CSPG Canada's Energy Geoscientists
TOURMALINE OIL CORP.
CORE CONFERENCE
16-17 May 2019 • AER Core Research Centre • Calgary, AB
Celebrating 50 Years

The use of cores, cuttings and outcrops to complement and refine our geological and structural understanding of the Banff, Exshaw and Pekisko formations

Jean-Yves, Chatellier *Tecto Sedi Integrated Inc.*
Amjed, Cheema *Pro-Geo Labs*
Mirza, Shahbaz, *Pro-Geo Labs*

Introduction

The present work is the first phase of an attempt to address some basin wide questions of timing and type of faulting/ tectonic activity affecting the Lower Mississippian strata in Western Canada.

Method

Descriptions and geochemical analysis of cores, cuttings and outcrops have been integrated with observations and data from other disciplines, including logs to get a regional picture. The geochemical data was acquired using X-Ray Fluorescence, i.e. essentially a handheld Bruker gun together; the quality control was made using a benchtop Rigaku XRF machine in the lab.

Examples

Two well exposed outcrops along Highway 1A gave a good basis for a densely spaced XRF analysis that helped define a chemostratigraphy for the Banff Formation in the Rockies; of most interest are Yttrium (Fig.1) and Manganese. Additionally, shades of grey profiles for the outcrops allowed to outline a period of calciturbiditic events within the Banff Formation characterized by dark grey grainstones (Fig.2) and chert (Chatellier, 2004).

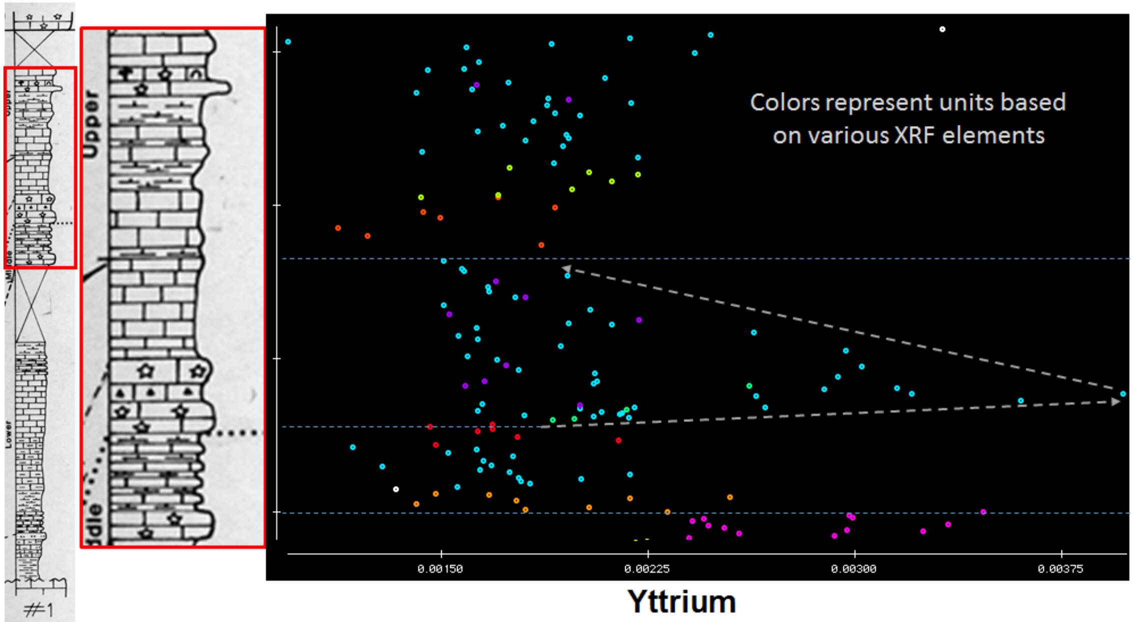

Fig.1 Middle and Upper Banff at Grotto Mountain road outcrop – expression of calciturbiditic facies as a function of XRF yttrium

