The Cadotte Member in Subsurface:
Beyond a Sheet of Sandstone, Beyond Trends of Paleo-Shoreline

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Introduction

The Cadotte Member of the Peace River Formation comprises the deposits of an extensive shoreline complex, spanning in excess of 350 km along depositional strike, and 200 km along depositional dip. As deposition of the Cadotte shoreline complex was generally free from “bottom effects” (the disruption of wave approach by palimpsest sediments exposed above wave-base), and post-depositional top-truncation was limited, it makes a very good study subject for the depositional architecture of energetic, progradational shoreline systems.

Methods Employed

In constructing cross-sections within the Elmworth area, it was recognized that there was a relationship between the wireline signature of the Cadotte Member, the datumed elevation of its top and productivity of well penetrations. This realization has led to a detailed mapping effort, focused at first on the Elmworth area, and now expanding to encompass the extent of the Cadotte complex west of the sixth meridian. Each well examined has contributed 6 stratigraphic picks and 10 shape descriptors/qualifiers to the dataset. This has allowed the production of traditional structure and isopach maps, as well as novel and highly insightful wireline-facies maps. At the submission of this abstract, preliminary maps have been produced with data from approximately 2000 wells, encompassing an area of approximately 8000 km2.

The resulting maps shed light on shoreline depositional trends, gross facies distribution, and and trends of accommodation space availability and base level variability during progradation of the Cadotte complex. The integration of these maps with production data reveals clear architectural control on hydrocarbon productivity. As previous regional mapping efforts in the Cadotte Formation have lacked the resolution and constitution to draw interpretation on detailed depositional architecture, these maps represent a major advancement.

Preliminary Results

The Cadotte Member represents a stepwise progradation with significant internal detail and contrast preserved in the resultant sediment body. Production trends show a strong correlation with the resolved depositional packaging, with many pools constrained to a single elongate architectural unit, or the boundary between successive units. Deposition within the productive areas of northwest Alberta (particularly the Elmworth field) is related to periods of low base level, and a comparatively dirty gamma-ray profile, which may reflect an elevated deltaic influence. Evidence for repeated base level change during Cadotte deposition is clear, with the amplitude increasing in a westward direction. Associated with drops in base level is evidence for local incision into the Cadotte shoreface. These incision trends appear to have been sealed at their basinward terminus through subsequent base level rise and back-stepping of the shoreline.

Looking Forward

This project is anticipated to produce both academic advancement and concrete deliverables directly applicable to exploration and exploitation within the Cadotte Member. Along the practical front, this study is generating a series of maps that are novel in approach and yield a high-resolution picture of the Cadotte Member. Through these maps a clear picture of Cadotte shoreline trends and trajectories is developing. The integration of architectural data and core description should enable variable reservoir quality to be tied to depositional controls. A wireline log-derived, core-tested facies scheme should be possible, vastly upping the value of readily available borehole geophysical data. As a detailed understanding of Cadotte Member depositional facies and dynamics continues to evolve through wireline- and rock-based study, it should be possible to establish criteria by which explorationists can efficiently vector their search for favorable depositional facies.

Conclusions

The Cadotte Member is far from a monotonous sandstone sheet. Step-wise progradation with significant internal detail and contrast is resolvable, resulting from changes in the rate and texture of sediment supplied to the shoreline, along with changes in exposure to basinal reworking. All of these factors appear to have been controlled by tectonically-driven excursions of base level. Architectural units within the Cadotte Member can often be traced for 50 km or more along depositional strike, but tend to be very narrow (commonly <1 km where well density provides adequate resolution). Most trends of well productivity within the Cadotte Member follow well-constrained architectural units elucidated through wireline facies mapping.

The generation of accommodation space for the Peace River Formation ultimately resulted from Cordilleran loading to the west with a subordinate influence from the depressed Peace River Arch. Both the thickness of the Peace River Formation's constituent members and the magnitude of base-level excursion reflected in the Cadotte Member increase with proximity to the active Cordilleran front. This demonstrates that base-level change during Cadotte deposition was driven largely by an intrabasinal, flexural response to loading/relaxation activity in the Cordillera rather than eustatic forcing.

While sealed incisions of local scale are present, regional incision of the Cadotte Member is not recognized within the area treated thus far. Incision cutting down from near the top of the Paddy Member does, however, bottom-out in the Cadotte along a very limited trend.

Note: This paper will be offered through complimentary oral and poster presentations. The oral presentation will focus on the foundation of the mapping and relay some of the insights and

conclusions drawn from the effort. The poster presentation will exhibit the preliminary maps and accompanying cross-sections for discussion.

Acknowledgements

This project is being undertaken as part of a larger collaborative effort focused on the lower Cretaceous Spirit River and Peace River formations, along with analogous modern depositional systems. This greater project involves several researchers from the University of Alberta, and Simon Fraser University. The research has benefited greatly from the financial support of Canadian Natural Resources Ltd., Conoco-Phillips, Devon, Nexen, Talisman, N.S.E.R.C. and Alberta Ingenuity.