AN OVERVIEW OF THE EXPOSED ORDOVICIAN-DEVONIAN SEDIMENTARY SUCCESSIONS IN ROSENDALE, ULTER COUNTY, UP-STATE NEW YORK

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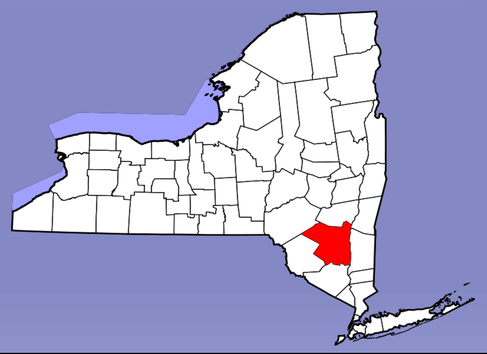
Abstract

The unique depositional conditions that formed the various sedimentary formations in Rosendale, NY have been subject to intense scientific scrutiny for the last decades. Interestingly, a variety of well-exposed lithological formations manifest a rich physical, chemical, and fossiliferous attributes both locally and regionally. Consequently, it is possible to infer that regional-scale processes such as sea-level variances could have affected the geological development of the sedimentary basin and subsequent lithofacies variation along the regional depositional trend. Undoubtedly, such processes resulted in the formation of the structural identity of the different rock formations present in Rosendale. Furthermore, the chronological formation of the Rosendale lithology encompassed Ordovician, Silurian, and Devonian time periods; which concords with current dating models for sedimentary bodies. However, the concrete circumstances in which these lithological formations were originated remain debatable. In particular, the behavioral influence of the Panthalassan Ocean over the paleo-Eastern seaboard remains unclear. Therefore, the formation of the macro and micro geological constituents of Rosendale could have been due to sea-level fluctuations in the region. Furthermore, at least two tectonic episodes namely the Taconic and Acadian orogeny deformed several units as evidenced by complex folding, faulting and development of pronounced angular unconformity between Ordovician Hudson River Shale (mostly dark-colored) and Silurian High Falls Shale (mostly reddish to brownish red). The basal contact of the High Falls Shale is generally considered to be situated near the base of the first red bed above the uppermost conglomerate containing quartz pebbles of the Shawangunk Formation. The upper contact of the High Falls Shale is gradational with the overlying Binnewater Sandstone. It is possible that the Panthalassan Ocean experienced transgression and regression events and provided major constraint to develop characteristic lithofacies associated with lower to mid-Paleozoic stratigraphy in Rosendale.

Map 1. Ulster County Location



Map 2. Ulster County, NY

Depositional Environment

The environmental conditions in which most lithological formations were deposited were marine environments where shallow basins accumulated significant amounts of sediments over long periods of time. Sea-level fluctuations contributed for the development of lithological profiles and the formation of fossils such as corals, brachiopods, and diverse shell-dwelling critters. Because of this evidence, it is possible to reconstruct the specific paleo-environments for each rock formation. Based on direct observations, the Rosendale area was subject of marine transgressive events and plate-tectonic mechanics

