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GEOLOGICAL MAP OF CARMANVILLE MAP AREA (2E/8), NEWFOUNDLAND

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DESCRIPTIVE NOTES

The Carmanville map-area was largely burned over in 1964. Consequently, visibility and rock exposure are good by Newfoundland standards. Most parts of the area are accessible by highway, wood roads or boat, but cross-country travel is locally hazardous due to deadfalls and loose boulders. The size, angularity and monomict character of many boulder accumulations suggests they represent underlying bedrock. Meagre evidence from striated outcrops suggests that glacial transport was east-northeast. Constructive glacial features are not abundant in this region.

The Gander River ultramafic belt (1,2,3) comprises allochthonous slivers of mafic and ultramafic rocks of uncertain age. Ultramafic rocks (1) consist essentially of serpentinite, with remnants of websterite and lherzolite and marginal carbonate-rich zones with talc-actinolite schist. Relict igneous layering of chrome spinel and pyroxene occurs southwest of Shoal Pond. Gabbro occurs as dykes and separate slivers. Mafic volcanic rocks (2) in the Carmanville area essentially represent resedimented submarine debris flows and turbidites presumed to have been transported downslope from oceanic islands into an environment itself characterized by pillow lava and hyaloclastite formation (Pickerill *et al.* 1981). Presumably correlative volcanics near Shoal Pond are strongly deformed greenschists. Plagiogranite (3) was emplaced prior to tectonic transport, and is the only granitoid rock sampled by the olistostromes (9-10). Faunal evidence suggests tectonic emplacement of the allochthons in Llanvirn-Llandeilo time, but the age of formation is unknown (? late Cambrian - Arenig). They may be correlative to parts of the Gander Group (4).

The Gander Group is of monotonously similar composition and lacks primary sedimentary structures, so that its thickness is uncertain. No basement has been recognized, though parts of the Flinns Tickle Complex (13) could conceivably be basement. Volcanogenic rocks (6a) appear correlative to volcanogenic rocks on Gander Lake which yielded an Arenig - Llanvirn fauna (McKerrow and Cocks 1977). Thinly bedded black and white siltstones of the Gander Group conformably underlie a red shale assemblage (5) south of Island Pond. Elsewhere Gander Group is truncated by allochthons of Gander River ultramafic belt. As defined by Currie *et al.* (1980), the base of the Davidsville Group lies within the red shale assemblage. On Coffs Pond, the base is marked by a 1 to 2 m red shale sequence unconformably overlying ultramafic rocks which has yielded conodonts indicating an age on the Llanvirn-Llandeilo boundary. The red shale assemblage partially interdigitates with essentially overlying conglomerate and sandstone (6). The conglomerates, which contain debris from the ultramafic slabs and from another (continental ?) source, fine southwestward and are facies equivalent to greenish fine-banded sandstone and siltstone with lenses of granule conglomerate (6a). This belt of coarse clastic rocks continues far to the south of the map sheet. Thinly bedded, graded to laminated turbidites with sharp, non-erosional bases (7), possibly representing outer fan or interchannel deposits, comprise the material originally designated Davidsville Group by Kennedy and McGonigal (1972). A more proximal turbidite facies occurs along the shores of Gander Bay (8) indicating proximity to a submarine channel. Conglomerate boulders south of the causeway may derive from a similar environment. The upper part of this turbidite sequence contains thin horizons of glacio-marine diamictite (Pickerill *et al.* 1979).

All lower sedimentary and allochthonous units were sampled and disrupted by large-scale olistostromes (9-10). Olistoliths range from granules to huge rafts several km. across. All stages of development are observed from incipient slumping and boudinage of competent beds, to disrupted remnants in a thixotropic matrix (Pajari *et al.* 1979). Mafic and ultramafic olistoliths occur only in the lower parts of the slides. The matrix changes from black pyritic shale containing Caradoc graptolites in the lower part to more silty material toward the top. The map boundaries of units 9-10 show the limits of abundant matrix, but much larger areas were affected by major slumps and slides.

Shallow water siltstones with windblown quartz grains (11-12) of the Indian Islands Group unconformably overlie olistostromes of the Davidsville Group along the west side of Gander Bay. A characteristic lower unit (11) contains coralline limestone lenses which yield a Llandoverian fauna (Williams 1972).