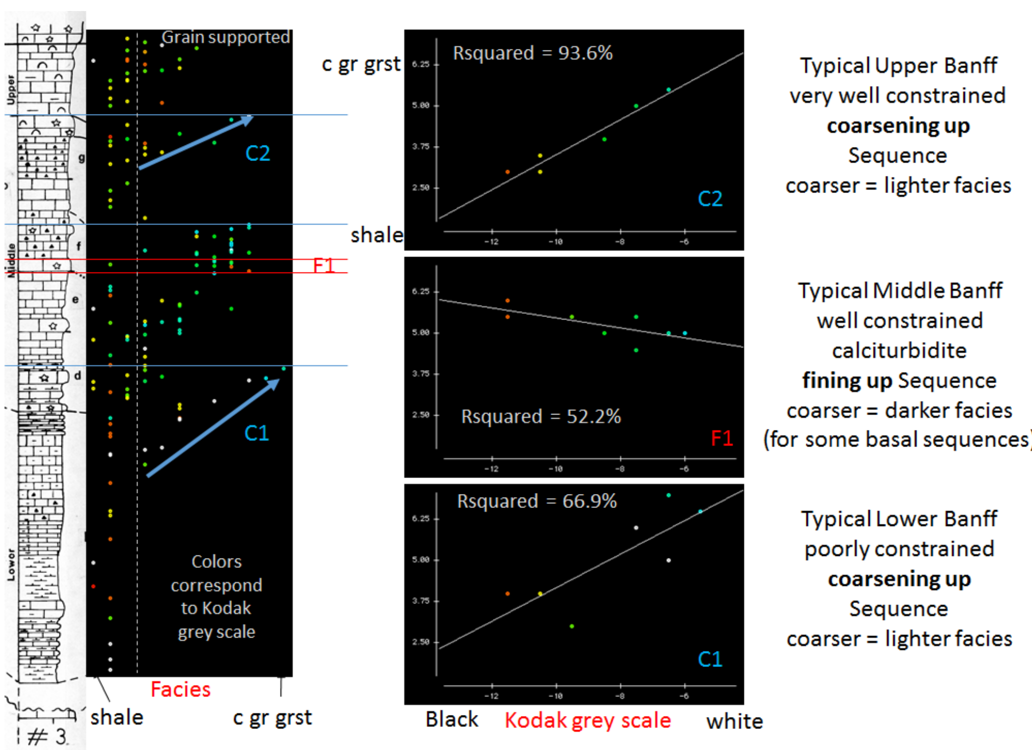

Fig.2 Shades of grey profile of West Minnewanka outcrop using the Kodak color standard

Note the clear distinction between grainstones associated with progradation and others with catastrophic events

For the subsurface, cores from seven wells were described and analyzed using the handheld XRF to complement detailed cuttings descriptions from 1000+ wells. One of the focus was mapping and characterizing hydrothermal dolomitization as first observed in well 7-36-42-10W5 and at the outcrop of the Corkscrew Quarry (Clearwater area). Yttrium (Fig.3), Strontium and Manganese have helped define chemostratigraphic units.

