**Kashagan Field, Kazakhstan, and the use of petrophysical rock typing for improved reservoir quality prediction**

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Kashagan, located in the Kazakh sector of the North Caspian Sea, is one of the largest oil discoveries made anywhere in the world in the last decade. It is a carbonate reservoir with an estimated more than 30 GBO oil in-place and with significant development challenges.

The discovery is in very shallow water that is covered by ice in the winter. Environmental sensitivity is high due to nearby sturgeon and waterfowl breeding grounds. Logistics are challenging.

The reservoir is overpressured with 15% $H_2S$. Development is planned to occur in phases, and much of the produced gas will be re-injected as a miscible fluid. One of the most likely subsurface risks that could impact the project development is unexpected regions of reduced permeability that would reduce gas injection capacity and thus limit oil production.

Petrophysical rock types (PRT) based on wireline logs calibrated to core MICP data are used to identify porosity- and permeability–based classes of reservoir facies within Kashagan field. PRT are linked to known diagenetic processes that control pore types, sizes and geometries in the reservoir rocks. Work by both the former operator, Agip KCO, and the current operator, NCOC, show that the combination of PRT data and geologic concepts of diagenesis allows improved spatial prediction of porosity, permeability, and water saturation within the reservoir interval.

Standard rock type discriminators (texture, lithofacies) failed to identify distinct porosity–permeability classes in high matrix porosity reservoir rock at Kashagan field. These components also cannot account for general lateral variations in reservoir quality across the field (RQ regions). PRT are derived from wireline gamma–ray, density, neutron, plus compressional and shear sonic tools calibrated to a suite of core samples representative of the spectrum of reservoir facies. These PRT distinguish several reservoir facies with different pore geometries and pore-throat distributions that carry distinct porosity–permeability transforms and saturation height functions. Petrographic and diagenetic studies of these reservoir facies show that changes in pore throat sizes are also generally reflected in pore size changes. These studies further reveal that several sequential dissolution events are the dominant control on the distribution of pore size variations in the reservoir. Knowledge of the mechanics of these dissolution processes combined with PRT log data therefore provide improved spatial constraints on porosity and permeability distribution in the reservoir.