FESAus Monthly Technical Meeting

Borehole imaging and interpretation of a carbonate reservoir

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Presentation:

The depositional and diagenetic controls on carbonate platform evolution are notoriously heterogeneous and difficult to determine from standard subsurface wireline logging techniques. Here, a combined borehole image (FMI Fullbore Formation MicroImager) and petrographic study allowed evaluation of depositional and diagenetic trends across an Australasian subsurface buildup that is a major recent gas discovery. The Elk and Antelope gas fields are hosted in Tertiary reefal, platformal and associated deep water carbonates in the present day foothills region of the Fold and Thrust Belt in the Gulf Province of Papua New Guinea.

A full suite of FMI image logs (>2800 m), and 292 thin sections (mainly from sidewall cores and cuttings) from both platform flank and shallow water deposits were evaluated during this study. Despite the obvious scale differences between the datasets there was some correlation between the independent petrography and FMI studies for: a) picking major facies boundaries, and b) interpretation of depositional environments, the latter particularly for slope and deep water deposits. However, thin section petrography proved critical in understanding primary depositional textures and secondary alteration features through the shallow-water carbonates where complex diagenetic overprinting had strongly impacted original fabric, and/or in regions affected by “gas smearing”. The petrographic study allowed more detailed examination of diagenesis and its impact on rock fabric (which links to the FMI textures). Component analysis and depositional textures identified in thin section are good indicators of original depositional environment. Full FMI coverage allowed textural definition on a dm/m scale, identification and characterisation of vertical changes, and likely large-scale variations in depositional environments and sequences. It was clear from combining the results of the two studies that diagenesis as well as depositional fabric had a strong impact on resultant FMI facies. The diagenetic overprinting would have been difficult to extract from the FMI data without the benefit of the petrographic work. This study shows the merits of selective petrographic analysis to calibrate the quality of facies interpretation from FMI images, and proved critical for enhancing and in places revising initial FMI interpretations.

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