

C02 Bridging the Gap

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Prediction of reservoir rock quality and distribution of porosity and permeability are not only the most important parameters in oil exploration but also the ones with major uncertainties. Ingrain has developed a methodology to properly capture heterogeneities of the samples that NOC and IOC companies have sent to our digital rocks laboratory.

Acquiring core data from a well is expensive and most of the times oil companies face the challenge of coring representative intervals that provides relevant information for reservoir understanding and modeling. Moreover, the process of selecting core plugs that capture the reservoir heterogeneities is not trivial.

Traditional core plug analysis provides one set of measurements per sample (single point data). At Ingrain, the same core plug is investigated for heterogeneities prior to evaluating the rock properties.

Through the help of macro CT imaging, Ingrain can quickly and accurately get a look inside the entire sample and see the variations represented by differences in density. This low resolution CT scan (1.25 mm per voxel), gives the user a three dimensional representation of features and understanding of density distribution and heterogeneity within the sample. In a joint effort, this volume is analyzed and a grid is determined to choose the regions where subsamples will be taken. The resulting three or more micro cores are imaged on a micro CT scan (resolution 0.8-10 microns per voxel). These high-resolution digital images are stacked to create a 3D volume and send to a process of image segmentation where grains and pores are differentiated and converted into a digital rock. Calculations are conducted on these digital rocks to compute porosity, permeability, electrical and elastic properties, and multiphase flow.

We will present examples of this topological information, where a trend of properties, for instance, porosity vs. permeability captures the forecasting of rock heterogeneities that can be used to improve well decisions and field management.