



Palaeogeographic mapping of the basal Epsilon Formation, southern Cooper Basin, South Australia: What are the controls determining the organic enrichment of the uppermost part of the Murteree Shale?

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Abstract

To support the voracious worldwide demand for energy resources into the future, a significant focus by energy companies is likely to be on the exploration and development of unconventional resources. One such unconventional resource that has started to attract more attention in recent times is the extraction of 'shale gas' – natural gas that is trapped within fine-grained sedimentary lithologies. Of particular interest is the *Munkarie* gas field, located in the southern Cooper Basin, South Australia. Within this field, the *Munkarie-2* and *Munkarie-4* wells contain a relatively high Total Organic Carbon (TOC) concentration from the top of the Murteree Shale. This project was charged with determining what were the controlling factors regarding the organic richness in the uppermost part of the Murteree Shale. Ironically, it is the overlying Epsilon Formation that may possibly determine what may be the cause of the 'sweet spot' for the Murteree Shale. Core logging was performed at *Munkarie-2* and *Toolachee-17* to gain a better understanding of the core. This confirmed that part of the *Munkarie-2* cored interval was a barrier island complex that existed in a microtidal lacustrine environment – the Murteree Lake.

Using *Schlumberger Petrel*, both 2D and 3D models were created from a total of 420 wells within the study area. The large quantity of data helped construct an assortment of geocellular models, subsea depth maps, isopach and sandstone percentage maps, culminating in the construction of a palaeogeography map. The palaeogeography map is a palinspastic restoration for the basal segment of the Epsilon Formation, exposing the depositional environments and reconstructing the fluvio-deltaic processes that were operative at the time. As deltaic progradation occurred, it is hypothesised that fluvial run-off from nearby floodplains created prosperous conditions for bacteria and algal organisms. Thus, a semi-enclosed lagoon caused by the existence of the barrier islands may have become anoxic due to the prolific multiplication of the organisms. Nourished by a nutrient supply from nearby fluvial systems, a proliferation of algae may have led to a dramatic increase in organic carbon on the lake floor. This study is proposing that the presence of barrier island complexes, situated in the basal part of the Epsilon Formation, could be connected to a localised organic TOC enrichment zone that has been recognised in the upper Murteree Shale (just below the lithostratigraphic boundary of the Epsilon Formation).

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