Stratigraphy, Depositional Environments and Devonian Reef Complex Revealed in Lower Howe Caverns

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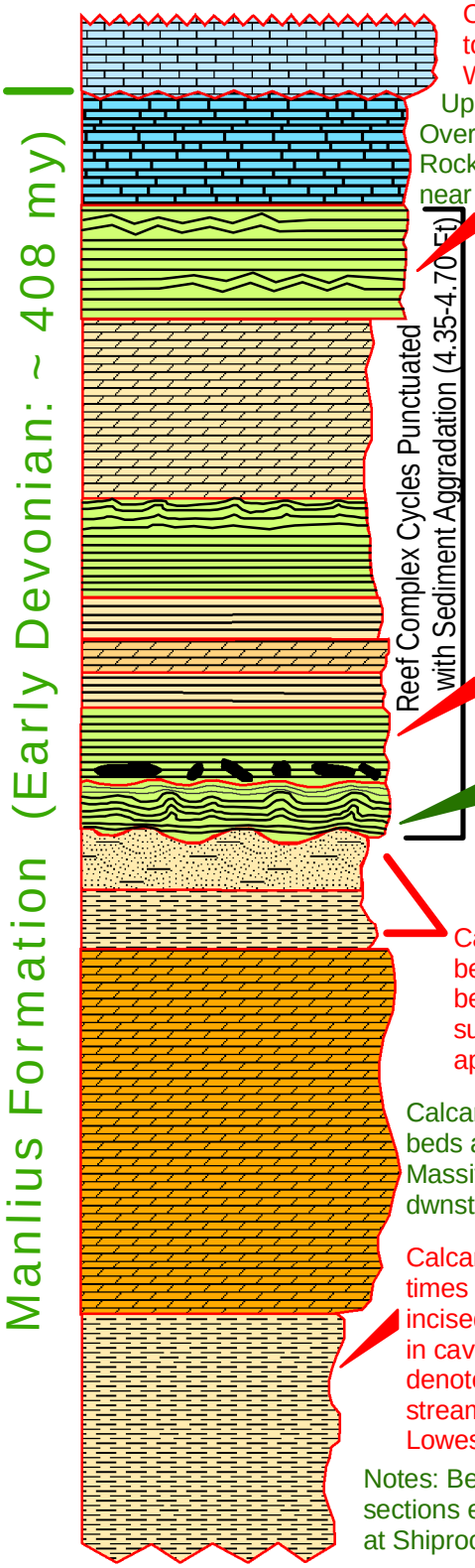

Coeymans Limestone: Thickness: ~ 50 ft; med. to thick-bedded; Light gray to white; massive; Ex. Locations: Bridal Altar & Winding Way entryway ceilings; Fossils; Offshore, subtidal, environment.

Upper Manlius ls: ~ 7.5 ft of thin beds - seen directly below The Mouse; Overlain by ~ 12 ft of thicker beds - seen above bridge railing nearest the Rocky Mtns; Light gray to white; Mod. fossiliferous; Tentaculites common near base. Large stromatoporoids present near top. Hot subtidal environment.

Stromatolitic limestone; Thickness: 0.87-0.93 ft; Light gray; Bed crinkling present locally; Cyanobacterial mat formed in tidal mud flat zone; Ex. Locations: Silent Chamber (top of 1st cement step below brick way), top of Shiprock, Lake of Venus-under roof dwnstm of mid-lake horiz. boat guide rail and above rail. Referred to as ribbon limestones

Finely bedded limestone above and below slightly crinkled mid-section stromatolitic beds locally ranging between 0.55 and 0.86 ft in thickness; Limestone locally appears massive; Light yellowish to pale brown. While three major stromatolite mats appear to stand out, indicating shallow subtidal to supratidal mud flat mat development punctuated by lime mud input and subaerial exposure (i.e., mud cracks, ripple marks), it is possible that many more subtle sea level oscillations occurred in this bed sequence before the tropical Helderberg Sea level slowly deepened. Stromatoporiods present in bedding partings.

Stromatolitic limestone: Thickness: 0.62-0.71 ft' dark blue gray; Generally non-crinkled like underlying bed; Locally appears as a thinly bedded limestone with clasts and fine bedding at base; Considered as part of underlying, primitive "plant" reef bed.

Stromatolitic limestone; Thickness: 0.38-0.42 ft; Light gray; Major marker bed; Cyanobacterial mat formed largely in intertidal zone; Ex. Locations: Lake of Venus grading from railing top to dam level, Pool of Peace and Shiprock, Level with top of lowest Silent Chamber step.

Calcareous mudstone; Thickness: 0.93-1.18 ft; Similar to mudstone below; Basal portion finely bedded; Top half more massive; Distict marker bed; Bed top highly undulatory, indicating subaerial exposure, erosion, and subsequent renewed sea transgression; Ex. Locations:Top surface of Turtle approx. level with bed base.

Shiprock Profile -----

Calcareous mudstone; Thickness 3.18-3.20 ft; Distinctly darker brown than beds above and below; Lacks mudstone appearance of adjacent beds; Massive, but finely bedded; Intertidal zone deposition; Ex. Locations: Immed. dwnstm of NCC collection box; Scalloped bed of Misery Crawlway; Shiprock.

Calcareous mudstone; Thickness: 5.7+ ft, Brown to dk yellowish brown, sometimes with black coating; Very finely bedded; Soft, easily eroded; Commonly incised below overlying bed and undercut by stream; Lowest section exposed in cave; River Styx rises from 10+ ft. below this unit; Mud cracks in partings denote episodic supratidal exposure above intertidal zone. Ex. Locations: In stream below Bridal Alter; Upstream Turtle fin slightly below upper contact; Lowest portion of Misery Crawlway.

Notes: Bed colors described above refer to weathered colors; Excellent column sections exposed immed. downstm of NCC collection box, at the Pool of Peace, at Shiprock, and in the Silent Chamber. Column is preliminary as work progresses.

Preliminary Depositional Interpretation: The bulk of the active Howe Caverns stream passage has formed in the middle to upper Manlius Formation. The Manlius Fm. records several cycles of mud-rich carbonate deposition, some in a shallow, hot, sea. Prior to the slow deepening of the sea, as recorded in the thick-bedded, relatively pure, Coeymans ls., the sea level fluctuated numerous times. This fluctuation is recorded throughout much of Howe Caverns & in the form of three distinct stromatolite beds separated by supratidal calcareous beds. Stromatolite beds are exciting in that they document the presence of three areally extensive and time sequential reef complexes, probably in a broad restricted, shallow subtidal, lagoon, or barrier reef environment. Stromatolitic mats formed in and immediately above the intertidal zone.