



Fractured unconventional reservoirs in the Crystalline Basement

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Since the late 1960-es, the crystalline basement of Tatarstan has been in the focus of intense geological and geophysical surveys. Since 1975, within the framework of the Subsoil Survey Program of Tatarstan, two extra deep wells have been drilled in the Republic, including: 20000-Minnibaevskaya well (bottomhole depth – 5,099 m, meters drilled in the basement – 3,215 m) and 20009-Novoeikhovskaya well (bottomhole depth – 5,881 m, meters drilled in the basement – 4,077 m), as well as 24 wells penetrating the basement at depth from 100 to 2,432 m. Reservoir properties of the crystalline basement rocks can be evaluated based on the resulting volumes of produced liquid, which vary from 0.027 to 125 m³/day. The highest flow rate was registered for well № 20000 Minnibaevskaya. Therefore, there are high-capacity reservoir zones in the crystalline basement of the eastern margin of the Russian Platform.

The statement saying that natural reservoirs with significant sizes and fluid storage capacities occur everywhere within the Precambrian crystalline massive on the territory of Tatarstan can be justified by the following provisions:

- deconsolidation and fracturing zones of the crystalline basement are registered by a full set of geological and geophysical methods applied in the process of geophysical well surveys and in the process of surface geophysical studies;
- there is a certain regular pattern of crystalline basement zone distribution by area and by profile.

Wide-spaced drilling into the crystalline basement helped to identify numerous zones of deconsolidation and fracturing with different fluid storage capacity and different extent of fluid saturation. Thickness of the crystalline basement reservoir zones varies from several meters to dozens of meters. Such zones were identified close to the crystalline basement top, as well as at depths more than 5 km. Well log survey was the key method used for reservoir differentiation in the crystalline basement.

In total, 16 wells penetrating the crystalline basement rocks with cumulative thickness 8,216 m were studied. The cumulative thickness of formations with potential reservoir properties in these wells was 375.6 m (or 4.6 percent from cumulative thickness of the crystalline basement profile). In total, 82 intervals were identified using well log data. Comparison of these intervals with the results of tests using KII-146 showed that reliability of reservoir zone differentiation in 16 wells in question was 69%. First of all, it should be noted that the studied wells included those ones where the recommended optimal well logging complex had not been applied. Besides, borehole conditions of tests with KII-146 were not optimal in all wells. Evidently, all these factors impacted the reliability of test results. Nevertheless, practically 70-percent confirmation of reservoir zone differentiation in the crystalline basement profile based on well log data allows using well log information for the analysis of regularities of the crystalline basement reservoir distribution by section and area.