Lithochemical and Petrographic Analyzes of Bazhenov Black Shales (Western Siberia, Russia)

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ABSTRACT

Bazhenov formation is regarded as one of the priority projects of oil exploration in Russia unconventional reservoir, showing both reservoir and source rocks properties. The core study include a wide range of methods: macrodescription of the core, different scales tomography, detailed petrographic studies, Scanning Electron Microscopy (SEM), X-ray diffraction (XRD), X-ray fluorescence (XRF), Rock-Eval pyrolysis. Numerous analytical data show that Bazhenov black organic-rich shales are characterized by exceptional diversity of chemical, mineral composition and structures, with relatively stable textural features. They are polymineral thus divided into predominantly clay, siliceous and carbonate. The mineral compositions and structures are defined both by primary (sedimentary) components and secondary diagenetic and catagenetic processes. Primarily for the purposes of lithotypes allocating the chemical analyzes data are used. This allows to differentiate members/ rock layers and carry out their correlation with geophysical data. Lithochemical correlation is based on the standardized chemical modules: Na_2O/K_2O, $(Na_2O+K_2O)/Al_2O_3$, Al_2O_3/SiO_2, $(Fe_2O_3+FeO+MnO+MgO)/SiO_2$, TiO_2/Al_2O_3, $(Fe_2O_3+FeO+MnO)/(TiO_2+Al_2O_3)$, $(TiO_2+Al_2O_3+Fe_2O_3+FeO+MnO)/SiO_2$). Additional information about chemical heterogeneity was obtained by distribution analysis of phosphorus, calcium, vanadium, rare earth elements and organic geochemical data. Three-component classification of Bazhenov rocks in the form of a triangular diagram is developed: carbonate phase – biogenic silica – clastic (including clay) minerals. In the Bazhenov Fr. sections the main petrographic types of rocks – clay-siliceous, siliceous-carbonate-clay, carbonate-siliceous mixtites, etc. Silica usually has a primary genesis associated with radiolarias. The carbonate phase are predominantly secondary. Framboidal pyrite commonly present as an impurity. Radiolarian shales are characterized by the best reservoir properties. Lithochemical and petrographic data are the basis for the sedimentological and conceptual geological models, petrophysical correlations, optimization of oil exploration and engineering.