In the area of anthropogenic wasteland, the precipitation is characterized by a higher TDS, from 5.0 to 14.0 mg/l. The concentration of sulfate ion increases to 7.7 mg/l and the pH value drops to 4.7.

The rain water of the background landscape is also ultra-fresh, acidic, chloride-sulfate sodium. However, TDS decreases here, its value varies from 1.7 to 9.6 mg/l, and the pH rises from 4.3 to 5.9.

The feature of microcomponent water composition is high content of copper, nickel, cobalt, manganese.

In the area of the anthropogenic wasteland, especially high concentrations of nickel and copper in atmospheric precipitation are observed - 0.29 and 0.72 mg/l.

Atmospheric precipitation penetrates the geological system. Here they interact with the water-bearing rocks. Water dissolves primary aluminosilicates with which they are nonequilibrium, enriched by chemical elements, and become saturated with secondary minerals such as kaolinite, illite, muscovite, Ca-, and Mg-montmorillonite. At the same time, the total mineralization, pH, temperature, water composition change. The source of CO2 in the waters, perhaps, is the processes of mineralization of organic matter.

It should be noted that soil plays an important role in the formation of water composition. It is assumed that the soil is a buffer in the path of penetration of aerotechnogenic copper and nickel into groundwater. The content of Cu and Ni in surface water in the zone of influence of dust-gas emissions of the copper-nickel plant is significantly higher than in the groundwater. This indicates that in area with undisturbed soil cover groundwater is protected from pollution through anthropogenically polluted atmosphere.

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LITHOLOGY AND CONDITIONS FOR FORMATION OF THE LOWER-MEDIUM-JURASSIC DEPOSITS OF THE SOUTH-EASTERN PART OF THE WESTERN-SIBERIAN PLATE IN CONNECTION WITH THEIR OIL AND GAS EFFICIENCY

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Western Siberia is the largest oil and gas basin in the world, and, therefore, the most important territory for the production of hydrocarbons on an industrial scale. The main hydrocarbon reserves are concentrated in the PreJurassic, Lower-Middle Jurassic, Vasyugansky, Bazhenovo-Abalaksky, Neocomian (including Achimovsky), Apt-Alb-Senomsky and Cenonsky oil and gas complexes [1].

In the south-east of Western Siberia (Tomsk Oblast), hard-to-recover reserves of the Lower Middle Jurassic productive deposits are of great interest to date due to the growth in the resource base and increase in oil production.

The relevance of the study in the Lower-Middle Jurassic deposits of the southeastern part of the Western Siberian Plate in the Tomsk Oblast is of no doubt due to the increased oil and gas content and poor knowledge in this sphere. As drilling increases, there is a growing awareness of great complexity of productive reservoir structure. To date, the information on formation conditions of local deposits and data on lithology need to be updated based on the modern concepts.

We have developed a comprehensive method for studying the Lower-Middle Jurassic oil and gas bearing deposits in the south of Western Siberia including the study of core samples to determine the genesis of the described deposits with paleogeographic reconstructions at the time of productive strata accumulation in the Lower and Middle Jurassic periods in the study area as well as modeling sedimentological environments and construction of 3D models.

The issues of the geological structure and conditions for the formation of the Lower Middle Jurassic deposits in the territory of the Western Siberian oil and gas province are considered in the works by many Soviet and Russian geologists: G.F. Stepanenko and L.S. Chernova (1998), M.Yu. Zubakova (1999, 2001), G.F. Ilyina (2002), N.M. Nedolivko (2003), T.G. Ten (2003), E.E. Dannenberg (2006), O.S. Chernova (2010, 2014), etc. At the present, it is possible to address the study in the features of complex reservoirs structure with low permeability of the Lower Middle Jurassic deposits by means of a complex research method.

The Western Siberian oil and gas province is located within the largest Western Siberian lowland in the world, in the West it borders on the Hercynian deposits of the Urals, in the East the province is confined by tectonic structures of the Yenisei Ridge and the Central Siberian ancient Paleozoic platform. Tomsk Oblast is the third largest oil industry center in Western Siberia.

