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Increasing the Efficiency of Development of Oil Fields in Shale Formations Based on the Use of New Seismic Exploration Methodology

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The main condition for efficient oil recovery from shale deposits is the consideration of fracture zones. It is the fracturing zones that determine well flow rates, productivity and the duration of well operation. The placement of producing wells in fracturing zones allows to abandon drilling of unproductive wells and to obtain the greatest production rates for a long time. The unevenness of oil saturation and the unevenness of the oil-producing potential of shales is proved by the example of the Bazhenov Formation of Western Siberia and the Domanik Formation of the Volga-Ural Region.

The success of drilling oil and gas wells is largely determined by a high hydrocarbon content and reservoir permeability at the point of penetration. Microseismic emission and scattered reflection waves are used for the reliable study of these parameters. The Seismic Location of Emission Centers and Side-View Seismic Location technologies have been developed for the observation, selection, and positioning of waves in a geological environment, which significantly extend the range of problems that are solved during seismic exploration of hydrocarbon deposits. Examples of application of these technologies in the exploration and development of hydrocarbon deposits are described.

In the presentation problems of improving the production efficiency of seismic exploration at oil and gas fields in the shale formation are considered. The way of this problem solution is demonstrated – it is based on the use of the different seismic waves classes: reflected, scattered, and microseismic emission waves. Combining CDP, SLEC (Seismic Location of Emission Centers) and SVSL (Side-View Seismic Location) and the use of these waves can provide independent and the most reliable information about the oilfield: traps, heterogeneity and uneven fluid saturation, distribution of open fractures in the reservoir and etc. This seismic methodology can significantly improve the main indicator of the efficiency of geological exploration – the successful results of exploration wells drilling, the location of which is determined by the results of combining the seismic surveys. The examples of this methodology application are demonstrated.

Comparison of SVSL data about the fracturing of geomedium and drilling and flow test data for four areas suggests the reliability of SVSL results and conformity with the actual distribution of fracturing in these areas. Considered are results of geological interpretation of 3D fracturing distribution using tectonophysical models, which allow estimate the character of deformation (folding type) of sedimentary formations. This is additional information improving the efficiency of conventional seismic structural models under conditions of salt-dome tectonics.