Geologic unit name: Thule

Geologic unit map code: PR-GLMTH

Unit Hierarchy:

Thule

Status: In current use

Geological period(s): Proterozoic

Full description: The onshore sedimentary–volcanic succession (Thule Supergroup) is at least 6-km thick, while offshore, around 77oN, 4–5 km of strata link opposing coastal outcrops (Funck et al., 2006). The Greenland and Ellesmere strata are defined by common lithostratigraphic nomenclature, at group, formation, member, sub-member and bed level. Basic sills occupy regionally consistent stratal levels (Dawes, 1997), two of which span Smith Sound (Dawes, 1997; Dawes 2009). Any model involving large displacements of Greenland relative to North America must fulfil specific expectations that are corollary to the model in question (Dawes 2009). Two basic models still being promoted require Nares Strait to be (1) the site of a major strike–slip fault with at least 200 km of sinistral displacement of Greenland and (2) the site of a suture zone along which Greenland collided with Canada after an intervening 200- to 400-kmwide strip of oceanic crust was subducted under continental crust at the seaway.

The lithostratigraphic Proterozoic (Neohelikian-Hadrynian) intracratonic Thule Basin of northern Baffin Bay is preserved between 76° and 79° N in Greenland and Ellesmere Island, Canada, contains little deformed and unmetamorphosed strata at least 6 km thick that are referred to the Thule Supergroup. The succession is composed of continental to shallow marine sediments with prominent red bed units, and one main interval of basaltic volcanic rocks. Diabase sills representing both the Mackenzie (Neohelikian) and Franklin (Hadrynian) magmatic episodes occur at certain levels. Neohelikian–Hadrynian age between c. 1270 and c. 650 Ma. The crystalline shield underlying the Thule Supergroup contains Proterozoic (middle Aphebian) crust that has given U-Pb zircon and monazite ages between 1960 and 1912 Ma (Frisch & Hunt, 1988) and a Rb-Sr whole-rock age of 1850 Ma (Dawes et al., 1988; Dawes 1997).

The Thule Supergroup is derived from the Thule Formation of Koch and Thule Group of Troelsen (1949, 1950). The Thule Supergroup is a multicoloured, mainly shallow-water sedimentary succession with one main interval of basaltic volcanic rocks. Basic sills are common at several levels. In broad lithological terms the succession is bipartite, being composed of a lower siliciclastic part with basaltic rocks and subordinate carbonate, and an upper part of mixed siliciclastic-carbonate strata. Red beds form prominent units in both parts. Lower strata are characterised by thick units of clean to ferruginous quartz arenites with conglomerates and some shale and carbonate intervals that give way upwards to an interbedded sequence of darker sandstone, siltstone and shale with subordinate dolomite. The upper part is composed of a well-layered carbonatered bed siliciclastic sequence with algal laminites characterized by cyclicity, with evaporite and subordinate chert.

The Thule Supergroup represents a variety of depositional environments from continental (subaerial to alluvial) to lacustrine and shallow marine (intertidal-subtidal) with intervals of cratonic magmatism. One of the magmatic episodes produced terrestrial tholeiitic effusives. The sediments, representing a very long time span (c. 600 Ma), are essentially undeformed but no major unconformities have been observed. Any fundamental breaks in shallow-water deposition must be represented by paraconformities. The lower siliciclastic part of the succession mainly represents alluvial plain to shallow shelf sedimentation with alternating intervals of tide-dominated and alluvial-dominated deposition followed by deposition in overall deltaic to subtidal environments. The upper part, characterised by cyclic sedimentation involving algal laminated carbonates and evaporites, indicates a low-energy environment and hypersaline conditions analogous to modern lagoonal sabkha deposits. The red coloration that is characteristic of many siliciclastic units could be taken to indicate a continental oxidising environment (Glennie, 1970). Stromatolites, algal laminites and microfossils (acritarchs and cyanobacterial organisms) have been described by Vidal & Dawes (1980), Strother et al. (1983), Dawes & Vidal (1985), Jackson (1986) and Grey (1995).

The Smith Sound Group, up to 700 m thick, represents the northern platform and basin margin equivalent of the Nares Strait and Baffin Bay Groups of the central basin. Composed of sandstones and shales with subordinate stromatolitic carbonates, the Smith Sound Group represents an overall shelf environment with long-lasting conditions for shallow water to subaerial deposition. Supratidal to marginally marine and intermittently lacustrine sedimentation prevailed (Dawes 1976a, b, 1979; Dawes & Haller 1979; Troelsen 1950, 1956).

The Nares Strait Group, up to 1200 m thick and representing the basal strata of the central basin, is composed of sandstones and basaltic volcanics including flows, sills and volcaniclastic deposits, as well as shale- and carbonate-dominated intervals. The Group represents deposition in alluvial plain, littoral and offshore environments, with accompanying terrestrial tholeiitic volcanicity (Dawes et al. 1982; Frisch & Christie 1982; Jackson 1986).

The Baffin Bay Group, overlying conformably the previous group, represents the most widespread strata of the Thule Basin reaching a maximum thickness of up to 1300 m. Sandstones and quartz-pebble conglomerates, with important intervals of shales and siltstones, represent mixed continental to marine shoreline environments with an interval of deeper water deposition, possibly in a prodelta or offshore basin (Munck 1941; Frisch et al. 1978; Dawes & Haller 1979; Dawes et al. 1982; Frisch & Christie 1982)..

The Dundas Group, 2 to 3 km thick and following the previous group along a gradational contact, comprises sandstones, siltstones and shales with lesser amounts of carbonate and evaporite. Deposition was in an overall deltaic to offshore environment (Dawes 1976a, b; Dawes et al. 1982).

The youngest strata, the Narssarssuk Group, 1.5 to 2.5 km thick, are preserved in a graben on the south-eastern margin of the basin. The cyclic carbonate - red bed siliciclastic sequence with evaporites represents deposition in a low-energy, hypersaline, peritidal environment in conditions perhaps analogous to modern coastal sabkhas (Davies et al. 1963; Dawes 1976a, b; Dawes & Haller 1979).

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