**ORGANIC GEOCHEMISTRY OF A 1.4-BILLION-YEAR-OLD EVAPORITIC LAKE: INSIGHTS FOR THE MARS 2020 SHERLOC INSTRUMENT.** J. T. Osterhout[1], A. D. Czaja[1] and Fralick P. W.[2], [1]University of Cincinnati (Department of Geology, 500 Geology-Physics, Cincinnati, OH 45221, osterhjt@mail.uc.edu; andrew.czaja@uc.edu), [2]Lakehead University (500 University Avenue, Orillia, ON, pfralick@lakeheadu.ca).

**Introduction:** Evaporitic lacustrine deposits on Earth provide a useful context for future investigations of early life on Mars. Ancient lacustrine systems are known to exist in many places on Mars [1], and have been considered interesting targets for future astrobiological exploration [2, 3]. Data from the *Curiosity* rover has revealed the presence of a previously habitable fluvial-lacustrine environment at Yellowknife Bay in Gale Crater [4] with ancient sedimentary rocks containing organic compounds native to Mars [5]. The upcoming *Mars 2020* rover mission will be equipped with a Raman spectrometer as part of the SHERLOC instrument, with the ability to detect and characterize organic compounds *in situ* [6]. Thus, similar studies of organic compounds in paleolacustrine settings on Earth can provide valuable insights for future astrobiological investigations.

**Materials and Methods:** This project examined the organic geochemistry and stable isotope geochemistry of carbonaceous chert-carbonates within the Mesoproterozoic (1.4-Ga-old) Middlebrun Bay Member of the Rossport Formation, Sibley Group in Ontario, Canada. The Rossport Formation has been described in detail and is interpreted as a shallowing-upward sequence of fluvial-lacustrine sediments exposed to increasingly arid conditions and heightened salinity levels [7]. This study will constrain the effects of thermal alteration on sedimentary organic matter by measuring $\delta^{13}C_{org}$ values and independent proxies of thermal maturity in kerogen. Initial Raman spectroscopic analyses of organics within the Middlebrun Bay Member suggest a thermal gradient diffusing outward from a mafic sill that intruded within the Rossport Formation, and this sequence of alteration is evident in the overall appearance of the unit (Fig. 1). Samples from the altered and unaltered zones have been classified according to their Raman Index of Preservation (RIP), a metric that allows for the *in situ* determination of relative geochemical alteration in fossil organic matter [8].

**Results:** Preliminary Raman spectroscopic measurements show RIP values for kerogen ranging from 7.7 to 6.8 (lower values record greater thermal maturity; Fig. 1), indicating that the degree of thermal maturity decreases with vertical distance away from the sill. Initial bulk carbon isotope analyses of extracted kerogen have yielded $\delta^{13}C_{org}$ values of –28.2 ± 0.1‰, signifying the presence of a microbial community dominated by photosynthetic metabolisms [9]. Further analyses will investigate the vertical succession of $\delta^{13}C_{org}$ values, RIP values and Deep-UV spectra across more than 0.5 m of section. The measured isotopic ratios and Deep-UV spectra will then be compared to their documented spectrum of thermal maturity. These results will provide a detailed geochemical context to facilitate astrobiological interpretations following future detections of organic compounds on Mars by the *Mars 2020* SHERLOC instrument.

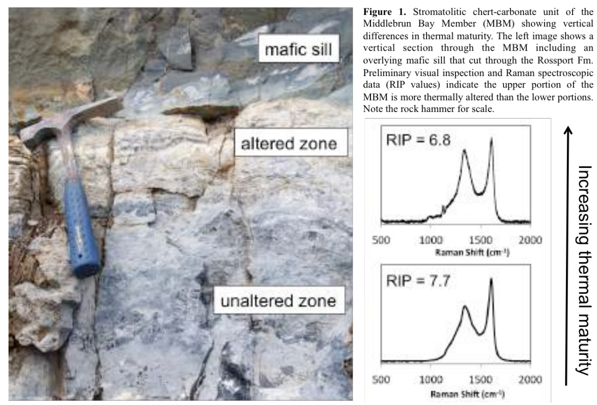


**Figure 1.** Stromatolitic chert-carbonate unit of the Middlebrun Bay Member (MBM) showing vertical differences in thermal maturity. The left image shows a vertical section through the MBM including an overlying mafic sill that cut through the Rossport Fm. Preliminary visual inspection and Raman spectroscopic data (RIP values) indicate the upper portion of the MBM is more thermally altered than the lower portions. Note the rock hammer for scale.

**References:** [1] Cabrol N. and Grin E. A. (1999) *Icarus, 142*(1), 160–172. [2] Scott D. H. et al. (1991) *Orig. of Life and Evol. of the Biosphere, 21, 189-98.* [3] Summons R. E. et al. (2011) *Astrobiology, 11*(2), 157–181. [4] Grotzinger J. P. et al. (2014) *Science, 343,* 124777-1–124777-14. [5] Freissinet C. et al. (2015) *JGR: Planets, 120*(3), 495–514. [6] Beegle L. W. et al. (2014) *11th Int. GeoRaman Conf.*, Abstract #5101. [7] Rogala B. (2007) *Can. Journ. Earth Sci.*, *44*, 1131–1149. [8] Schopf J. W. et al. (2005) *Astrobiology, 5*(3), 333–371. [9] Schidlowski M. (2001) *Precam. Res., 106*(1), 117–134.