2005). Accordingly, the most informative were the following molecular parameters: pristane – phytane ratio (Pr / Ph), isoprenoid coefficient $[(Pr + Ph) / (nC_{17} + nC_{18})]$, methyl dibenzothiophenes ratio (4MDBT / 1MDBT). Not only genetic but also thermal maturity factors were considered by means of the above-mentioned set of parameters and the difference of various oil types was also easily determined (Table 1).

Bazhenov oil type, generated by organic matter (OM) of Bazhenov Formation, is the basic oil resource in West Siberia (Kontorovich, 1984). This oil is stratigraphically confined in the Upper Jurassic traps and Cretaceous complex. Bazhenov oil type is the major part of the hydrocarbon reserves of the Tomsk region.

Togur oil and gas type is the antipodes of the Bazhenov one. This type includes not only oil of the Togur Formation (Lower Jurassic), but also all the other source rocks located in the wide range from Permian – Triassic to Middle Jurassic. The majority of which are confined in the Upper and Middle Jurassic traps, as well as, crust weathering. Under favorable conditions (lithologic windows, faults), oil and gas of this type can migrate to overlying depositions - Upper Jurassic and even Cretaceous depositions.

The main oil and gas source rocks of the Palaeozoic type are related with Middle Devonian and Middle Carboniferous marine depositions. The basic difference of this type from the previous two is its high thermal maturity. Majority of Palaeozoic oil and gas is located in the Palaeozoic rock base and crust weathering. However, one can find this type in Lower and Middle Jurassic traps, and even in Upper Jurassic traps.

As seen from table 1 all gas components of the Bazhenov type have a light composition. This is due to the nature of OM in the Bazhenov Formation and its low thermal

maturity. The not high thermal maturity of Lower and Middle Jurassic OM (Togur type) is determined by light oil methane isotope composition of this type. On the other hand, high-oxidized OM (often called humus) results in heavy oil isotope composition, beginning with ethane. Heavy methane isotope composition and its corresponding Palaeozoic oil groups can be explained, considering high thermal maturity, produced by Palaeozoic deposition OM.

Based on molecular composition characteristics, it is possible to determine the oil genetic type independent of deposition geologic conditions.

An excellent example of dimensioned interreservoir cross-flows is the deposition formation in Luginetsk, Myldzhinsk, Severo-Vasugansk oilfields in the Tomsk region. Isotope composition measurements of gas indicated the fact that deposition formation in these structures involves two stages. Firstly, residue gas deposition, generated by Palaeozoic OM developed under the regional Bazhenov suite. Later, Togur or (and) Bazhenov type hydrocarbons were generated and formed oil pool.

Genetic type	Source rocks	Parameters									
		Oils / Source rocks			Gases ($\delta^{13}\text{C}$, ‰)						
		Pr/Ph	(Pr+Ph)/(nC ₁₇ +nC ₁₈)	4MDBT/1MDBT	C ₁	C ₂	C ₃	iC ₄	nC ₄	iC ₅	nC ₅
Bazhenov	Bazhenov Formation J ₃ tt – K ₁ br	<u>1.0 - 1.5</u>	<u>0.5 - 1.0</u>	<u>0.8 - 3.5</u>	-58.1	-42.8	-38.5	-35.0	-36.5	-33.3	-34.9
		0.9 - 1.8	0.3 - 2.0	0.5 - 5.0	-51.8	-37.8	-34.6	-31.9	-33.6	-28.2	-28.9
Togur	Different source rock P – J ₂	<u>2.0 - 7.0</u>	<u>0.1 - 0.9</u>	<u>1.3 - 4.6</u>	-52.4	-32.4	-29.5	-28.7	-30.9	-28.8	-27.5
		1.5 - 7.5	0.1 - 1.5	1.8 - 5.5	-41.9	-25.9	-24.9	-25.0	-25.4	-25.5	-25.5
Palaeozoic	C ₂ D ₂	<u>1.0 - 1.7</u>	<u>0.1 - 0.4</u>	<u>1.9 - 6.3</u>	-45.0	-37.2	-33.2	-34.4	-34.2	-32.7	-33.3
		no samples	no samples	no samples	-41.4	-31.1	-30.1	-30.4	-29.9	-29.2	-29.1

Table 1. Geochemical parameters of source rocks, oils and gases of different genetic type

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