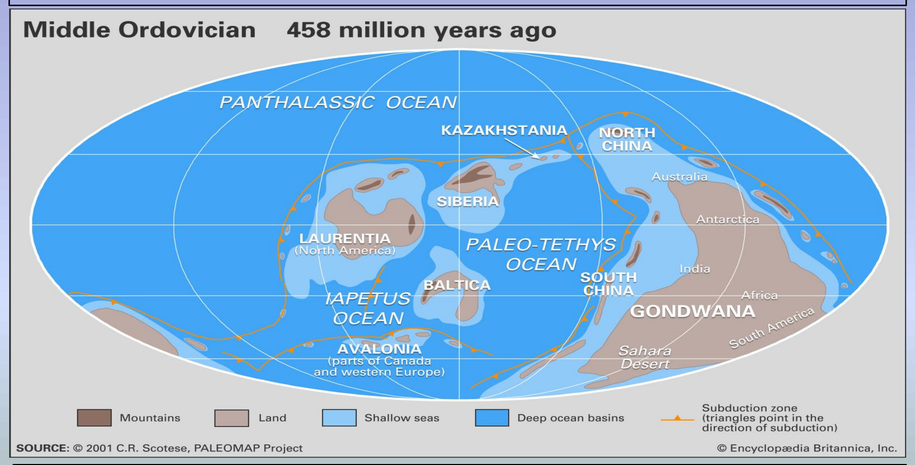


Figure 1. The Paleo-conditions in which the different lithological formations located in Rosendale were formed had specific conditions that influenced composition, morphology, and attitude of each one of them. From a macro-perspective, the regional geology started its development in the Ordovician period 480 Million years ago approximately. This period was characterized for the formation of the supercontinent Laurentia. This landmass experienced a prolonged tectonic dynamism that displaced it toward the southern hemisphere of the planet.

Geological Profiles of Rosendale, Ulster County Up-State, NY

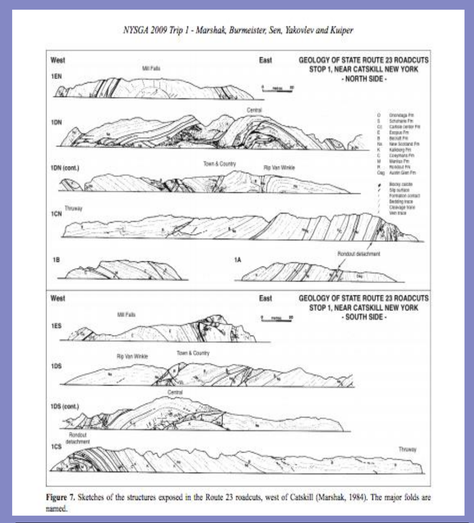


Figure 7. Sketches of the structures exposed in the Route 23 roadcuts, west of Catskill (Marshak, 1984). The major folds are named.

Figure 2. Sedimentary Depositions Along Route 23

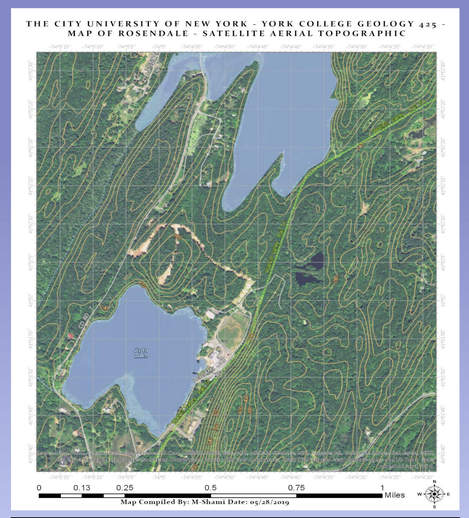
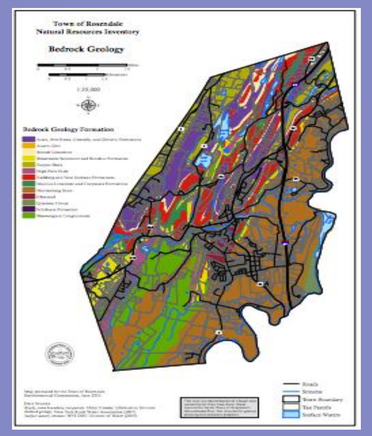


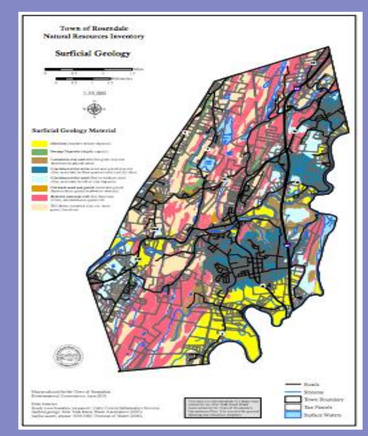
Figure 5. Topographic map of the Interlake Area. Rosendale, NY

