

The aim of the project is to check the impact of the tuffite/bentonite layers occurrence on the propagation of vertical hydraulic fractures during fracturing treatments. To achieve this, a full analysis of the rock material using advanced research techniques should be carried out. In addition, special attention should be paid to the stress regime in the reservoir and to proper determination of the fracturing conditions, which have a significant impact on the propagation of fractures in the deposits examined.

The research hypothesis assumes that high clay content tuffite and bentonite layers may act as a lithological barrier for the fracture propagation. It is mainly due to a decrease of friction on bedding planes, change of elastic parameters and reduction of brittleness. The biggest problem with the fracture development through tuffite or bentonite layers may appear in reservoirs with low vertical to the minimum horizontal stress difference.

The project includes mineralogical (X-ray diffraction, X-ray diffraction of the separated clay minerals), chemical (X-ray fluorescence spectroscopy), geomechanical (Uniaxial Compressive Strength tests, ultrasonic measurements) investigations, microscopic observations (using petrographic and scanning electron microscope) and hardness tests on tuffite/bentonite samples. The results will be compared with the data from the well logging and juxtaposed with the laboratory tests carried out so far on prospective shales by the service companies and research institutes as part of the projects related to the examination of the Silurian-Ordovician plays in the Baltic Basin. Then, the model of tuffite/bentonite will be created. Based on the studies listed above, the mineralogical, chemical, structural and geomechanical features of the analyzed layers and surrounding shales will be compared. The estimated stress conditions will be used to recognize the tectonic regime. The pressure necessary for the propagation of the vertical fracture through the tuffite/bentonite layers of a defined thickness will be determined, as well as the minimum thickness of these layers at which they will form a lithological barrier for the fracture propagation. Moreover, the authors will analyze and describe the behavior of tuffite/bentonite with specified mineralogical features during hydraulic fracturing treatment. Finally, the influence of the tuffite/bentonite layers occurrence on the stimulation of unconventional reservoirs will be determined.

The main reason for this research is the need to accurately identify layers that can act as a barrier to the propagation of hydraulic fractures during intensification operations in a well. Prospective as source, reservoir and seal rock, Silurian-Ordovician shale, has been well described during the BlueGas research program, as well as other scientific and commercial projects taken before. The tuffite/bentonite layers that occur within them, due to the unstable thickness along the basin and lack of prospectivity for gas generation, were subjected to less accurate analysis. The chance of encountering tuffite/bentonite beds with thicknesses exceeding 1 m in other shale reservoirs, like e.g. Wufang Longmaxi formation (China), makes it necessary to thoroughly analyze the impact of these rocks on performing intensification treatments.

The effect of research, analyzes and models can be used in the fracturing treatments design and the creation of unconventional reservoir models both in Poland and abroad.