Geophysical Research Abstracts, Vol. 8, 01936, 2006
SRef-ID: 1607-7962/gra/EGU06-A-01936

Extensive early diagenetic carbonate cementation of fluvial successions, Upper Cretaceous, Book Cliffs, Utah: an example of large-scale detrital carbonate remobilisation.

K. Taylor (1), R. Gawthorpe (2)

(1) Manchester Metropolitan University, Manchester. UK (k.g.taylor@mmu.ac.uk), (2) University of Manchester, Manchester. UK.

Extensive early diagenetic carbonate cementation of marine sandstones is a commonly documented process, as an internal supply of marine carbonate shell material is often available. However, such cementation of fluvial sandstone successions is generally considered to be minimal. Here we document an example where carbonate cementation of fluvial successions is intensive (cement bodies over 100 m) and extensive (occurring over distances of 10s of kms) with implications for modelling of sub-surface reservoirs.

The Book Cliffs of Utah and Colorado, USA, exposes an extensive, 200 km, succession of Upper Cretaceous fluvial, coastal plain, shoreface and offshore strata. Cement bodies up to 100m long and 20m thick are present within the lowstand fluvial strata of the Desert Member and Castlegate Sandstone. These cement bodies are composed of early diagenetic ferroan dolomite (up to 3 mol% Fe), preserving minus-cement porosity of up to 40%, possessing δ^{13}C values of +3.4 to -3.9$^{o}/_{oo}$ VPDB and δ^{18}O values of -8.5 to -12.5$^{o}/_{oo}$ VPDB. In addition to cemented units, whitecaps, up to 10m thick, are present beneath coals, having formed from the early diagenetic leaching of detrital dolomite. Field mapping of cement body distribution reveals that cement bodies are present in two stratigraphic settings: in amalgamated fluvial lowstand units; and in amalgamated lowstand/highstand sand bodies. In the latter case, cementation cuts across sequence boundaries. In both cases cement bodies are restricted to units laterally down-dip from whitecaps.

The only realistic source for the cements is detrital dolomite remobilised from the up-dip whitecap units, an interpretation supported by field observations and $\delta^{13}C$ data. This source has also been shown for cements in marine shoreface sandstones in the Book Cliffs succession. $\delta^{18}O$ data suggests that cements precipitated from meteoric fluid, although recrystallisation cannot be ruled out. The shape and distribution of the cement bodies, commonly governed by lithological boundaries and with their long axis in a down-dip direction, together with their relationship to whitecaps, supports an interpretation of detrital dolomite remobilisation by meteoric fluids. We propose that at times of relative sea-level fall these lowstand and lowstand/highstand sand bodies acted as confined aquifers. At these times basinward meteoric fluid migration remobilised diagenetically leached detrital dolomite from up-dip, leading to extensive dolomite cementation in down-dip portions of the fluvial succession.