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Application of Microscopy Image Analysis for Pore Space and Pore Size Distribution in Bioturbated Clastic Rock

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Statement of the Problem: Bioturbation is a prominent type of heterogeneity that exists in the reservoir and has an impact on the porosity-permeability distribution and resulting flow behavior. It is a common perception that bioturbation reduces the permeability of the primary sedimentary fabric mainly because biogenic agitating of stratified sediment lowers the sorting of the sediment, inhibiting flow capability. In recent times, most of the producing reservoirs are found to be bioturbated, contrary to the initial belief. Hence when characterizing heterogeneous reservoir, the degree of bioturbation and its effect on reservoir quality are important parameters (porosity and permeability). However, there is still a lack of knowledge on the impact of bioturbation on porosity-permeability distribution in reservoir rocks, especially in Indian context. The Bhuj formation (Guneri), is a variably bioturbated sandstone unit occurring in outcrops in Kachchh basin. The present study is aimed at estimating the impact of bioturbation on the porosity of reservoir rocks of the Bhuj formation (Guneri).

Methodology & Theoretical Orientation: The Bhuj formation provides a good outcrop correspondent of clastic reservoirs throughout the Kachchh Basin. The Guneri member of the Bhuj formation has various degree of bioturbation (BI-0 to BI5) making this as a suitable candidate for sampling. Thin-sections were prepared to estimate porosity, by vacuum impregnating the epoxy in the clastic rock cut from the outcrop samples. The thin-sections were examined for a pore size and pore space analysis using an integrated petrographic image analysis (PIA) system consisting of high-resolution microscope adapted with a digital camera for image acquisition and open source image analysis software (ImageJ) package for image processing. The methodology developed allows estimation of pore throat and pore size from the thin section image.

Findings: The image analysis software was used to measure fundamental textural properties observed in thin-section. Data sets were generated from the thin section image analysis using point counting variables such as porosity and pore size distribution. The developed methodology successfully estimated porosity, which was validated from routine core analysis.

Conclusion & Significance: Thin-section analysis is essential as reservoir properties can be directly observed and key details regarding reservoir conditions better understood. Ultimately, critical details regarding reservoir quality can aid in the design of better and more efficient oil recovery methods.

Biography:

Shubham Saraf is currently pursuing Master of Technology course in Petroleum Engineering and his expertise in Image process analysis and Petro-physical parameter identification. Open and contextual identification is based on a pore network model to responsive constructivists creates new pathways for improving oil recovery technique under the guideline of Bhawanisingh G Desai. He has acquired a sound overall knowledge of leading edge engineering principles, research and development, with emphasis on designing, modeling and testing of Petroleum geological model development system and proficient in the use of various modeling software including current releases of ImageJ, Petrel, Matlab, etc.

He had done Bachelor of Technology degree in Mechanical Engineering from Gujarat Technological University and his expertise is also in designing, modeling and quality analysis system. His personal attributes include leadership and sound judgment as well as creativity, analytical and troubleshooting skills and interact productively with people from diverse backgrounds and have a history of quality work carried to timely completion.