

## Upper Ordovician Reefs in the Hudson Bay Basin; Potential for Hydrocarbon Reservoirs

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### ABSTRACT

Upper Ordovician (Katian) buildups are reported from the Hudson Platform on Southampton Island at the northern end of the Hudson Bay. These mounds belong to the Red Head Rapids Formation and consist of a massive core with thinner stratiform counterparts. The core has been loosely described in the past as micritic, algal, or microbial limestones with metazoans of subsidiary importance. The mounds are up to 500 m in width with minimum vertical relief of 15 m. They occur a few metres above Upper Ordovician source rocks. The reefs contain voids, vugs and fractures some of which are coated or locally filled with bitumen and dead oil. The Red Head Rapids Formation mound is primarily composed of boundstone and cementstone with various proportions of early calcified sponge tissues, microbial encrusters, synsedimentary cement and small metazoans. The accretionary mechanisms of the mounds were mainly the result of frame building by early calcified sponges and small colonial corals and binding by calcimicrobial elements for the boundstone facies, and of marine cement precipitation near the seafloor for the cementstone facies. Petrography has revealed early diagenetic phases (synsedimentary marine cements and neomorphosed sponge network) as well as bitumen and late cements filling secondary pore space; late stage dolomitization and dedolomitization are observed. Early calcite phases, made up of neomorphosed aragonite, have the least negative  $\delta^{18}\text{O}$  values of all phases and a trend to more negative  $\delta^{18}\text{O}$  and  $\delta^{13}\text{C}$  values is noted for paired early and late cements. Fluid inclusions (FI) have both liquid and vapour phases, with the vapour usually making between 10 and 20% of total volume. The measurements of FI assemblages generated values of 74°C to 156°C. Limited  $T_m$  measurements on these provided a temperature of -12.9°C to -10.9°C, which translate to salinity of 14.9 to 16.8 wt% NaCl<sub>equiv</sub>. The values are high given the indications of low temperature history of the succession from other thermal indicators. The correlation of FI and  $\delta^{18}\text{O}_{\text{VPDB}}$  (-7.1 to -12.3‰) data indicates that late pore and fracture filling cements were precipitated from a saline fluid having  $\delta^{18}\text{O}_{\text{SMOW}}$  values between +4 and +8‰. This suggests that the reef recorded high temperature and saline burial fluids prior to hydrocarbon charge.