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Summary of the doctoral dissertation

Application of non-destructive core measurements to increase information on reservoir rock parameters to use them for comprehensive interpretation and reinterpretation of data from selected boreholes

The research carried out in the doctoral dissertation aimed to create a measurement and interpretation system, which is to obtain reliable results of well logging with the accuracy of laboratory measurements. Continuous core measurements allow for the generation of logging results without the impact of the borehole and facilitate the depth matching of the core to well logs data. Four main chapters can be distinguished in this work: research methodology with a description of the devices used, partial results of core measurements made on various types of rocks, a proposal for a research system and comprehensive data interpretation for selected boreholes. The methodological part concerned the description of the equipment for continuous measurements of cores in the field of natural gamma radioactivity (K, U, Th) with the application for bulk density measurements using the gamma-gamma method, X-ray fluorescence spectrometers (XRF) for measuring the chemical composition of rocks and computed tomography (CT) for imaging of the core structure, as well as determination of radiological density in Hounsfield units (HU). Rock studies were carried out on material representing formations of different lithologies, such as shales, sandstones, limestones, dolomites, anhydrite, siltstones and heterolithic sandstone-siltstone-claystone complexes. The results of measurements made using individual methods have been described in detail and compared with the results of laboratory measurements and well logging data. Test measurements with data processing and interpretation were made on the cores from five boreholes (T-1, O-4, Pt-1, L-7, P-5H), whereas a comprehensive interpretation of the results was carried out for three other boreholes (J-1, P-4, T-2).

The new methodology of spectral gamma measurements made it possible to obtain precise concentrations of potassium, uranium and thorium in rocks with high and low radioactivity. The results made it possible to standardize the archival gamma-ray logs made with the Russian-type probes from imp/min to API standard units and to obtain data on the content of K, U, Th in the core intervals. Using the Cs-137 source in the device for the gamma equipment made it possible to carry out measurements of the bulk density in g/cm^3 units. The lithological interpretation based on XRF measurements and mineralogical - chemical models allowed to obtain logs with increased resolution and a more significant number of minerals than the interpretation of the well logging. In addition, it has been shown that the XRF measurement methodology can be used during geosteering procedure. The results of the core tests using the CT computed tomography method were presented in combined images and continuous curves of density in HU units.

The experience and the presentation of the full scope of measurement and interpretation workflow allowed to propose a procedure for conducting a full range of analyzes, considering various types of material provided for research. The procedure considers the full range of analyzes as well as the measurements of selected parameters depending on the client's needs.

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Podpis