Post-Taconic carbonate ramp development: the Late Ordovician Lourdes Formation, Port au Port Peninsula, Newfoundland

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The Caradocian Lourdes Formation, outcropping continuously along 18 km of coastline on the Port au Port Peninsula, constitutes the only post-Taconic Ordovician carbonate succession in Newfoundland. This ~75 m-thick succession represents a prolonged period of carbonate ramp development, punctuated by unconformities that bound the formation and each of its three depositional members. The nature and significance of the base of the formation are obscured in its only onshore exposure; on the Port au Port Peninsula, the Lourdes Formation has been recently re-interpreted to form the hanging wall of a regional thrust fault which displaced the succession to its current position, directly overlying the Humber Arm Allochthon. Deposition began with the Shore Point Member, possibly coeval with Caradocian sea level rise. It comprises peritidal siliciclastic and carbonate cycles, and is capped by a paleokarst unconformity. Renewed transgression following subaerial exposure led to deposition of deeper subtidal, predominantly carbonate sediments of the Black Duck Member. This member marks a peak in biological activity on the ramp, with an abundant and diverse shelly fauna, intense bioturbation, and most notably, the occurrence of a large number of coral bioherms in the uppermost 15 m. A prominent paleokarst surface forms the top of the Black Duck Member, and is overlain by sandstone and cobble conglomerate representing exposure, differential erosion, reworking of fossil elements, and seaward transport of siliciclastic detritus during relative sea-level lowstand. A third and final phase of carbonate ramp development followed with deposition of the Beach Point Member, an argillaceous, shallow-marine carbonate unit containing metre-scale shallowing upward units and unusual in-situ brecciated grainstone beds. Pyrite-coated and bored hardgrounds and related intraclasts suggest slow sedimentation and near-surface to seafloor diagenesis and reworking. The proportion of siliciclastic silt and clay increases upward throughout the Beach Point Member, culminating with the overlying shales and sandstones of the Winterhouse Formation. As there is no evidence for a significant rise in sea level, the final demise of the carbonate ramp was likely caused by changing circulation patterns and increased siliciclastic input marking a new stage of basin development.

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