Wembley Field and the Laterally Adjacent Shale and Sand: Major Transgressive-Regressive Cycle within the Triassic Doig Formation

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This work addresses the problem of Anomalously Thick Sand Bodies (ATSBs) in the Triassic Doig Formation and provides an alternative depositional model. It is suggested that instead of being estuarine channel facies (Harris and Bustin, 2000); abandoned channels that cut into lower shoreface margin (Gibson and Edwards, 1990) or fault-related sand bodies (Willis and Wittenberg, 2000), these bodies actually formed as a result of a prograding barrier bar off an antecedent shelf.

The Triassic-age Wembley Field of the Doig Formation is of interest because it is a sand body that overlies and is laterally encased by Doig shale. Both the sand body and the inter-Doig shale are overlain by Halfway shale. Lateral to the sand body is an inter-Doig sand which separates the Doig shale from the overlying Halfway shale. The encasing Doig shales have been separated into easily recognizable units that can be related to a major Regressive-Transgressive cycle.

Lateral to the Wembley sand body, the Doig shales can be subdivided into 3 units. The lowermost unit, a shale (unit A), predates deposition of the Doig sand body, thinning westerly from an eastern platformal setting, which can be traced beneath the sand body. It is parallel laminated, with no evidence of marine life or any significant sedimentary structures. The second unit, unit B_W, is the lower portion of the shale laterally adjacent to the main sand body to the west. B_W is age equivalent to the sand body. Slumping and deformation with high bedding angles, slump blocks and a mud conglomerate are all observed within this shale unit. To the west, and adjacent to, the main sand body, is a third unit of the shale, unit $C_{W.}$ This unit is younger than the Wembley sand body and has low to horizontal bedding angles, with no signs of slumping and very little deformation.

To the east of the sand body, unit B_E, is the lower portion of the shale laterally adjacent and age equivalent to the sand body. No slumping or deformation is observed. Bedding is near horizontal within this unit. The third unit of the shale (unit C_E) is laterally adjacent to the sand body to the east. Unit C_E is younger than the Wembley sand body and has evidence of intense burrowing as well as deposited bioclasts. When Wembley sand deposition was terminated, deposition no

longer occurred on the sand body but became focused on the basin to the west and the embayment to the east. This resulted in the deposition of the upper portion of the laterally adjacent east and west shale (units C_W and C_E).

An erosional unconformity at the top of the Doig shale is marked by a pebble-rich conglomerate layer. This unconformity resulted from a relative drop in sea level and represents the lowstand, regressive component of the depositional cycle. Overlying the unconformity, after sea level stabilized, is a thin sand unit, the inter-Doig sand (unit D). The inter-Doig sand, present in the west and the east, postdates the laterally adjacent Wembley sand body. Unit D has low amounts of shale and silt at both the base and top, but has interbedded silt and sand in between. Sometimes the interbedded unit has a bioclastic-rich layer. Due to high levels of fragmentation, it is difficult to determine the origins of the bioclasts, although it is likely molluscan in origin. Irregular orientation of the shell debris may be a result of storm deposits washing over the main sand body.

A second unconformity at the top of the inter-Doig sand is equivalent to a similar unconformity at the top of the main Doig sand body and is also marked by a conglomerate layer. This latter conglomerate represents a transgressive cap, which is part of the transgressive portion of the Halfway depositional cycle that ultimately was deposited over the entire area.

By relating slumped mudstone conglomerates observed in both unit B_W and at the base of the main sand body; observing bioturbation at the top of unit C_E but not in unit C_W, and finding evidence of thinning of unit A to the west it can be suggested that, contrary to previous depositional models of channels deposited in bodies of shale, the rocks may be representative of a palaeo-barrier bar environment deposited on a shelf.

A modern day analogue to the Wembley field is that of a barrier bar prograding off an antecedent shelf at an angle to the coastline, as seen off the coast of Newfoundland [as studied by Davis & Harper, 2005].

References

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