

Fibrous Illite in Clio Field, Carnarvon Basin, Western Australia

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Fibrous illites are a late authigenic clay occurrence in the Triassic Mungaroo Formation. In other global deep basin settings, fibrous illite grows at the expense of potassium feldspar and kaolinite. Detrital potassium feldspar and authigenic kaolinite are found commonly in the Mungaroo, making it an ideal environment for illite precipitation.

In SEM images, fibrous illite can be seen growing off of the edge of kaolinite particles. Commonly in the Mungaroo, fibrous illite grows until the potassium feldspar is consumed. Fibrous illite grows in a temperature window that is often 120-140C in global basins, but there is variability in this temperature range due to reaction kinetics. In Clio Field, the temperature window is broader, and seems to bracket 120-155C. Earliest illite fibers are seen growing off of the edge of kaolins at 120C, and field trends illustrate that by 155C, kspat weight percent approaches zero with some kaolinite left over. For this reason, it seems as though the illite growth reaction in Clio is kspat limited, not kaolinite limited.

Fibrous illite dramatically increases pore system tortuosity and decreases permeability. Fibrous illite occurrences are common in the Mungaroo Formation and the development of illitic tortuous clay is predictable within the context of temperature and sandstone composition. Fibrous illite is also easily damaged or “matted down” if not dried in a way that preserves the fiber tortuosity as shown in prior publications. Critical point drying has been proposed as a non-damaging core drying technique, but there are other methods. The potential exists for challenges in Mungaroo Formation reservoir characterization if core permeability data does not match the subsurface condition because of clay alteration.

Future work will include a program to date the illites with K/Ar methods and further constrain the timing of diagenetic events of the Carnarvon Basin. This will help Chevron’s exploration and appraisal in these field areas.

Notes