The Lower-Middle Jurassic deposits in the study area are represented by the Gettang-Early-Toarsky oil and gas bearing complex consisting of alternating coastal-marine and lacustrine-alluvial sandy-clayey and shallow-marine sediments, Late-toar-Aalensky and Bayos-Batsky oil and gas promising complexes consisting of stratigraphically shielded sand beds with industrial hydrocarbon reserves.

In the early Middle Jurassic, sedimentation in the study area occurred under the frequently changing paleogeographic conditions and was accompanied by the change in various forms of relief, which probably resulted in the formation of reservoirs with special filtration and capacitance properties [2].

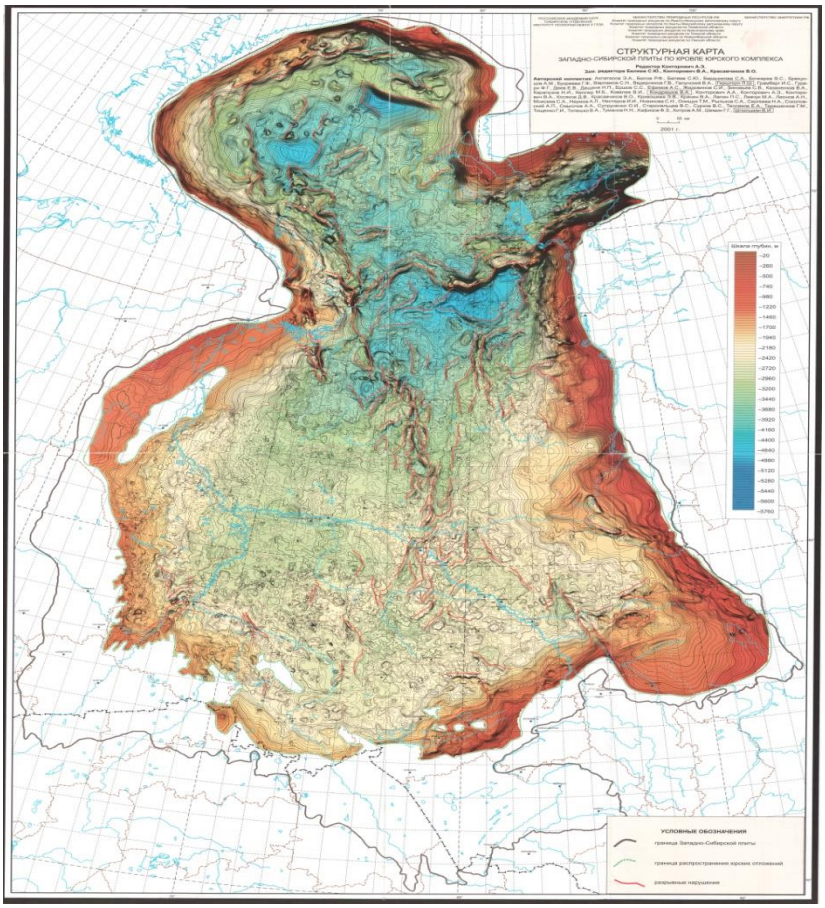

Fig. 1 Structural map of the West Siberian plate on the roof of the Jurassic sediment complex (A.E. Kontorovich, 2001)

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HYDRATE FORMATION AS THE MAIN PROBLEM DURING GAS-CONDENSATE FIELD EXPLOITATION

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Exploitation of gas and gas condensate fields considers a lot of technical difficulties during the operation due to gas hydrate formation. Hydrates are crystals combined from water and gas at high pressure and low temperature environment. Formed hydrate can reduce the diameter of the tubing or pipeline and finally plug it. Once plugged the pipeline can't transport the fluid to the target place which is leading to significant losses in production and revenues.

The most important step in controlling hydrate formation is to determine appropriate pressure and temperature conditions for hydrate process to start. There are a lot of commercial phase equilibrium computer programs that allow performing accurate prediction of hydrate formation conditions. Incipient hydrate formation programs enable the prediction of the PVT conditions at which hydrates begin to be formed. Gibbs energy minimization programs or flash programs predict all phases and amounts at higher pressures and lower temperatures than the incipient hydrate formation point. Also it is possible to calculate the required amount of inhibitor per volume of produced gas for safe exploitation conditions (Fig.1). The hydrate formation plot allows performing quick operating decisions regarding to the exploitation regime [2].