Figure 8. Early Paleozoic Brachiopod

Map 3. Rosendale Geology



Map 4. Bed Rock Geology



Map 5. Surficial Geology

Descriptive Lithology

The geological characteristics of Rosendale, N.Y. are unique. The degree of complexity in terms of stratigraphy, composition, and process of formation is ideal for the exploration and analysis of multiple geological processes. Furthermore, this location harbors significant amount lithological features appropriate for the application of skills pertinent to geology and the execution of field techniques such as geo-location, mapping, and instrumentation. In Rosendale, three distinctive time periods (Ordovician, Silurian, and Devonian) formed seventeen lithological formations. Correspondingly, these formations can be classified into four major lithotype categories: Conglomerate, Shale, Sandstone and Limestone.

Limestone Outcrops

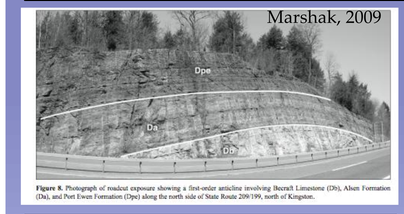


Figure 8. Photograph of roadcut exposure showing a first-order anticline involving Becraft Limestone (Db), Alsen Formation (Da), and Port Ewen Formation (Dpe) along the north side of State Route 209/199, north of Kingston.

Figure 3. Cross Section

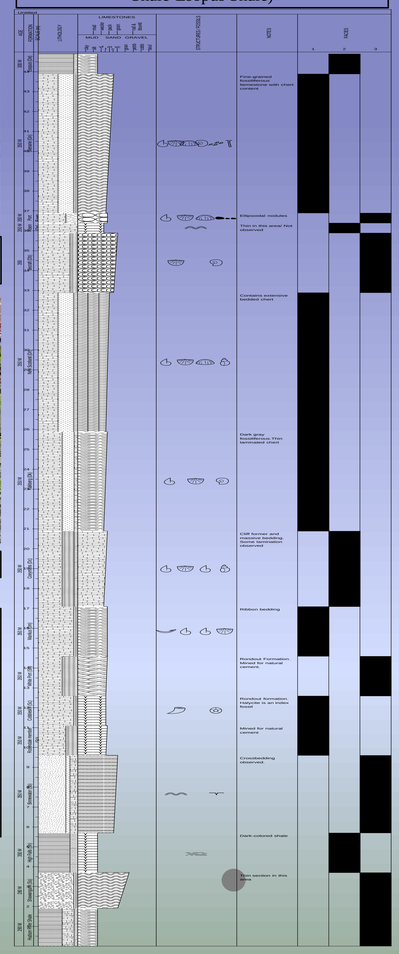
Figure 4. Visible faulting in cement series unit with clay-rich infilled zone

Figure 6. Rondout Formation with dolomitic limestone

Figure 7. Thinly laminated limestone (Manlius)

As a result of plate tectonics, vast areas of continental shelf were formed around the south and east continental margins. These areas would become the perfect ecosystem in which distinct habitats for marine fauna was developed. In fact, diversification and speciation of aquatic invertebrates occurred for 40 million years due to natural niches that permitted rapid evolutionary changes. As Laurentia experienced drastic climatic and biologic changes, sea levels fluctuated for extended periods of time; which initiated inter-continental geologic processes. Further, conclusive evidence in the geologic record proves that a series of transgression and regression events formed vast geologic formations. Moreover, convergent plate boundaries produced compression and deformations on the east margin of Laurentia. In this scenario, large segments of the continental craton were submerged as sea levels raised and temperature spiked during the Mezo-Ordovician. Consequently, evolutionary constrains forced the development of complex marine organisms that specialized in the specific conditions of the shallow-marine waters of Laurentia and its adjacent aqueous basins.

Figure 9. Generalized Type Section (Hudson River Shale-Esopus Shale)



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Structures of the Hudson-Valley Fold-Thrust Belt in the Appalachian Foreland of Eastern New York
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