ENVIRONMENTAL PROBLEMS OF OIL PRODUCTION IN THE BAZHENOV FORMATION

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Russia has long been the world's leader in hydrocarbon production. Since conventional oil and gas reserves are being depleted, the continuous research is being carried out to find a new resource base, which will be comparable in terms of recoverable hydrocarbons to the existing oil and gas provinces which are currently being developed.

The two most probable sources for alternative hydrocarbon production have been recently identified: the Arctic shelf and the Bazhenov formation, which is the largest oil shale formation in the world. It is obvious that Arctic shelf development will be conducted in the conditions unsuitable for human life, while the Bazhenov formation which embraces almost entirely West Siberian territory is located in areas with more developed oil production infrastructure.

According to the experts' researches, about 26 trillion of shale oil can be recovered from world's deposits of oil shales. The amount is 13 times higher than conventional oil reserves. These resources will provide continuous production for about 300 years considering the modern rates of hydrocarbon consumption. Therefore, based on technological progress, the development of shale oil deposits is currently a top priority due to large amounts of shale oil reserves.

The fact that Bazhenov formation provides an analogue to Bakken formation is of great importance. It is well-known that Bakken formation development led to a high increase in US oil potential. The identification of common and distinctive features of Bazhenov and Bakken shales becomes relevant to apply American technology to shale oil extraction in case of the Bazhenov formation, taking into account its characteristics.

The similarity of "black shales" in low-permeability reservoirs is proved due to common features of rocks in both formations which are high radioactivity, high reservoir pressures, as well as abnormally low conductivity.

The main differences between Bazhenov suite and Bakken formation are:

• presence of low-permeability rocks in the Bakken formation, in contrast to Bazhenov suite, which is characterized by abnormal permeable rock sections;

• different ages (Bazhenov suite refers to Upper Jurassic formation, while Bakken deposits to Paleozoic formation).

The Bazhenov formation is mainly composed of thick dark fractured mudstones and siltstones with schistose texture, and characteristic oil odor (Fig. 1). The rocks contain jelly-like macrofauna and organic matter (Fig. 2).

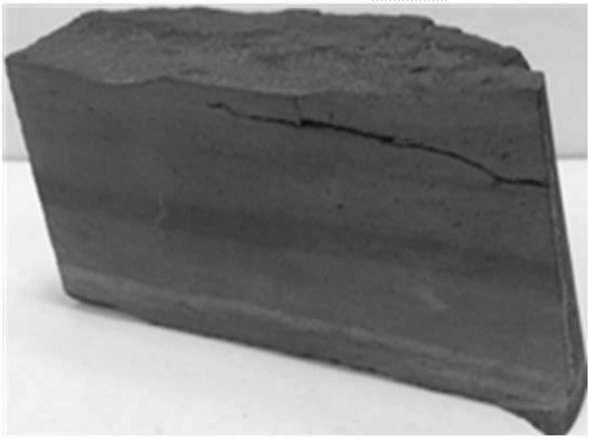

Fig. 1. Bazhenov formation core sample (depth selection - 2822.7 m)

Thus, Bazhenov shales can be the source for oil and gas industry development.

There are two basic ways of shale oil extraction which are open-cast mining and subsurface drilling. Open-cast mining leads to shale oil processing in special installations where shales are pyrolyzed without access of air, thereby the resin is released from the shale rock. Extraction of oil directly from the reservoir is done through drilling horizontal wells and subsequent hydrofracturing, sometimes alongside with additional thermal or chemical reservoir heating. Unconventional oil development conducted by these methods leads to a number of environmental problems:

- Water pollution. As a result of shale oil production through hydrofracturing, ground waters are polluted by hazardous chemicals, which were used for formation breakdown, and due to release of huge methane amounts, which get into the soil and drinking water, making it "explosive".

