Bedrock Geology of the Whycocomagh Map Area (11F/14), Inverness County, Nova Scotia

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The Federal-Provincial Targeted Geoscience Initiative (TGI) was aimed at increasing the level and cost-effectiveness of private sector exploration for mineral resources by upgrading and expanding the geoscience knowledge on which exploration depends. The TGI provided an impetus to compile and update previous geological mapping on the Whycocomagh map sheet (11F/14) in southwestern Cape Breton Island and reassess previous work and economic potential in the area. The oldest stratified rocks in the map area are part of the George River Metamorphic Suite (GRMS), and are exposed in the Creignish Hills and on North Mountain. They consist of low-grade metamorphic rocks including slate, quartzite, marble and metavolcanic rocks (Blues Brook and Malagawatch formations, respectively). The depositional age is poorly constrained, but published U-Pb data suggest an age of ca. 637 Ma for metavolcanic rocks in the GRMS. This age contrasts with locally preserved stromatolites in marble of the same unit that suggest a Mesoproterozoic age. Associated with the GRMS are fault-bounded low-pressure/high-temperature amphibolite-facies para- and orthogneiss, amphibolite and migmatite (Skye Mountain Metamorphic Suite (SM), Lime Hill Gneissic Complex, and Melford Formation) which are part of the Bras d'Or Gneiss. The maximum age of the Bras d'Or Gneiss is constrained by detrital zircons to be as young as ca. 693 Ma from paragneiss in the SM. Associated tonalitic orthogneiss yielded zircon grains with ages of ca. 565-560 Ma, interpreted to be the igneous crystallization age. The metamorphic rocks have been intruded by varied dioritic to granitic plutons with ages of ca. 555 Ma and calcalkalic, continental-margin arc affinity. These rocks represent the southernmost exposed part of the peri-Gondwanan Bras d'Or Terrane.

Unconformably overlying, or in faulted contact with, the older rocks is a late Paleozoic basin fill comprising sedimentary rocks of the Carboniferous Horton, Windsor, Mabou and Cumberland groups. Basaltic and rhyolitic flows of the Devonian Fisset Brook Formation are in faulted contact with the Horton and Mabou groups in the western part of the map area. The Horton Group consists of coarse- and fine-grained clastic rocks. These rocks are locally overstepped by the Windsor Group. The Windsor Group is dominated by saline evaporite rocks including salt and minor potash with subordinate carbonate rocks, anhydrite and redbeds. It is complexly deformed with isoclinal and recumbent folds in the middle and upper parts. The structural complexity has been attributed to the Ainslie detachment, a major decollement above the basal anhydrite and basal carbonate of the Lower Windsor Group. However, these features could also be attributed to regional-scale solution collapse of the 'mobile' Windor Group. The medium- to fine-grained clastic strata of the Mabou and Cumberland groups conformably overlie the Windsor Group and are generally less deformed (e.g. Maple Brook Syncline).

A drillhole was commissioned to investigate the cause of highly positive aeromagnetic anomalies in the River Denys basin. It intercepted amygdaloidal basaltic flow rocks on top of Carboniferous strata, confirming the results of an earlier drilled hole. A recent $^{40}Ar/^{39}Ar$ whole-rock analysis indicates that the basalt is Mesozoic in age and hence may be genetically related to the Triassic-Jurassic North Mountain Basalt on mainland Nova Scotia. The presence of other positive magnetic anomalies in the basin suggests that Mesozoic basalt may be more widespread in southwestern Cape Breton Island than previous expected.

The pre-Carboniferous rocks are hosts for numerous base- and precious-metal deposits and are sources of carbonate rock, building stone and aggregate. Carboniferous rocks contain major industrial mineral deposits including salt and gypsum, as well as numerous occurrences of base metals, barite, potash, limestone and anhydrite. Carboniferous units are also currently being explored for their hydrocarbon potential. Cretaceous deposits are known to exist along major faults in the map area and potentially can be exploited as sources of clean sand and clay.