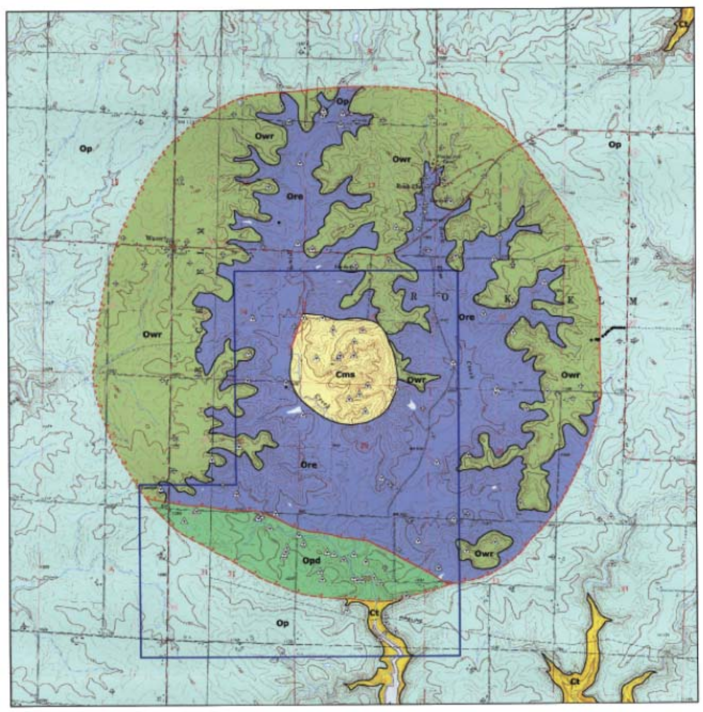
Rock Elm Crater, Pierce County, WI: Stratigraphy of a Recently Exposed Proposed Central Peak Outcrop and Characterization of Soils. C.M. Slowinski[1], M.M. Navis[1], C.L. Kairies Beatty[1], W.L. Beatty[1], J.L.B. Anderson[1] and H.A.S. Dolliver[2]. [1]Department of Geoscience, Winona State Univ., Winona, MN. [2]Department of Plant and Earth Science, Univ. of Wisconsin River Falls, River Falls, WI. (corresponding author: JLAnderson@winona.edu)



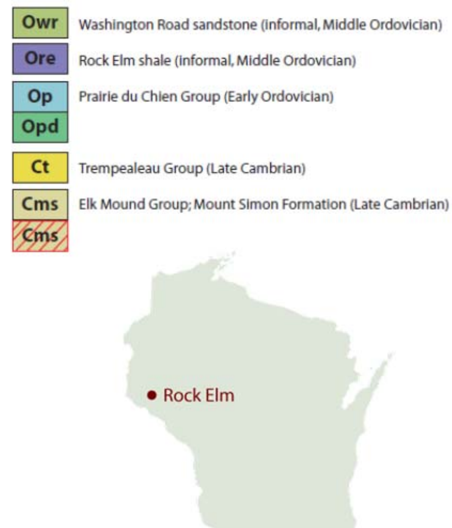
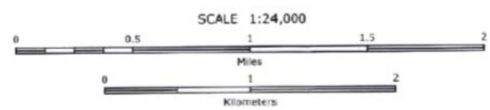


Figure 1. Geologic map of the Rock Elm impact crater, Pierce County, WI [1]. Contour interval 20 ft.



Introduction: The Rock Elm crater (Figure 1), Pierce County, WI, is Ordovician in age[1]. This 6.5 km diameter complex crater has a central peak likely composed of the Mt. Simon Sandstone, lifted 250-300 meters above its normal stratigraphic position[2]. Since the crater's formation, the region has undergone heavy glaciation that has removed the ejecta deposit and the uplifted crater rim. Two sedimentary units fill the crater: the Rock Elm Shale and the Washington Road Sandstone. These units are unique to the crater [2].

Our group is currently working on two lines of research at the Rock Elm crater. First, we are characterizing a sandstone outcrop within the central peak area that was recently uncovered by the landowners. We present here the first stratigraphic analysis of that outcrop and compare it to other sandstones in the region to determine if it is related to the Mt. Simon Sandstone. Second, we are investigating anecdotal information that the soils developed within the crater on the Rock Elm Shale are of poorer agricultural quality than the soils formed outside the crater on the Decorah Shale. We are analyzing the chemical and physical properties of these soils to evaluate this claim.

Methods – Stratigraphy: Four sections of the newly discovered proposed central peak outcrop were selected for in-depth stratigraphic analysis. Multiple sections were chosen so that both vertical and lateral variation within the outcrop could be examined. At each study site, the vertical succession of rocks was carefully measured and described in detail and representative samples from the dominant lithologies were collected. A high-resoution panorama of the outcrop was captured using a GigaPan Epic robotic camera mount. A detailed graphic log of each of the stratigraphic sections was created. Petrographic thin sections of the rock samples are being prepared.

