

As a result of these diagenetic effects the majority of the resultant sandstones are tight. The sandstones with the best porosity contain few lithic fragments. Quartz overgrowths are extensive and authigenic clays are abundant in these sandstones. These more porous sandstones occur at 2881, 3891.5 and 3900.5 metres depth in Pelican-5.

2. Lithic Fragments

Fine-grained material in these rocks which is not attributable to authigenic carbonate or kaolinite is derived from sand-grade lithic clasts which were deposited with the quartz grains. This identification/interpretation is based on the fact that the material varies in nature (mineralogy and texture) on a scale of 0.1 to 0.4 mm. This variation reflects the different kinds of lithics incorporated into the sandstone. Had the clays been derived from a clay matrix (fine-grained detritus which infiltrated between the sand grains in the immediate environment of deposition) then they would be homogeneous over the whole area of the thin section. It is likely that the fine-grained sedimentary and metasedimentary lithics encountered in Pelican-5 are likely to contain mainly illitic and illite-smectite interstratified clays - derived from the alteration of sericite and micas in the original rocks.

Note that there is likely to be a variety of reactive minerals in these Pelican-5 reservoirs (carbonate, kaolinite, smectite and more than one clay from the lithics) and this should be considered in assessing, for example, stimulation proposals.

3. Diagenetic Model

It is not possible to evolve a full understanding of the diagenesis of these sandstones without more detailed study, but some comments can be made.

These are fluvial (non-marine) sandstones and are hence likely to have been saturated initially with low pH waters of low ionic strength. In these conditions, and given flushing with equally fresh water, kaolinite (and quartz) are stable mineral species and precipitate when the concentration of aluminium and silicon ions in the porewater is sufficient. Other authigenic clays (smectite, randomly interstratified smectite/illite and hairy illite) appear to form after the kaolinite and quartz and commonly coat these minerals. These authigenic clays are commonly associated with the lithic fragments, and probably form from the alteration of sericite and micas in the original sediments.

The authigenic clay minerals tend to be most abundant in samples and portions of samples, where some porosity has remained after the lithic fragments have been squashed between the quartz grains during compaction of these sandstones.