Improved Permeability Estimates in Carbonate Reservoirs Using Electrofacies haracterization: A Case Study of Mumbai High South

Pushpa Sharma, G. Mamgain, V. K. Bahuguna, and Chaman Lal
Reservoir Group, KDMIPE, Dehradun, India, s_1968@rediffmail.com
Fax – 0091-135-2759934

Electrofacies Characterization is a simple & cost-effective approach to obtaining permeability estimates in heterogeneous carbonate reservoirs using commonly available well logs. Permeability is one of the most important characteristics of hydrocarbon bearing formations in a reservoir. Formation permeability is often measured directly from core samples in the laboratory or evaluated from the well test data. The first method is very expensive. Moreover, the well test data or core data are not available in every wells in a field, however majority of wells are logged. Permeability determination is an active research area in petroleum industry as there is no direct formula for calculation of permeability from logs.

In this Paper we proposed a two-step approach. First, we classify the well-log data into electrofacies types. This classification does not require any artificial subdivision of the data population but follows naturally based on the unique characteristics of well-log measurements, reflecting minerals and lithofacies within the logged interval. A combination of principal component analysis (PCA), model-based cluster analysis (MCA), and discriminant analysis is used to identify and characterize electrofacies types. Second, we apply nonparametric regression techniques, the Alternating Conditional Expectation (ACE) algorithm, to predict permeability using well logs within each electrofacies. Such techniques are completely data-driven and do not require *a priori* assumptions regarding functional forms for correlating permeability and well logs. We applied the proposed technique to a highly heterogeneous carbonate reservoir in the Mumbai High South for generation of permeability transform. Such developed permeability transform by aforesaid technique can solve problems for estimating continuous permeability profiles more accurately in uncored wells.

This approach appears to result in better permeability predictions, leading to an enhanced reservoir characterization based on flow, permeability (rather than storage), or porosity in Mumbai High South. This can have potential benefits both in daily operations and in reservoir simulation efforts. This application also envisages the power and versatility of electrofacies characterization in improving reservoir descriptions in complex carbonate reservoirs.