The Union College Distinguished Science and Engineering Lecture Series presents:

Microbial reefs, ooid shoals, and a tropical island: Cambrian Laurentian shelf margin, York Co., PA

Dr. Carol deWet

Associate Dean of the Faculty and Professor of Geosciences
Franklin and Marshall College

- Friday, April 6th, 2012, Union College
- 12:50 PM, Olin Auditorium
- Sponsors: SUN (Skidmore Union Network), Union College Department of Geology

Abstract: Cambro-Ordovician shelf margin deposits of the Great American Bank (eastern North America) experienced significant regional dolomitization and/or metamorphism, but the Middle Cambrian Ledger Formation in south central Pennsylvania contains a shelf margin facies complex that includes exceptionally well preserved microbialite sheet reefs riddled with centimeter- to meter-scale submarine cavities. The reefs and associated sands, composed of reef-related allochems, interfinger with ooid shoals forming a high energy shelf margin facies association located near the seaward margin of the Middle Cambrian Laurentian platform. The Ledger Formation's ooid shoal complex, exposed in the Magnesita Refractories quarry in York County, Pennsylvania, is pervasively dolomitized.In contrast to the ooid dolostone, most of the Ledger reef facies, also exposed in the quarry, remains limestone. This has facilitated detailed interpretation of the reef's depositional and diagenetic history, including a more complete understanding of the microbial reef sheet morphology, documentation of a previously unrecognized type of cryptic microbial morphology (endolite), and analysis of a meter-thick intraclastic grainstone bed, interpreted as a subaerially exposed upper shoreface deposit.

Modern reefs in high energy settings adapt by building robust coral frameworks that can withstand normal current activity and wave action. In the Middle Cambrian, coral framebuilders were absent so to exploit high energy ecological niches,

organosedimentary constructers, primarily cyanobacteria (+/- algae and bacteria) had to develop a similarly robust morphology. We propose that low growing, thick, cohesive microbial sheets, such as documented here from the Ledger Formation, provided minimal wave resistance and, therefore, outcompeted stromatolites and thrombolites to form subtidal wave-resistant structures in such high energy settings.

Similar to modern reefs, these microbial sheets contain cavities across a range of scales, from mm-sized fenestrae to meter-sized, stromatactis-type voids capable of sheltering and supporting delicate shrubs of *Epiphyton*-like dendrites and cryptic endolites, as detailed below. Microbial processes dominated all ecological niches; forming the substrate, colonizing cryptic spaces, and coating and encrusting other microbes. The reef microbialite consists of weakly bedded sheets composed of shrubs and stubby strands of calcified *Epiphyton*- and *Angulocellularia*-like elements. Centimeter-scale domal stromatolites, thrombolites, oncolites, dendrolites, and oval, multiple-layered, organo-sedimentary, cryptic structures, informally termed endolites, form lenses and distinctive structures. Petrographically, the microbialite is expressed as clots, stringers, arborescent garlands, and dendritic shrubs. The Ledger microbial assemblage closely resembles living cryptic, mat and domal algal and cyanobacterial forms reported from shallow water settings in the Pacific Ocean and the modern structures provide useful analogies for the Ledger Formation's enigmatic Middle Cambrian fossil morphologies.