Provenance of the Springbok Sandstone, Surat Basin, QLD

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INTRODUCTION AND AIMS

The late Jurassic Springbok Sandstone is located within the Surat Basin in Queensland and comprises a thick sequence of fluvial-lain feldspathic to lithic sandstones interbedded with minor siltstone, carbonaceous mudstone and coal (Green et al., 1997; QGC Ltd, 2012; SANTOS GLNG, 2014). Along the basal unconformity of the unit there is a high amount of spatially variable erosion into the underlying Walloon Coal Measures (WCM), a prolific and highly developed Coal Seam Gas (CSG) resource (McKellar, 1996; Hoffmann et al., 2009). The Springbok Sandstone is known to have both aquifer and aquitard characteristics as a result of regional variability in porosity and permeability (Power & Devine, 1970; QGC Ltd, 2012). Therefore, the presence of a water bearing formation above and possibly in hydraulic connection with the WCM has the potential to significantly impact the dewatering processes that enable gas to flow. In addition, a clean quartzose sandstone that occurs at the top of the sequence, referred to as the Weald Sand, is only mapped on the western side of the basin (SANTOS GLNG, 2014). Its occurrence, provenance and sedimentary origins hold a key to the palaeogeography of the Springbok to Westbourne transition. Overall, this project aims to investigate the provenance of the Springbok Sandstone, in conjunction with the results from a paleoflow analysis, providing detailed models of the drainage pattern within the basin. Through understanding the sediment source there will be a greater understanding of the depositional history of the unit.

PROJECT LOCATION

The Surat Basin extends across south-eastern Queensland into northern NSW covering an area of ~300,000 km² (Fig 1). The Surat Basin unconformably overlies the late Permian to early Triassic Bowen and Gunnedah Basins, as well as two basement terrains to the east and southwest of these basins (Exon, 1976). Respectively, these terrains are the convergent margin New England Fold Belt (NEFB) and the Central West Fold Belt (CWFB) (Exon, 1976).

FACIES ANALYSIS

Sedimentary fill in the Surat Basin occurred within fluvo-lacustrine environments from the early to early-late Jurassic and was overlain by coastal to shallow marine environments from the mid-late Jurassic to early Cretaceous period (Fig 2).

SELECTED WELLS

The wells selected for detailed analysis in this study (Fig 3) were nominated based on their data availability as well as permitting laterally widespread facies analysis.

METHODOLOGY

The unit is divided into two overall fining upwards sequences known as the upper Springbok and the lower Springbok Sandstone (Figure 7 and 8) (QGC Ltd, 2012). The blocky log signatures of the lower Springbok Sandstone are suggestive of basin wide, amalgamated stacked channel sequences, where the lower proportion of muds suggests deposition occurred within braided river settings (QGC Ltd, 2012). The heterogeneous log signatures of the upper Springbok Sandstone are suggestive of less amalgamation of the channels and the increase of lower energy facies is indicative of a meandering river environment (QGC Ltd, 2012).

Current evidence indicates that the Springbok Sandstone / WCM interface is an erosional unconformity as indicated by the red line in Figure 4 (Sliwa et al., 2013). This study will continue on the work by Sliwa et al., (2013) through providing information on the depositional controls for the Springbok Sandstone.

Well cores will be scanned using the HyLogger Technology; a system which uses reflectance spectroscopy and high resolution imagery to obtain detailed mineralogical analysis of the core. This non-destructive method will provide quantitative and objective mineralogical data which eliminates errors often encountered by visual interpretation. Figure 5 shows results from Pleasant Hills 25 for the Springbok Sandstone interval. Previous investigations have indicated that the Springbok Sandstone is predominantly Feldspathic Litharenite in composition. Figure 6 is an image of a thin section created by Santos from Springbok 1 Jungle 1 and shows the sample in plane (left) and cross (right) polarised light. The blue colouring depicts secondary porosity due to dissolution of feldspar grains.

Radiometric dating, such as zircon dating, will enable a geological age constraint to be applied to the sediment and will assist in understanding the geological age gap that is constrained by the erosional unconformity. This age will be compared to pre-depositional tectonic and volcanic events experienced by the surrounding topography.

REFERENCES


References


