

High-Resolution Stratigraphic Architecture of the Alexandra Reef Complex (Frasnian), Northwest Territories

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ABSTRACT

The Late Devonian (Frasnian) Alexandra Reef Complex is superbly exposed over a distance of ~ 45 km near Hay River, in the southern Northwest Territories. Unlike most exposed reefs in western Canada, the Alexandra Reef Complex escaped significant dolomitization and tectonic deformation. As such, one can stand on the ancient peri-tidal deposits at Alexandra Falls and walk out, across depositional strike, through back-reef, reefal, and fore-reef facies associations. Preservation of the respective depositional textures is exceptional.

Detailed field mapping and coring show that the Alexandra Reef Complex developed on a ramp with a gentle slope of $< 1^\circ$, and includes a “main reef” package and “top reef” package. The ramp included biostrome development in the shallower regions and deposition of muddy sediments around isolated framebuilders in the deeper, basinward areas. The “main reef” package included bioherm and biostrome development over an area ~ 20 km wide, and had very low relief. Stromatoporoids and microbialites, including stromatolites, dominated the reef fabric. The reef margin was formed of a broad (up to 3.5 km wide) zone of storm reworked reef fabric and intraclastic sediment.

Sea level deepening over the complex resulted in growth of deep-water fasciculate rugosan (*Smithyphyllum*) thickets overtop of bioherms in the reef-front region, concentration of stromatoporoid - dominated bioherm and biostrome development to the flanks and top of the “main-reef” margin, and steep-sided mound growth in the back-reef region. The deepening event marks the shift to the “top-reef” package, and as the rate of buildup gradually outpaced the rate of sea level rise, aggrading bank deposits prograded across the complex. Shallowing and significant restriction over top of the complex is interpreted to have terminated its development.