

Stratigraphic Trapping Geometries in the Sunchild-Ferrier-O'Chiese Area: A Mississippian Banff Formation Play-Type Downdip from Subcrop

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ABSTRACT

The Banff succession of West Central Alberta comprises a thick (up to 190 metres) package of argillaceous basin-filling carbonates. Correlations suggest that overall basin-filling took place largely from east to west.

The succession generally lacks reservoir quality however industry activity in the mid 1990's revealed the presence of a number of skeletal-rich dolomitized grainstones in what has been termed the Middle Banff of the Sunchild – Ferrier – O'Chiese area. Industry activity refocused on this area following the drilling of the 02/16-3-44-10W5 well that DST'd in the Middle and Lower Banff at 21.6 mmcf/d. On production since November 1998 this well is part of the Ferrier Banff 'A' Pool and has produced over 13 Bcf of gas.

Core examination reveals that the producing interval is comprised of flat-bedded to low-angle cross-bedded, bitumen stained dolograins with moldic and intercrystalline porosity up to 15% and 760 md. The grainy intervals pass laterally into argillaceous carbonates of the more regional Middle Banff.

The presence of these seemingly isolated clean grainstone intervals within the Middle Banff succession points to a significant variation in the otherwise monotonous clinoforming regional succession of argillaceous mudstones. The clean blocky nature of the unit on logs combined with its composition in core suggests two possible depositional settings:

1. Isolated shoals developed along the outer ramp – clinoform margin of the Middle Banff;
2. Localized incised features on the ramp margin possibly feeder channels for more seaward debris aprons.

Both settings may be expected to give rise to bedded crinoidal deposits, however, by dating sections on the base of the overlying Pekisko, it is apparent that these features lack positive topographic relief and instead appear "incised" into the underlying unit (be it Middle or Lower Banff). Laterally equivalent or just pre-dating strata comprise more argillaceous mid-ramp sediments containing scattered crinoids. The lateral change from grainstone to

regional argillaceous ramp is rapid and can take place in distances less than 1 kilometre.

It is proposed that these incised features represent feeder channels whereby coarse sediment from the upper ramp (crinoids) was reworked to the basin during storms. As the seaward debris apron grew, the sediments “backed up” into the incised channel, eventually filling it. Rapid deposition of thicker units preserves the bedding from reworking due to subsequent bioturbation. The “channels” appear to show a relatively uniform upper stratigraphic level (or levels) but to incise to different levels depending on their position on the outer ramp (seaward versus shelfward).

Based on geometry alone it is tempting to assign these deposits to a “low stand systems tract”, however evidence for widespread exposure of the shelf is lacking. Furthermore the dominantly crinoidal composition of these deposits argues for the presence of a shelfward subtidal “carbonate factory”.

Perhaps of more paramount importance to this play-type, however, is subsequent diagenesis. Production and reservoir quality is related directly to the presence of dolomite. As the enclosing Banff section is predominantly limestone, it must be assumed that dolomitizing fluids were funnelled locally to the Middle Banff section by faulting. Consequently the identification of faulting and its relative timing is critical to the prospectivity of this play-type. A number of pools are also present in the overlying Pekisko Formation and appear to be diagenetic traps related to local dolomitization of an otherwise widespread carbonate deposit again suggesting fault plumbing.

Recognition of the key criteria governing this play-type suggests that it may be extended paleogeographically around the perimeter of the Banff basin (or rather Middle Banff basin) over a significant portion of West Central Alberta. Furthermore this development is in an area between the producing Pekisko subcrop to the east and Elkton – Shunda subcrop to the west, so has been only lightly explored at the Mississippian level.