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ORGANIC MATTER CATAGENESIS AND PETROLEUM POTENTIAL OF MESOZOIC DEPOSITS OF WEST SIBERIA

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Based on vitrinite reflectance (R^0_{vt}) and using mathematical modeling and computer technologies, schemes of organic matter catagenesis have been constructed for different stratigraphic levels of the Mesozoic of the West Siberian megabasin: for the top of Upper Jurassic (J_3), Middle Jurassic (J_2), Triassic deposits and Jurassic basal horizons (J_{1-2}). The level of OM maturity varies within grades PC_3-MC_3^2 (R^0_{vt}=0.4-2.0%) at the Jurassic top, PC_3-AC_2 (R^0_{vt}=0.4-3.0%) at the top of the Middle Jurassic, and PC_3-AC_3 (R^0_{vt}=0.4-5.0%) at the bottom of the Jurassic. The distribution of zones with different levels of OM maturity in Jurassic sequences in the megabasin is a typical manifestation of regional static catagenesis. In the margins of the region, the degree of OM catagenesis in the entire Jurassic complex reaches protocatagenesis (grade PC_3, R^0_{vt}<0.5%). Towards the central regions, in which Jurassic deposits occur at greater depths, the degree of OM catagenesis gradually increases and reaches maximum in the north, where the sequences subsided into zones with hard P-T conditions. In the areas of maximum burial in the north of the megabasin, the level of OM maturity reaches late mesocatagenesis (grade MC_3^2 (R^0_{vt}=1.5-2.0%) at the Jurassic top, the middle apocatagenesis (grade AC_2, R^0_{vt}=3.0%) at the top of the Middle Jurassic, and the end of apocatagenesis (grade AC_3, R^0_{vt}>3.5 %) at the bottom of the Jurassic. At the top of the Triassic, the level of OM maturity varies within grades MC_1^1-AC_2 (R^0_{vt}=0.5-3.0%). The peculiarities of OM catagenesis in these deposits are similar to those in the Jurassic. The level of OM maturity is moderate along the margins and in the center of the megabasin and is higher in the north (AC_{1-2}, R^0_{vt}=2.0-3.0%). The OM catagenesis reaches grade AC_3 (R^0_{vt}>3.5 %) in the Triassic basal horizons of the northern areas. The absence of coalification jump in transition from Lower Jurassic to Upper Jurassic deposits is a typical feature. Hence, Triassic deposits are typical platform sequences, which underwent maximum catagenesis simultaneously with Jurassic sequences, and, therefore, they should not be identified with the Paleozoic ones by using term “pre-Jurassic complex”.

In Mesozoic sequences, the OM catagenesis is governed by depths of their burial and, correspondingly, maximum temperatures, which they have experienced. In Jurassic and Triassic deposits, the level of OM maturity ubiquitously increases with depth, but with

different intensities, depending on the character of thermal field. The basement consolidation is of Hercynian age in zones of intense thermal field. The gradient of OM catagenesis with depth is particularly significant in zones where Mesozoic deposits are overlapped by granite massifs and also along rifts and active fluid-conducting faults (Shaim, Krasnoleninsk, Salym, and Koltogor regions with enhanced heat flow). The gradient of catagenesis is the lowest in the areas with pre-Baikalian age of the basement folding.

The relationship between the petroleum potential and OM catagenesis of the enclosing strata has been established. In the most part of the Ob step and along the periphery of the Taz-Gydan regional depression, Jurassic deposits occur in the oil window (R^0_{vt}=0.50-1.15%), and the majority of oil fields are concentrated in them. In the northern areas, Lower Jurassic and Middle sedimentary strata occur in the deep zone of gas generation (R^0_{vt}=1.15-3.0%). They yielded the inflows of light oils and fat and dry gas. Triassic sedimentary strata throughout the most part of the region have not yet passed out of the oil window. However, the terragene composition of these deposits suggests that predominantly gaseous hydrocarbons form in them. In the north, the rocks occur in the zone of deep gas generation, and preservation of only gas pools is possible in them. No commercial hydrocarbon fields have been discovered in Triassic strata.

The intervals of oil and gas generation zones and possible oil and gas content in the Mesozoic strata have been defined more exactly. In the most part of the region, Jurassic deposits occur in the oil window and contain the majority of oil pools of the region (Middle Ob region, Shaim region, etc.). In the north of the megabasin, to depths of about 3.6-4.2 km, Jurassic strata have not passed out of the oil window and could be of interest for oil field exploration. Lower in the section, the deposits occur in the deep zone of gas generation (grade MC_3^1-AC_1, and preservation of gas accumulations is likely in them. All of the commercial oil pools of West Siberia occur mainly at depths to 4.0 km. Lower in the section, accumulations of light oils or dry and fat gas have been found. In the south of the region, Jurassic strata occur in the oil window, and preservation of both oil and gas pools is possible in them. These theoretical conclusions have been confirmed by the results of oil exploration activities.