Stable Carbon Isotope Analysis of the Tribes Hill Formation: Literature Investigation and Field Work

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Introduction

Studying stable carbon isotopes can be informative of Earths climatic history, improve biostratigraphy correlations, and inform our interpretations of the global cycle (Edwards and Saltzman 2014). I am interested in studying the Tribes Hill Formation because it has a lot of potential. I came across the Tribes Hill Formation during my preliminary literature search on carbonates in New York State. Accessible outcrops in NYS are far and few between due to vegetation overgrowth and the geologic history of the region. My goal was to collect Ordovician aged samples and test them once back at Bryn Mawr.

The Tribes Hill Formation of the Beekmantown group is characterized as a limestone and dolostone dominated, sparsely cherty and silty carbonate sequence ("Beekmantown Group (NYObk;2)" n.d.). It consists of four subunits, the Sprakers Member (intertidal deposition, sandy tempestite limestone and shale), the Van Wie Member (subtidal deposition, shale and limestone), the Wolf Hollow Member, (massively bedded, thrombolitic), and the Canyon Road Member (glauconitic limestone, evaporitic dolostone). The Tribes Hill Formation was deposited on the low slope, wave dominated East Laurentian passive margin in the Early Ordovician. It is bound by unconformities. This unit exhibits a cyclic deepening and shoaling sequence, indicative of a transgressive margin associated with the rising of the Laurentia epicontinental sea. (Landing, Westrop, and Knox 1996).

The Tribes Hill Formation of the Beekmantown Group in Montgomery County, NY provided good exposures of Ordovician rocks. The Tribes Hill Formation has been studied extensively by paleontologists for its abundant fossil assemblages, but little geochemical analysis has been conducted. Thus, my project is exploratory in nature and I am eager to determine if there is anything to investigate more in these units.

Why Carbonates and Carbon Isotopes

Marine sedimentary rocks are an important tool for studying global change over long periods of time due to the process of their formation. Carbonate sediments are formed in shallow, tropical, highly agitated, biodiverse environments via direct or biogenic precipitation from sea water. Weathering and erosion break down carbonate structures into sediment and transports them to the subtidal zone where they lithify into carbonate rocks. In their lithification, carbonates capture chemical signatures that can give us a snapshot into the past. My project is exploratory because the Tribes Hill Formation has not yet been analyzed isotopically. I am eager to see what the rocks can tell us.

Methods

I began with a literature review. Most of the geologic surveys and lithologic focused projects in this region were conducted in the 1980's or earlier. Since then, geologic definitions and interpretations, urban change, land privatization, and plant growth has changed the geomorphological landscape. A large part of my project was compiling information on currently accessible outcrops Based on literature research, Montgomery Country, NY was selected for field work. I decided to visit Montgomery County because it had the greatest concentration of previously located outcrops, as reported by Ed Landing in a previous work. Landings geologic columns were utilized to locate in section (Figure 1) (Landing, Westrop, and Knox 1996). Prior to my excursion, localities were organized into a google map that was used to locate on the day.

Field work consisted of two days in Montgomery County, where I was assisted by my Dad, who is a geologist by profession. We successfully found five of the eight and discovered a new locality that was previously blocked by a building. On day two, we focused our efforts on localities that we were certain we could successfully collect. We utilized a Jacob staff for measuring outcrops, dilute HCL to test for carbonates, a sledgehammer, and a geologic hammer to collect samples

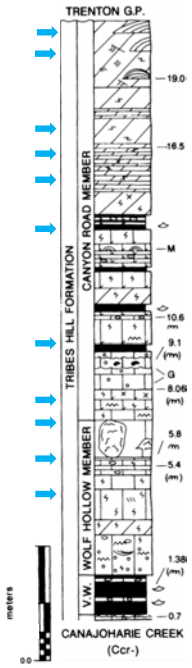

Fig. 1
Canajoharie Creek lithologic column, Landing et. al, 2016. Arrows indicate approximate sample locations. Scale to left of column, correct for misprint in journal.

Localities and Samples

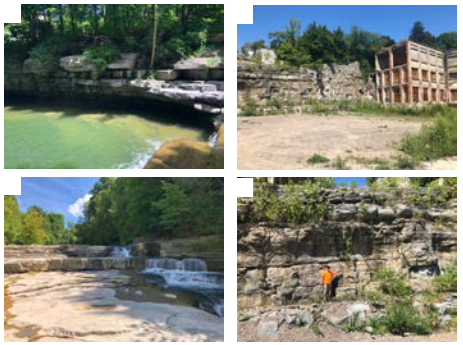

Figure 2
A: Canajoharie Creek swimming hole, base of the CCR section. Van Wie member at water level overlain by cliff forming Wolf Hollow. **B:** Canyon Road Member outcrop, massive bedding. Taken at Canajoharie Creek. **C:** Mill Street outcrop, building for scale. Possibly upper Tribes Hill Formation. **D:** Mill Street locality exhibiting layer cake stratigraphy.

Field Work Observations

Canajoharie Creek was the most extensive outcrop. The base of this roughly 21 meters section was located at the waterline of the swimming hole in the creek. The softer, shaly Van Wie Member lies at the waterline to few meters above the pool. This unit is thinly bedded and dark grey in color, and heavily eroded. The Van Wie deeper set in comparison to the uncomformably overlying Wolf Hollow Member. The Wolf Hollow is blocky and cliff forming (Fig. 2A). Samples from this unit vary widely. Samples from the base sections are matte grey with undetermined crossbedding structures. Samples from middle to top sections are medium to dark grey, visibly crystalline, finely laminated wacke- and packstones. Some samples have green and iron oxide stains on fresh surfaces. The Canyon Road Member uncomformably overlies the Wolf Hollow. Samples from the lower bedding are medium grey, visibly crystalline wackestones interbedded with a pebble sized grainstones. The upper sections of the Canyon Road are dark grey, predominatly featureless micrites interbedded with one fining upward grainstone.

Neither of the pervious reports about Montgomery Country mentioned the Mill Street outcrop. It appears a building in this locations was recently demolished. It is my hypothesis that this newly exposed section is also part of Tribes Hill Formation based on the valley topography of the area and the lithologies I observed. The outcrop is about 9.5m vertical (Fig. 2D). At about 8m we observed a buff to tan eroding massively bedded section, which is comparable to beds in the upper Canajoharie Creek section. This may be a useful correlation bed. Four samples were collected These samples are all dark grey wackestones with no stratigraphic orientation.

Prospects

My expectation on return to campus is to start the process of analyzing specimens. I will prepare them in rock room work, cutting down into billets, grinding them into thin sections, and ultimately drilling them under microscope to collect powers that can be used in a Cavity Ringdown Spectrometer (CRDS). Currently, I have some developing hypothesis, but given the novel nature of this initial investigations, we wont trust know more until the lab works gets underway.

References

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