

Fault-fracture diagenesis of Lower Carboniferous carbonate platforms, UK- potential analogues for giant carbonate reservoirs of the Caspian region?

Cathy Hollis and Alanna Juerges

School of Earth, Atmospheric and Environmental Science, University of Manchester, UK

Relatively little data has been published on the diagenetic overprint of the giant carbonate oilfields of the Caspian Region, even though it has been widely recognised that both early and late diagenetic processes play an important role in controlling reservoir quality (eg. Jones and Xiao, 2006). In order to better predict and visualise the control of diagenetic processes on porosity and permeability, well-studied and accessible analogues are required. Since the diagenetic evolution of the Lower Carboniferous (Visean) carbonate platforms of the UK have been widely investigated and documented, they potentially provide valuable data on the mechanisms and timing of porosity modification within a time-equivalent tectono-stratigraphic context.

This study concentrates upon the diagenetic evolution of the Derbyshire and North Wales Platforms, using integrated field, petrographical and geochemical characterisation. The platforms record widespread evidence of cementation within the marine and meteoric environment. In particular, a well-developed cement stratigraphy developed in response to tectonically and glacio-eustatically controlled sea level fluctuations. Cementation from aquifer-derived porewaters occluded much of the matrix macropore network in the shallow burial environment, and therefore late burial diagenetic processes are dominated by fault-fracture controlled fluid migration and circulation. The burial diagenesis of the Derbyshire and North Wales platforms is dominated by pervasive cementation of faults and fractures by calcite. This calcite is coeval with hydrocarbon emplacement and Mississippi Valley-type (fluorite, barite, galena) mineralisation. Locally, these phases are preceded by fault/fracture related dolomitisation. Although there is some indication of solution-leaching beneath aquitards to form metre-scale 'pipes', the burial environment was largely one of porosity degradation. A diagenetic model will be presented that relates the distribution of burial diagenetic carbonate cements and mineralisation to post-rift basinal subsidence and inversion, with the onset of the Variscan Orogeny. The diagenetic evolution of the platforms will be compared and the application of the data and models to the Caspian region evaluated, including an assessment of the likely diagenetic controls on porosity and permeability in the subsurface.

Jones, G and Xiao, Y., 2006, Geothermal convection in the Tengiz carbonate platform, Kazakhstan: Reactive transport models of diagenesis and reservoir quality. AAPG Bulletin, 90, 1251-1272