Salic igneous and metamorphic rocks (13-21) developed during one extended period of deformation and elevated temperature, extending from Silurian to Carboniferous time. Parts of the Flinns Tickle Complex (13) can be traced directly into Gander Group and Davidsville Group sedimentary rocks, but parts of it may be older. A complete set of metamorphic isograds can be mapped in the Davidsville Group from illite-chlorite assemblages to andalusite, but the Gander Group lies mainly in greenschist facies (biotite-muscovite) with an abrupt jump to upper amphibolite facies. Peak metamorphic conditions reached roughly 650°, 4 kilobars under almost water saturated conditions (Pickerill *et al.* 1978). Emplacement of the Rocky Bay, Tims Harbour and Fredericton plutons (13), dated about 400 my. (Pajari and Currie 1978), may have been coeval with this metamorphism. Like most others, these plutons display a massive core with strongly foliated margins, suggesting syntectonic emplacement. An extensive suite of early dacitic dykes in the Davidsville Group may be related to this magmatism. Tracing of sedimentary units up to the metamorphic gradient leaves no doubt that some of the migmatite and heterogeneous granite gneisses (15-16) developed by anatexis (Currie and Pajari 1977). However, their distribution in the Gander Group is not clearly understood, since they separate low grade rocks from high grade equivalents. The White Point, Aspen Cove and Island Pond plutons (17-18) represent stages in the process by which anatectic melt is progressively cleaned of inclusions and homogenized. The White point pluton shows variation from migmatite, through a sheeted complex to fairly massive biotite-quartz monzonite. The Aspen Cove pluton exhibits a differentiation sequence from biotite-quartz monzonite in the core through muscovite-biotite granite to garnet-muscovite aplite in the rim.

The Ragged Harbour complex (20) and Deadmans Bay pluton (21) contain characteristic trachytoid, porphyritic quartz monzonite. The phenocrystic to porphyroblastic crystals of microcline are much larger in the Deadmans Bay pluton. Both plutons contain late muscovite-garnet aplite, as a central plug of graphic granite in Ragged Harbour, and as dykes in Deadmans Bay. The surroundings of these plutons are extensively migmatized and metasomatized. K-Ar determinations suggest a late Devonian to Carboniferous cooling age for these plutons (345-360 my).

Rare, north-trending, internally zoned spessartite dykes (22), up to 50 cm wide, cut the Davidsville Group east of Gander Bay. Comparison with similar occurrences in Notre Dame Bay suggests the dykes may be of Mesozoic age.

The Davidsville and Indian Islands Groups exhibit a dominant planar fabric, commonly a slaty cleavage, but becoming a through going schistosity in high-grade rocks. This main fabric is axial planar to isoclinal folds of similar style with plunges that vary, often within a few metres, from steep to horizontal. The main fabric is composite. Two deformation episodes can be observed in many thin sections where schistosity or slaty cleavage sweeps around porphyroblasts containing straight inclusion trails inclined to the external fabric (D1 and D2). This main fabric is kinked or crenulated (or both) by later structures (D3), and larger folds at Ladle Cove Head also belong to D3. Generally shallow dipping crenulations and minor structures postdate D3 at Ladle Cove Head and Island Pond (D4). Although four periods of deformation can locally be identified in the Davidsville Group, deformation is extremely inhomogeneous, so that large parts exhibit only one prominent (composite) cleavage. The Indian Islands Group also shows inhomogeneous deformation, but the degree of deformation is always less than that in the juxtaposed Davidsville Group, demonstrating that deformation commenced prior to Llandovery time. Gander Group rocks exhibit a north-trending cleavage axial planar to isoclinal small folds (D2), partially and locally transposed by northeast trending cleavage locally associated with attenuated small folds (D3). Near the ultramafic slabs these structures are transposed and obliterated by intense northeast trending - northwest dipping cleavage and mylonitization (D4). The structural evolution of the gneisses and migmatites appears generally similar to that of the Davidsville Group. Granitoid plutons northwest of the ultramafic slabs were emplaced between D2 and D3 and bear later fabrics. The Ragged Harbour pluton postdates D3 but contains D4, while the Deadmans Bay pluton contains no tectonic fabric. Porphyroblastesis occurred between D1 and D2, between D2 and D3, and post-D3 in the southeastern part of the area. We interpret the data to indicate collision of an easterly derived continental rise prism (Gander Group) with a volcanic island arc in pre-Llanvirn-Llandeilo time, resulting in eastward tectonic transport (Gander River ultramafic belt) and subsequent instability of the sedimentary column (Davidsville Group). The region had stabilized by Llandovery time (Indian Islands Group), but the consequences of collision produced paroxysmal metamorphism and plutonism, accompanied by renewed eastward transport, in late Silurian to Carboniferous time.

At present there is little economic interest in the map-area. Chromite occurrences at Shoal Pond have been extensively prospected. The ultramafic rocks also contain high concentrations of nickel (0.05 percent). Williams (1964) reported scheelite in quartz veins associated with Tims Harbour pluton. Reconnaissance with a radiation detector suggests the same region exhibits a radioactive anomaly. Trace amounts of chalcopyrite occur in volcanic rocks south of Carmanville.

