The oil-and-gas-bearing capacity of the Siberian platform and Taimyr fold conjunction includes several accumulation regions: southern (Siberian platform), central (Anabar-Khatanga salt basin) and northern (pre-Taimyr zone of Kiriako-Tass rises) (Pronkin et al., 2012). Permian deposits are perspective as well as the adjacent areas of the Anabar-Khatanga trough, where the complex of Permian age deposits is the main hydrocarbon (HC) fluid generation source. The purpose of the study is to characterize the composition, genesis and the thermal maturity level of the dispersed organic matter (DOM) of the Upper Paleozoic deposits of the Kiriako-Tass rise, and to evaluate their oil-and-gas-bearing capacity.

The studied stratigraphic transect (Fig. 1) includes Middle Carboniferous – Early Permian, Middle – Late Permian and Early Triassic periods of the sediment cover formation. The studied samples include silts and silty-clays, fine-grained sands of makarovskaya and sokolinskaya formations and dolerites. Wide variation in TOC content which does not correlate with the lithotype of rocks is important feature of the samples. TOC varies between 0.25 and 4.25% for argillites and siltstones, and from 0.11 to 1.30% for sandstones within one formation (Ps,k). The maximum of Ccarb content was detected in intrusive rocks, and is confirmed by the distribution of calcite-filled cracks that likely have been formed during post-magmatic processes and were identified microscopically in thin sections of dolerites. The low content (less than 0.01%) and oxidized state of the extractable components of DOM (EOM) in clay rocks (ratio of chloroform extracted to alcohol-benzene extracted part of the OM – $A_{\text{chl}}/A_{\text{alc-bnz}}$, is between 0.3 and 0.8) allow to refer them to the “residual bitumoids” that have undergone the process of primary migration. The highest degree of bitumenosity ($\beta = A_{\text{chl}}*100\% / \text{TOC}*k$ is between 3 and 7, where $k = 1.3$ – conversion factor for ancient rocks) was detected in dolerites and sandstones of the upper part of the section (P$1_{\text{sk}}, P_{2-3_{\text{bk}}}, T_{1_{\text{zv}}}$, Fig. 1). The increased content of HCs in composition of OM in these samples can also testify to the primary migration. The group composition of the EOM ($A_{\text{chl}}$) of all the studied samples is dominated by HCs (ca. 70.5% in relation to resins and asphaltenes) with the high content of aliphatic components in their composition (Aliphatic/Aromatic = 2.5).

Molecular characteristic of aliphatic HCs of all the samples testify to their common humic-sapropel composition, comparable conditions of generation and thermal maturity level. Distribution of n-alkanes is consistent in clay, sandy and intrusive rock samples ($C_{27}/C_{17} = 0.3 - 0.8$). The observed dataset points to the migration nature of HCs in dolerites and basalts, but they can be of both syngenetetic and epigenetic origin in clay rocks. The comparable distribution of terpanes and steranes in all samples testifies to the single source of HCs and an equal thermal maturity of DOM (Fig.1). The small variation in values of maturity indexes of terpanes ($Ts/(Tt+S+Tm)$ and $H_{31}S/(S+R)$) indicates the catagenetic stage of OM transformation ($MK_1$, $R_o$ ca. 0.61) and some characteristics allow to consider carbonate rocks as the main source of HCs ($H_{29}/H_{30} = 0.6-0.8$, $H_{13}R/H_{44}R >0.5-0.9$). However, the absence of gammacerane, which is marker for the evaporate formations identification, testifies to the different genesis of OM in the studied rocks and in rocks of the Anabar-Khatanga trough, where the Devonian salt complex affects the composition of DOM (Kashircev et al., 2013).
According to the composition of steranes and their ratios (steranes $C_{29}/C_{27} = 1.2 – 1.3$) the formation of DOM has taken place during the shallow water conditions and has humic-sapropel genesis (Peters et al., 2005). The diasteranes to steranes ratio ($C_{27}$dia/$C_{27}$ = 0.5–0.9) indicates the influence of clay minerals on the diagenetic transformation of DOM. The high content of naphthalene, phenanthrene and their alkylated forms can also testify to the significant influence of migration processes. The values of $R_o$ (ca. 0.5–0.7) are calculated using MPI (ca. 0.3–0.5) that corresponds to the early stage of mesocatagenesis (MK). This combination of high polymerization of DOM, characteristic for the late catagenetic stages, and low values of the biomarker thermal maturity is likely a result of the mixed origin of OM, that have been formed during the syngenetic and epigenetic processes.

The study suggests that the Upper Paleozoic deposits of the Kiriako-Tass rise contain DOM of the mixed humic-sapropel composition that has been formed in the shallow water conditions. Epigenetic HCs have been generated in Permian deposits as a result of primary migration activated by geodynamic processes. Thus, the use of biomarker analysis (in particular terpanes) for the definition of potential sources of the migrated HCs allows correlate their origin with the underlying Low Carbonic limestones and Permian clay deposits. Despite the loss of oil-and-gas-bearing capacity signs by the Upper Paleozoic rocks, the entire region still remains perspective due to the thermal maturity level (MK1-MK2) and the humic-sapropel genesis of DOM characteristic for the potential oil source formations.

Kashirtsev et al., 2013. Geology and mineral resources of Siberia, V.1, P.54-63.
Pronkin et al., 2012. Oil and Gas Geology, V.1, P. 30-44.