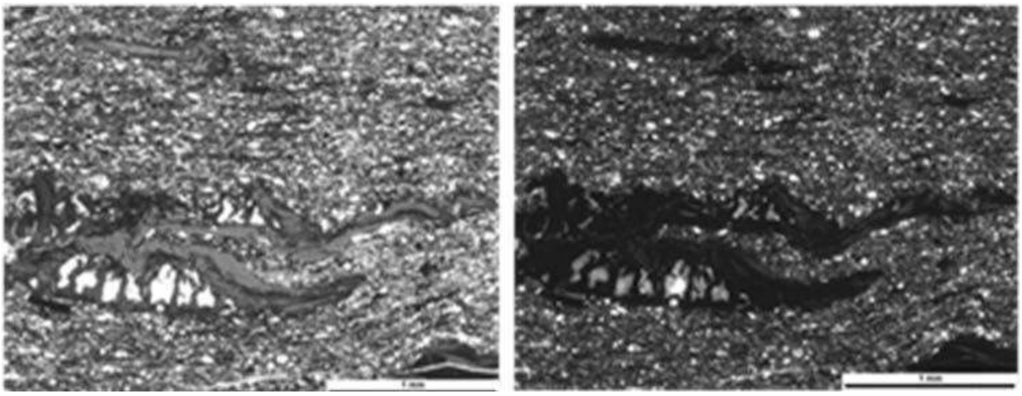

Fig. 2. Thin section images of Bazhenov formation rocks with macrofauna (left - without the analyzer and right - with the analyzer)

- Water Consumption. Shale oil production directly from the reservoir requires large quantities of water. In a standard field a single hydraulic fracturing is performed using about 27-86 million cubic meters of water per volume accounting for 0.5-1.7 million cubic meters of chemicals. On average, 12 hydraulic fractures may be performed in each well.
- Climate change. Emission levels of greenhouse gases during shale oil-gas production and employment are much higher than in conventional hydrocarbon production. As a result of the research it was revealed that the damage from the use of raw shale is comparable to the damage from the use of coal. According to the US government, methane seepage amounts in shale gas extraction are at least one third higher than in case of natural gas production.

At present commercial development of Bazhenov shale oil deposits is certainly a priority for the oil and gas industry in Russia. Nevertheless, high profit should not be the only reason for producers in exploration and development of shale oil deposits, since shale oil production technology has not yet reached the level at which the environmental impact is insignificant.

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COMPOSITE FOAM GLASS WITH PROTECTIVE AND DECORATIVE GLASS COVERING ON THE BASIS OF THE AMORPHOUS SILICEOUS ROCKS SOUTH KAZAKHSTAN REGION

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The possibility of obtaining a composite foam glass with protective and decorative glass coatings based on amorphous siliceous rocks of South Kazakhstan region by one-stage technologies, while foaming foam glass mixture and sintering finishing with a vitreous layer is considered. Some results of the research samples of the resulting material are presented. The processes of sintering occurring during heat treatment in the preparation of foamed glass, the nature of the effect of dispersion of the starting powders of raw materials and temperature-time conditions of heat treatment on the structure and properties of the resulting material have been studied. The expediency of adding sodium hydroxide (13-20% conc.), ensuring the formation of a foamable mass during the heat treatment, which allows to increase the vapor pressure, which in turn allows to increase the porosity and the foam glass to achieve uniform distribution of pores in the material, thereby improving the insulation performance of foam glass is proved.

Due to the huge scales of modern construction the ways of foam glass usage in construction of various buildings and constructions are extendingsteadily.

In comparison with other heat-insulating materials a foam glass most fully meets requirements of modern constructive architectural concepts in construction, caused, first of all, by that it has a number of valuable properties, such as porosity, small water absorption, durability, etc[1].

Foam glass is known to be a kind of material from the closed glass cells that has a spherical shape. Water absorption of it in full immersion in the liquid does not exceed 5% of the total volume of material and caused only by the accumulation of moisture in the surface layer. Waterproofing and vapor sealing properties of the foam glass and isolation applied with high reliability. In its operation the thermal conductivity, strength, stamina and form do not change. Foam