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'Upper' Montney-'lower' Doig: quo vadis?

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In the formal type section (1962) of the Montney and the Doig in well 6-26-87-21W6 in NE BC, the top of the Montney and base of the Doig are placed at the base of the high-gamma 'Black Shale Member' of the Doig (formal designation; not shale, mainly phosphatic, bioclastic sandy siltstone- informally, the 'Phosphatic Zone' of the Doig or similar). The BC Department of Energy currently recognizes this boundary as the official Montney-Doig divide for industry usage in BC, and has listed two Montney zone designation wells (33004: 10-18-79-14W6, and 33012: 6-28-86-21W6, with defined depths) as reference wells (David Richardson, BC MEM, pers.comm., 2011). However, core-based projects by the first author and associates in the early 1990s, and other industry sources, showed that there was a westward-thickening, multicyclic wedge of siltstone (0 to 20+m thick) below the Doig Phosphatic Zone in western Alberta and into NE BC that differed (less so to the far west) in lithofacies and log character from underlying Montney, and had some characteristics similar to the upper Doig. In earlier GDGC reports, this unit was designated informally as the 'Lower Doig Siltstone' (LDS). The base of the LDS is marked by a gamma spike and a phosphatic lag, and becomes increasingly intra/lithoclastic and erosional to the east and into western Alberta; in that area, it is interpreted to be an unconformable shoreface ravinement over a subaerial unconformity, occasionally marked by spectacular tabular clast conglomerates. This boundary is the 'D4' marker of earlier reports, also so designated here for convenient reference. Although requiring biostratigraphic confirmation, the D4 marker is believed to correspond to the Smithian-Spathian boundary, and thus to a global third-order sequence boundary.

In western Alberta, the AEB has designated a Crown Land type Montney well at 6-32-76-11W6 and a Doig type well at 3-22-78-10W6. In both of these wells, the Montney-Doig boundary as defined by the AEB is placed at the base of the LDS (preceding definition), and thus at the D4 marker/unconformity. The choice of the Doig type well is complicated by the presence of a relatively localized productive sandstone, the 'Gordondale' sandstone of earlier GDGC reports, between the LDS and the regional Phosphatic Zone of the Doig. The Gordondale sand is bounded by phosphatic to intraclastic lags, and probably is a discrete

unconformity-bounded sequence. The base of this sand, and/or the base of the Phosphatic Zone, is interpreted to be at or close to the global Spathian-Anisian second-order sequence boundary.

In west-central Alberta, the LDS thins depositionally and by erosion, eventually pinching out eastward. The basal D4 unconformity is in turn truncated by the mid-

Triassic Coplin and younger unconformities, so that eastward, the Worsley Member of the Charlie Lake unconformably overlies the deeply eroded Montney.

To the west, in the central Peace River Block/Arch area, the LDS thickens and the underlying D4 boundary extends out to a shelf margin on underlying 'true' Montney in the Pouce Coupe area (ca. T81, R12W6). Further westward, along a trend line from Pouce Coupe to ca. T78, R17W6 in NE BC (within the 'Hudson Hope Embayment'), the projected D4 boundary plunges progressively down stratigraphic section as a slope-onlap surface at the base of a slope onlap wedge (Ashton Embry, pers.comm, 2010) or lowstand wedge. By T78,

R16W6, the D4 boundary (now a conformable surface), if correctly projected from western Alberta, lies about 170m below the base of the Phosphatic Zone of the Doig, with only ca 100m of Montney as defined in western Alberta below the D4 marker to the top of the Belloy; that is, only about 38% of about 280m of Lower Triassic section in that area of NE BC is Montney by extension from the Alberta AEB Montney reference well- but obviously, the entire section is Montney by BC MEM definition.

The top of the lowstand wedge is marked by a gamma spike and phosphatic lag; it becomes more conformable westwards. The wedge itself, thickest (35m+) within the Hudson Hope Embayment, is constrained by underlying structure, particularly as revealed by residual structure mapping of the top of the Paleozoic. The eastern sector of the wedge includes the Dawson multicyclic burrowed sand-silt reservoir facies, again structurally constrained. From a classic sequence stratigraphic approach, a basin floor turbidite fan complex may be predicted within the lowstand wedge to the west, perhaps exposed in outcrop?, and possibly present in the subsurface?

So, why 'quo vadis'?- where is this (stratigraphic nomenclature) going? What is Montney, what is Doig? Sometime, somewhere, there is a requirement for an inter-provincial, industry-involved resolution of the upper Montney-lower Doig succession utilizing lithofacies correlations, sequence stratigraphic framework, possibly new biostratigraphy, and seismic stratigraphy. This is more than an academic exercise; it has legal, provincial regulatory implications.

The presentation will illustrate aspects of this issue using a key east-west log-based section and core photographs to document relationships, with additional comments on facies and reservoir significance.