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Lithofacies Classification Based on Spectral Yields and Borehole Microresistivity Images

Lithofacies classification for borehole geology has, in general, been based on many different log responses and characteristics. Borehole image data are a proven, valuable resource for geological evaluation. Another useful device is the borehole spectroscopy tool, which generates the broad elemental composition of the rock and its quantitative geochemical lithology. The two outputs complement each other well for detailed geological interpretation.

This paper introduces a novel lithofacies classification and processing scheme for use with borehole geological studies. The classification system uses the dry weight mineralogical output from wireline elemental capture spectroscopy data, and utilizes a ternary diagram approach with a corresponding set of rules to create dry-weight mineralogy-based lithofacies. This output is further refined to a more detailed level of formation representation using calibrated micro-resistivity image data and a second set of rules. The final results can then be presented as an output log as a detailed geological column displaying the calculated lithofacies. Numerical data from the final lithofacies results can then be used for additional computation as well as input for modeling.

This new approach to lithofacies classification can be extremely valuable for stratigraphic interpretation such as depositional environment, detailed well-to-well geological correlation, and static reservoir modeling. The information may also be used in the planning, execution, and evaluation of borehole pressure and fluid sampling programs. Additional applications exist for wellbore stimulation procedures, completion and production strategies, and project economics. In addition to a summary of the tools and methods employed, selected case studies will be illustrated.