Diagenesis evaluation in sedimentary basins for hydrocarbon exploration

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Low temperature isotopic and geochemical studies are important tools in hydrocarbon and mineral exploration. Integration of diagenetic studies with isotopic dating and geochemical tracing tools can constrain timing and pathways of hydrocarbons into reservoirs. Time represents a key value in determining whether hydrocarbons will inhibit further diagenetic reactions, which can significantly affect reservoir quality by increased or diminished porosity preservation. Isotopic age and geochemical tracing data provide information about the origin of hydrocarbons, fluid flow, brittle faulting and mass transfer. Results of combined diagenesis and isotopic studies using tools such as K-Ar, 40Ar-39Ar, Rb-Sr, REE and stable isotope data (O) from areas in Europe (NW German basin), Australia (Copper Eromanga basin), New Zealand (Taranaki basin) and China (Tarim basin) will be presented to demonstrate applications of these tools to unravel geochemical aspects of diagenetic processes. All study areas contain reservoirs with a range of specific high temperature diagenetic illites that significantly reduce reservoir characteristics and allow investigation of diagenetic processes and thermal histories of deeply buried tight gas sandstone reservoirs. Diagenetic regimes are similar in most study areas suggesting trends to evaluate diagenetic patterns. All studies focus on the geochemical record of authigenic illite as the major clay mineral component in these sandstones. The illite displays a wide range of morphologies, modes of occurrence and origins, which can be dated and traced by geochemical tools.