Methods – Soils: Soil cores were collected at six different locations (three inside and three outside the crater) where soils developed either on the Rock Elm Shale (inside the crater) or on the Decorah Shale (outside the crater). At each site, a bucket auger was used to obtain a soil core. Coring stopped once the C horizon (partially altered parent material) was reached (approximately 1.5 m). Each soil core has 3-5 horizons, delineated by major differences in soil forming processes. The color of each horizon within a core sample was determined using the Munsell® Color Chart and each core was photographed. Texture of each sample was evaluated using field techniques (feel/ribboning). Samples from each horizon were placed in separate, labeled Ziploc® bags and returned to the lab. A sample of the Rock Elm Shale was also collected.

The pH of each soil horizon within a core was determined by mixing 10 g of sample with 10 mL of reverse osmosis (RO) water. The pH was then measured using a Hach® pH meter and probe. Percent moisture of each of the soil samples was determined by drying 5 g of sample in an oven at 105 ^{o}C until the weights were constant (about 72 hours).

Preliminary Results – Stratigraphy: Four dominant lithologies were observed at the new outcrop: a bedded mudstone; an iron-stained siltstone; a fine, bedded sandstone; and a friable, poorly sorted massive sandstone. Each of these lithologies is present laterally across the outcrop.

Preliminary Results – Soils: The pH of soils within the crater consistently decrease with core depth (Figure 2). The pH of the soil outside the crater is inconsistent and no trends are evident within the cores or between the three sites (Figure 3).

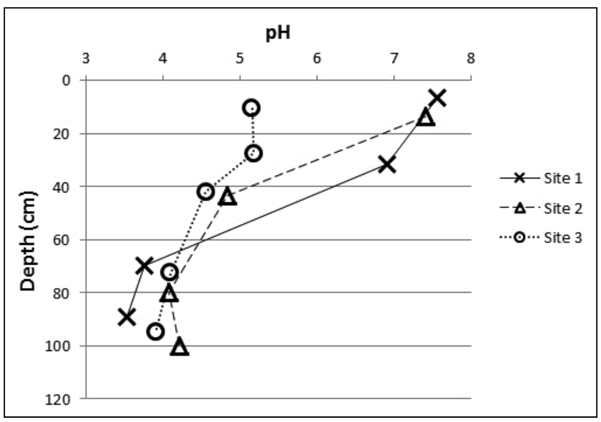


Figure 2. pH of soils within the Rock Elm impact crater.

Future work – Stratigraphy: We plan to analyze the thin sections of samples collected from the proposed central peak area as well as samples collected from known Mt. Simon formation outcrops. We hope to correlate this new sandstone outcrop with one of the three sandstone units in the region (Mt. Simon, Jordan, or St. Peter sandstones). We will also compare it to previous studies of other central peak outcrops at the Rock Elm crater[2]. In particular, we will examine thin sections for evidence of shock metamorphism, such as planar deformation features, that would indicate an impact event.

Future Work – Soils: Additional sample analyses will be completed to fully characterize the chemical and physical properties of the soils that developed in the Rock Elm impact crater. In particular, trace and major elemental composition for the Rock Elm shale sample and each of the soil samples will be determined using a four-acid digestion (hydrochloric, nitric, perchloric, and hydrofluoric acids) followed by analysis using inductively coupled plasma-optical emission spectroscopy (ICP-OES) at Activation Laboratories in Ancaster, Ontario, Canada. The data will be used to compare the geochemistry of soils within the crater to soils in other parts of Pierce County.

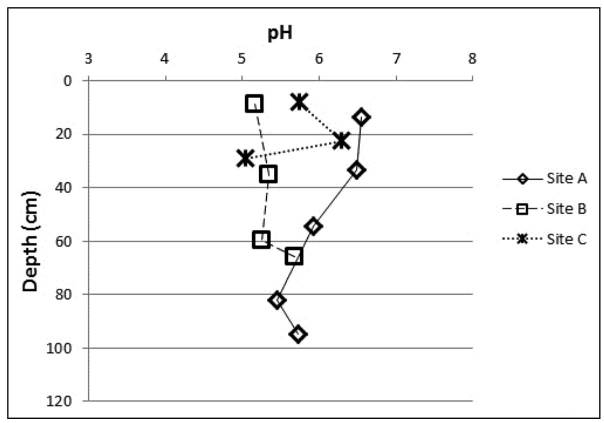


Figure 3. pH of soils outside the Rock Elm impact crater.

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References: [1] Cordua, W. (1985) *Geology*, *v13*, 372-374. [2] French, BM et al. (2004) *GSA Bulletin, 116,* 200-218.