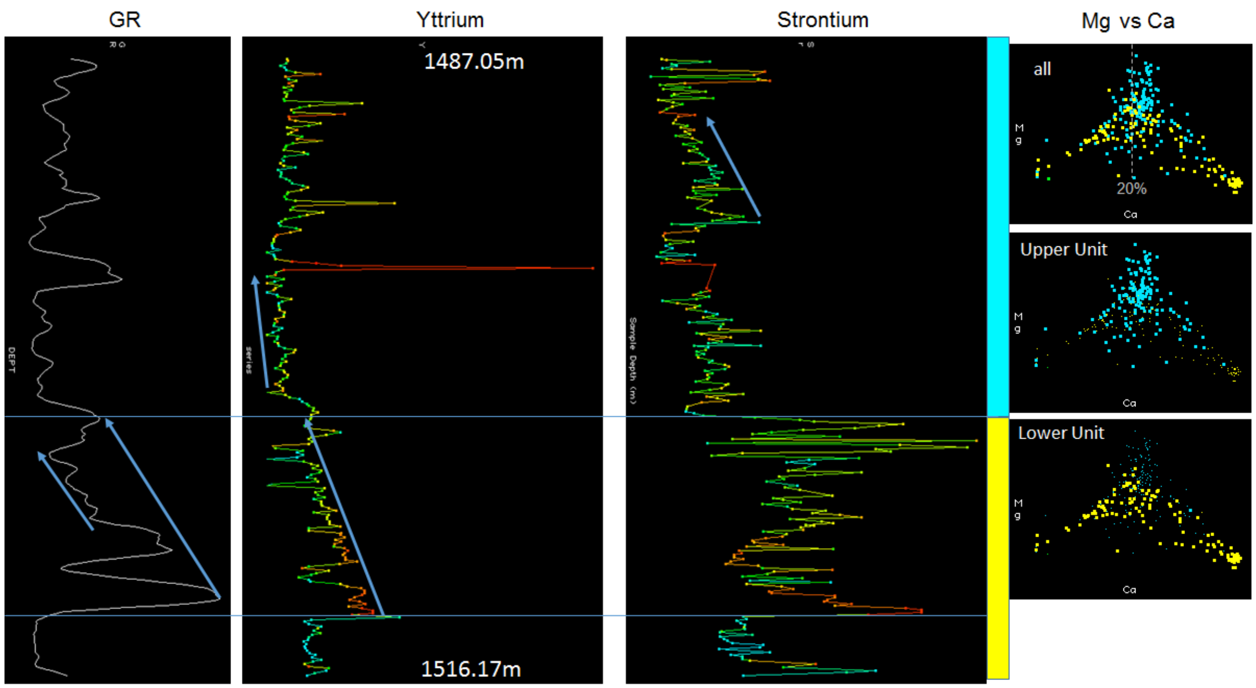

Fig.3 Stratigraphy breakdown using XRF profiles of Yttrium and Strontium for well 3-36-55-7W5

In cuttings, synsedimentary fault activity has been recognized by linear trends of oolites within the Exshaw (Fig.4) as well as by commonly chert rich clinoforms initiated along faults which locally controlled some Leduc reefs.

Integration with Aeromag data has outlined very thick porous units within the Banff Formation that perfectly overlies the southern edge of the Snowbird Tectonic Trough. Some faults affecting the Banff have been best expressed by overdolomitization and other ones by open fractures (Chatellier, 1992). Oil stains as recorded in the cuttings description allowed to map some preferential migration paths within the basin. Relative timing of various tectonic episodes has been tentatively proposed using complementary observations when available.

Figure 5 combines hydrocarbon production (red being higher cumulative BOE) and Pekisko dolomite percentage based on cuttings descriptions (largest dark blue diamonds having 100% dolomite). Too high percentage of dolomite (red circle) indicates dolomitization of mud-supported facies found in depressions away from the reefs with no hydrocarbon discoveries in Paleozoic rocks whereas linear patterns indicate faut related dolomitization along faults.

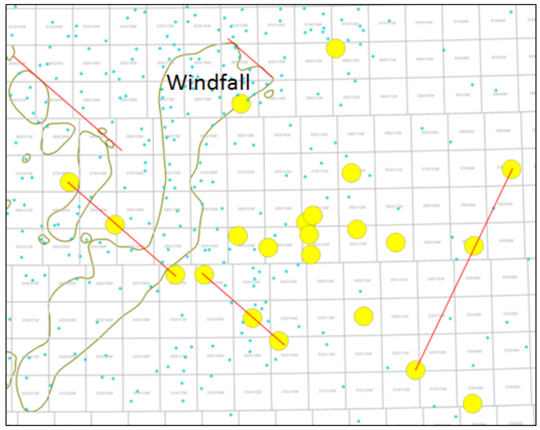

Fig.4 Alignments of Exshaw oolite in line with known regional fault orientation

Note the parallelism of the NW-SE oolite lineaments with the northern edge of the Windfall Leduc platform

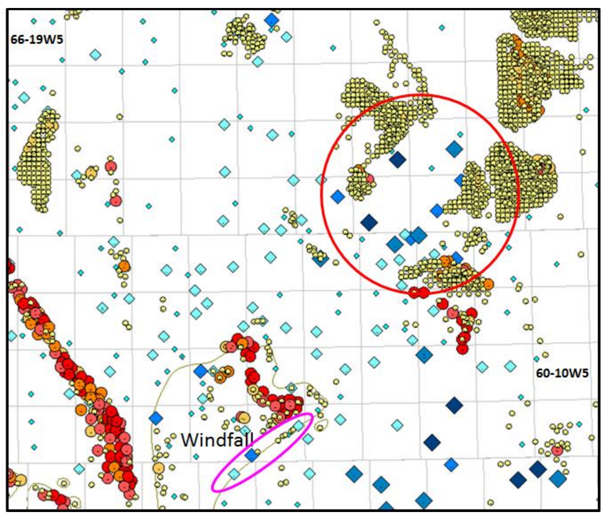

Fig.5 Pekisko Dolomite content based on cuttings description compared to Paleozoic hydrocarbon cumulative production

Example of fault controlled dolomitization (purple) and sag related dolomitized facies (red circle)

References

Chatellier, J-Y., 1992, Structurally controlled diagenesis of a carbonate ramp (Banff Formation, Alberta, Canada), Sedimentary Geology, Vol. 79, p. 77-90.

Chatellier, J-Y., 2004, Chert, a diagenetic and sedimentological indicator often underused, Mississippian examples from Alberta and world analogues, CSPG convention 2004, Calgary, 10 page extended abstract