Deep Structures and Their Possible Impact on Formation Development and Natural Gas Production, Medicine River Area, Alberta

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ABSTRACT

The Red Deer-Buck Lake area of west-central Alberta has been a prolific producer of conventional oil and gas. In recent years, the focus of exploration has shifted towards drilling for shallow unconventional gas, including coalbed methane. It is postulated that the same deep structural controls that made the area rich in multi-level conventional targets will control the distribution of unconventional gas to some degree.

Previous workers have shown that the study area is floored by three NE-SW trending Precambrian domains known as the Thorsby, Rimbey, and Lacombe domains. Deep faults bounding or parallel to the Precambrian domains sliced the area into four large blocks (Buck Lake, Rimbey, Sylvan Lake and Penhold) that appear to have had slightly different motions during Phanerozoic time. The deep faults appear to have been reactivated by roughly northeasterly directed compressional events at the continental margin during Phanerozoic time.

Huge volumes of natural gas have been produced from Mississippian, Jurassic and Cretaceous reservoirs in this area, particularly where the extentional zone along the Rimbey Arc intersects Mississippian and Jurassic zero-edges. Gas production of the Lower Mannville spreads out widely between the deep faults in addition to the Mississippian and Jurassic zero edges. Upper Mannville gas production also appears to follow structural trends. As well, Cardium gas production is confined to the places where thick Cardium sandstone is present, whose distribution appears to be influenced by structural trends, assumed to be faults. Gas production in Viking sandbodies, (though linear) does not appear to follow the same structural trends. Gas production in the Belly River Formation may have been controlled by both structures and distribution of fluvial sandbodies. In addition to structural and stratigraphic trends, the edges of some reservoirs are associated with modern drainage.

Among the Upper Cretaceous-Tertiary coal zones, three coal zones (Drumheller, Carbon-Thompson and Ardley) are relatively well developed in the area. The thickest (10-15 m in net thickness) Ardley coals are present in the Buck Lake block. The distribution of Ardley coal in the other part of the area trends NW-SE, with a net thickness of 2-15 m. The Carbon-Thompson net coal thickness varies across the area, 2-4 m in net thickness and is associated with the Rimbey block. Drumheller coal thicken to the east and the net thickness ranges 3.1-8.4 m in the

Penhold block, southeast of the area. If productivity and prospectivity trends in these coal zones can be linked to deeper structural trends, then operators might be able to use deep structural elements possibly mappable by dense conventional drilling data to find new exploration fairways for unconventional gas resources.