AAPG Annual Convention
Salt Lake City, Utah
May 11-14, 2003

Gavin L England[1], R Stuart Haszeldine[1], Janes Cleverley[2], Stuart A Barclay[3], Bruce W.D. Yardley[2], Quentin J. Fisher[2], Colin M. Graham[1], Tony Fallick[4] (1) Edinburgh University, Edinburgh, United Kingdom (2) Leeds University, Leeds, United Kingdom (3) CSIRO Petroleum, Australia (4) Scottish Universities Environmental Research Centre, Glasgow, United Kingdom

Applying Ion-Microprobe Technology in Reconstructing Quartz Cement History in an Upper Jurassic Sandstone Reservoir of the Outer Moray Firth Basin, North Sea, United Kingdom

The development of syntaxial quartz overgrowths in sandstone reservoirs greatly reduces intergranular porosity, and so impairs reservoir quality. The oxygen isotopic composition of authigenic quartz provides information on compositions and origins of pore fluids during cementation and so helps to reconstruct timing and rates. Many previous O isotope studies of diagenetic quartz have relied on bulk techniques of mechanical or chemical separation; these inevitably yield mixed results. Recently developed ion-microprobe techniques can analyse overgrowths in situ within polished thin-sections at a finer spatial resolution (20-30 microns). This allows analyses to be positioned solely on individual quartz overgrowths.

This study examines O isotopic composition of quartz cement from one typical coarsening-up shoreface sedimentation unit within an Upper Jurassic sandstone reservoir of the Outer Moray Firth Basin, UK North Sea. The same sedimentary unit was examined above and below the oil-water contact. The shallower well has an average of 14% quartz cement and 17% porosity, while the deeper well contains 20% cement, 12% porosity. At 11,500 ft, δ^{18} O values in cement range between+19 and +26 ‰ (average +23 ‰, n=55). At 13,600 ft, δ^{18} O values range from +17 to +25 ‰ (average +19 ‰ n=45). Fluid inclusion palaeo-temperatures enable interpretation of isotopically evolved porewater in the deeper well. The differences reflect either: 1) increased quartz cementation associated with increased burial; or 2) the effects of progressive oil fill halting quartz growth in the shallower well, while the deeper well in the water saturated zone continues with quartz cementation today.