GENETIC TYPES AND CATAGENESIS OF PALEOZOIC OILS IN THE SOUTH-EAST OF WESTERN SIBERIA (RUSSIA)

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The vast majority of Paleozoic oil deposits in the West-Siberian petroleum basin (Russia) are located in the south-east of Western Siberia and confined to the Chuziksko-Chizhapskaya saddle. There are a lot of papers dealing with Paleozoic oils of Western Siberia (A.A. Trofimuk, V.S. Vyshemirsky, E.A. Kontorovich, N.P. Zapivalov, I.V. Goncharov, E.A. Kostyreva, etc), but the nature and types of these oils are still subject to debate. The long period of Paleozoic deposit accumulation (over 200 million years) and, therefore, change of sedimentation conditions gave rise to several oil sources in Paleozoic deposits. Based on differences in compositional parameters across the region, several groups of Paleozoic oils have been identified [Goncharov I.V et.al, 2015].

Additional studies (GC/MS, GC/MS/MS, EA-IRMS) of over 70 samples of Paleozoic oils from 17 fields in the south-east of Western Siberia (SEWS) have demonstrated significant variations in molecular and isotopic parameters that describe the nature (types of biological producers, conditions of their fossilization) and catagenesis of oil source organic matter.

Paleozoic oils in the south-east of Western Siberia are differentiated by group in Fig. 1. The first group (I in Fig.1) is represented by oils with compositional parameters that are significantly different from those of other groups. It includes oils from five fields: Kulginskoye, Yuzhno-Tambaevskoye, Yuzhno-Tabaganskoye, Archinskoye, and Solonovskoye. Oils of this group are characterized by high content of C24 tetracyclic terpane (C24 tetracyclic hopane/C26 tricyclic hopane ratio). High concentrations of C24 tetracyclic terpane indicate high-salinity lagoon sedimentation conditions of the initial organic matter, carbonate facies [Peters et al., 2005]. Moreover, oils of these fields are characterized by the highest values of ABI parameter as compared to other Paleozoic oils in the region. The ABI parameter is associated with high molecular weight alkylenzenes with odd-numbered alkyl substituents (C\textsubscript{15}, C\textsubscript{17} and C\textsubscript{19}) that strongly dominate their surroundings. The same unique composition of alkylenzenes, as in these SEWS oils, have been found in oils of Algeria (Ain-Zeft), Paleozoic oils of Belarus, and Precambrian oils of Eastern Siberia. The presence of alkylenzenes with odd-numbered C\textsubscript{15}-C\textsubscript{19} N-alkyl substituents can be explained by the presence of specific biological precursors. For example, such alkylenzenes have been found in some fungi (\textit{Corticium saticinum}) [Gripenberg J., 1952]. Perhaps, the more ancient forms of fungi with similar specific composition of alkylenzenes were widespread in pre-Jurassic times. The predominance of alkylenzenes with odd-numbered C\textsubscript{15}-C\textsubscript{19} N-alkyl substituents is also associated with algal life forms (\textit{Gloeocapsomorpha Prisca}) and cyanobacteria (blue-green algae) [Fowell M.G. et al., 2004]. The predominant contribution of prokaryotes in generating organic matter of oil of the first group is indicated by minimum tricyclic terpanes (contribution of bacterial and algal lipids) to hopanes (contribution of prokaryotes) contained in them. All Paleozoic oils vary widely in terms of C23TT/C30Hop (Fig. 1-a). Oils of the second group (II in Fig.1), making up the vast majority of oils in the region, were generated by organic matter with participation of more complex organisms and prokaryotes in less saline conditions. Oils of the third group (III in Fig. 1) are characterized by minimum
contribution of prokaryotes in generating organic matter and minimum salinity of the sedimentary basin.

The identified groups of oils are characterized not only by specific facial genetic parameters, but also by changes in catagenesis parameters (Fig. 1-b). More mature oils demonstrate a higher ratio of tetracyclic terpanes to hopanes (C24TeT/C30Hop parameter), which is associated with greater thermal stability of tetracyclic terpanes. As catagenesis grows, the distribution of high molecular weight alkylbenzenes becomes smoother, while decreasing the ABI parameter (Fig. 1-b). Oils of the first group demonstrate the greatest changes in catagenesis parameters and their maximum values. The carbon isotopic compositions of oils of this group also show extreme values in the δ13C range for all samples tested in this study (Fig. 1-b). Changes in both molecular catagenesis parameters and carbon isotopic compositions as a whole are unidirectional for the entire set of samples.

Notably, oils of different genetic types can be found even within the same field (Archinskoye).

![Figure 1](image.png)

**Figure 1** Changes in molecular parameters and carbon isotopic composition of Paleozoic oils in the south-east of Western Siberia

References