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Application of QEMSCAN and nanoindentation on drill cuttings

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Abstract

Reservoir characterization traditionally is based on log interpretation supported by core analysis. In this process drill cuttings are often overlooked, even though they can provide valuable information on the lithostratigraphy and rock properties for reservoir characterization. The main advantage of drill cuttings is that they are almost always available as they are stored for most wells and are collected for large parts of the well trajectory, in contrast to core samples which are often not available due to the time and costs associated with the acquisition of cores. However, to successfully utilize drill cuttings for reservoir characterization certain challenges need to be overcome, including the development of appropriate analytical methods since the traditional core analysis methods are not applicable to drill cuttings.

In this paper we discuss two innovative analytical methods, i.e. QEMSCAN and nanoindentation, that are applicable to drill cuttings. QEMSCAN is a nondestructive method for quantitative mineralogical analysis which combines scanning electron microscopy with energy dispersive x-ray spectroscopy. Nanoindentation is a method for determining the mechanical properties of small samples by pressing a hard tip with known properties into the surface of a sample.

The applications of these analytical methods to reservoir characterization are demonstrated using different case studies. In these case studies, the results of QEMSCAN analysis are used for lithostratigraphic analysis, i.e. to identify and delineate different lithostratigraphic zones and correlation of these zones between wells. Furthermore, the mineralogical and textural data support the development of sedimentological models. The results of the nanoindentation measurements are used to determine the mechanical properties of the different lithostratigraphic zones. Finally, the drill cuttings data are integrated with wireline log data to calibrate petrophysical log interpretation resulting in a more accurate reservoir characterization.

The case studies demonstrate that by using innovative analytical methods on drill cuttings, i.e. QEMSCAN and nanoindentation, valuable information on the lithostratigraphy and rock properties can be obtained. The analysis results support reservoir characterization and contribute to a more efficient exploration and production of oil and gas fields.