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LEGEND

Jurassic ? 22 Lamprophyre dykes

-intrusive contact-

Carboniferous

21 DEADMAN'S BAY PLUTON: coarse grained biotite quartz monzonite with megacrysts of microcline perthite; rare aplitic dykes

-intrusive contact-

RAGGED HARBOUR COMPLEX (units 19-20)

20 White muscovite garnet leucogranite, aplitic to pegmatitic with graphic patches

-relations unknown-

19 Trachytoid, porphyritic pale grey biotite granodiorite

- gradational contact (?) -

ISLAND POND, ASPEN COVE and WHITE POINT COMPLEXES (units 17,18)

18 Massive to foliated, coarse, biotite-muscovite quartz monzonite, locally garnetiferous in leucocratic parts

- gradational contact -

17 Fine to coarse-grained biotite granodiorite and quarts monzonite

- gradational to intrusive contact -

16 Heterogeneous granitoid gneiss and pegmatite with schlieren of 14a, 15a

- intrusive contact -

15 Migmatite, 11-par-11 gneiss, sheeted complex; 15a complex of 16 and 14a, 15b complex of 18 and 14b

-gradational contact -

14 FLINNS TICKLE COMPLEX: Quarts-feldspar-biotite-muscovite gneiss and schist, commonly containing garnet and/or sillimanite. Minor quartzite and amphibolite. 14a metamorphosed equivalents of unit1, 13b-metamorphosed equivalents of units 1-9 (may be older than 13 in part)

- relations unknown -

13 ROCKY BAY, TIMS HARBOUR AND FREDERICTON PLUTONS: Homogeneous tonalite with poikilitic biotite, commonly amphibole bearing. 13a-foliated granodiorite rich in dykes, 13b dacitic to rhyolitic dykes

-intrusive contact -

Llandovery

12 INDIAN ISLANDS GROUP (units 11-12)
White to pale grey siltstone and quartzite with millet seed quartz grains. Local conglomerate lenses

-gradational contact-

11 Greenish grey siltstone with pale grey fossiliferous limestone and calcarenite lenses. 11b silicified hornfels

- unconformity -

DAVIDSVILLE GROUP (units 5-10)

10 Thin bedded greenish grey to black slate and siltstone with numerous slumps and olistostromes. 10b pillowed basalt olistoliths

- relations unknown -

Caradoc 9 Olistostromes with black pyritic shale matrix and olistoliths of units 1-8. Large scale soft-rock deformation, hydroplastic and thixotropic disaggregation. 9a hornfels around Rocky Bay pluton

-cross-cutting contact-

8 Turbidite sandstone and siltstone with local full Bouma sequences. Numerous minor slumps and soft rock deformation, local channel conglomerate

-gradational contact-

7 Fine-banded grey-black siltstone and shale with shale lenses, shale-flake conglomerates, graded beds, minor slump structures

-gradational contact-

6 Granule and conglomerate lenses with volcanic and ultramafic clasts in grey black siltstone and shale. 6a green sandstone and siltstone facies equivalent to above

-gradational contact-

Llanvirn 5 Red shale with local grey-green bleached areas, occasional limestone beds. Basal sequence of thin-bedded black and white siltstone

-gradational contact-

Arenig(?) 4 GANDER GROUP: Uniform thin-bedded grey green siltstone and quarts wacke; minor pelitic interbeds and conglomerate lenses. 4a green volcanogenic schist with amphibolitic lits and dykes

- fault contact-

GANDER RIVER ULTRAMAFIC BELT (units 1-3)

3 Shattered, chloritized pl-aglomeratic porphyry, tronjhemite dykes sills and stocks

-intrusive contact-

2 Volcanogenic sediments, tuff, agglomerate, minor pillowed basalt. 2a volcanogenic sandstone and minor limestone, 2b debris flows, 2c hyaloclastites, 2d rubble of volcanic and ultramafic rocks, probably gradational to 6

- unconformity-

1 Massive to schistose pyroxenite, peridotite, dunite. 1a serpentinite, 1b magnesite and sukerite, 1c gabbro and diorite

Tectonized and/or Carboniferous

Silurian or Devonian

Llandovery

Middle to Late Ordovician

Middle to Late Ordovician

Middle Ordovician and older

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CARMANVILLE
NEWFOUNDLAND

Scale 1:50,000 Échelle

Miles 1 0 1 2 3 Miles
Metres 1000 0 1000 2000 3000 4000 Metres
Yards 1000 0 1000 2000 3000 4000 Verges

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