**Chemostratigraphic Recognition of a Disconformity in Mississippian Strata of the Northeast Appalachians, New Brunswick, Canada**

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**Abstract**

Mississippian strata host the only onshore gas field in Atlantic Canada at McCully, southern New Brunswick. Strata overlying the current tight-gas reservoir unit and shale-gas target (Albert Formation, Horton Group) consist of carbonate-evaporite rocks (Windsor Group) that are enclosed by ~2 km of redbeds assigned to a lower Sussex Group and upper Mabou Group. To date, this latter unit lacks significant marker beds and there is no significant biostratigraphic recovery, despite recent extraction of ~5 km of drill core from eight wells. Research on this core relates to hydrogeological and stratigraphic issues with Mabou strata.

Broadly, mudstone, siltstone and sandstone at the base of the Mabou Group gradually coarsen upward into conglomerate, and are considered the result of active alluvial fan progradation from the northeast. Also encountered in several of the cores was a single interval of localized, horizontally laminated to cross-stratified bluish grey sandstone, containing carbonaceous plant fragments and siltstone intraclasts. Although the interval can also be recognized in wireline logs, there does not appear to be a correlative reflector in seismic.

One hundred eighty five samples from four boreholes have so far been analyzed using ICP-MS and XRD. Chemostratigraphic analysis of various elemental ratios has revealed two packages bounded by an interval that correlates with the grey sandstone beds and intraclasts. Changes in the ratios are interpreted to mark a broader population of mineral species in the upper package. This further implies variation in the provenance and substrate environment of the alluvial-fan sediment either side of a disconformity represented by reduced horizons and rip-up clasts produced by sediment reworking along this boundary.
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ABSTRACT

Mississippian strata host the only onshore gas field in Atlantic Canada at McCully, southern New Brunswick. Strata overlying the current light-gas reservoir unit and shale-gas target (Albert Formation, Horton Group) consist of carbonate-evaporite rocks (Windsor Group) that are entailed by ~2 km of redbeds assigned to a lower Sussex Group and upper Mabou Group. To date, this latter unit lacks significant marker beds and there is no significant biostratigraphic recovery, despite recent extraction of close to 5 km of drill core from 8 wells. Research on this core relates to hydrogeological and stratigraphic issues with Mabou strata.

Broadly, mudstone, siltstone and sandstone at the base of the Mabou Group gradually coarsen up into conglomerate, and are considered the result of active alluvial fan progradation from the northeast. Also encountered in several of the cores was a single interval of localized, horizontally laminated to cross-stratified bluish grey sandstone, containing carbonaceous plant fragments and siltstone intraclasts. Although the interval can also be recognized in wireline logs, there does not appear to be a correlative reflector in seismic.

A total of 131 samples from three boreholes have so far been analyzed using ICP-ICP-MS, and XRD. Chemostatigraphic analysis of various elemental ratios has revealed two packages bounded by an interval that correlates with the grey sandstone beds and intraclasts. Changes in the ratios are interpreted to mark a broader population of intraclasts. Intraclasts were studied using XRD in thin sections, with multiple crystal fragments and rip-up clasts of carbonaceous shales, in some instances showing continuous clay laminae.
CHEMISTRY AND THIN-SECTION ANALYSES

XRD analyses have been performed on samples from 02-05 (open red square symbol) and 05-04 (open blue square symbol). The results indicate that the grey zone is composed of detrital material containing feldspars (leached).

There is evidence that feldspar content increases from proximal to distal locations. For example, in 02-05, feldspar content is higher in the grey zone than in the overlying beds.

Crystallographic analysis of feldspars indicates that the grey zone is composed of detrital material containing feldspars (leached).

For borehole 02-05, samples were collected systematically at regular intervals. For the other two boreholes (02-01, 05-04), samples were collected at irregular intervals.

CHEMOSTRATIGRAPHY (ICP-MS ANALYSES)

For borehole 02-05, samples were collected systematically at regular intervals. For the other two boreholes (02-01, 05-04), samples were collected at irregular intervals.

For crossplots of elements more commonly associated with detrital phases (e.g. Nb, Ti) and minerals associated with biogenic phases (e.g. Ca-Mg) in illite; Ca-Mg not plotted) there is no change across the grey zone. High correlations with similar regressions indicate few, and similar, mineral phases are present containing these elements both above and below the grey zone.

A crossplot of elements typically associated with biogenic phases (e.g. Ca in bioclasts, Nb in illite). Ca-Mg are plotted to indicates the absence of biogenic phases and Sr in illite. Sr is typically predominated in the detrital fraction, there are again typically major differences above and below the grey zone.

Crossplots of elements more commonly associated with detrital phases (e.g. Nb, Ti) and minerals associated with biogenic phases (e.g. Ca-Mg) in illite; Ca-Mg not plotted) there is no change across the grey zone.

For crossplots of elements more commonly associated with detrital phases (e.g. Nb, Ti) and minerals associated with biogenic phases (e.g. Ca-Mg) in illite; Ca-Mg not plotted) there is no change across the grey zone.

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