

Diagenesis and Reservoir Quality Evaluation Using Combined Petrographic, Isotopic and Geochemical Records

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Isotopic and geochemical studies are important tools in petroleum exploration. Diagenesis is integrated into larger multi-disciplinary studies to address complex issues such as reservoir management in high cost and risk environments to evaluate economic success. Isotopic dating and geochemical tracing are effective tools to constrain timing and location of migration pathways of hydrocarbons into reservoirs. Time represents a master value in determining whether hydrocarbons will inhibit further diagenetic reactions, which can significantly effect reservoir quality by increased or diminished porosity preservation. Isotopic age and geochemical tracing data provide implications about the origin of hydrocarbons, fluid flow and mass transfer.

Results of combined K-Ar, Ar-Ar, Rb-Sr, rare earth element and stable isotope data from studies in Europe (NW Germany) and Australia (Copper Eromanga basin) will be presented to demonstrate applications of these tools for reservoir estimation and management. Both areas contain reservoirs with a range of specific high temperature diagenetic illites that significantly reduce reservoir characteristics. These areas allow investigation of illitization processes and thermal histories of deeply buried tight gas sandstone reservoirs. Illite is a major clay mineral component in these sandstone and is responsible for their low permeability. It displays a wide range of morphologies, modes of occurrence and origins, which can be dated and traced by geochemical tools.