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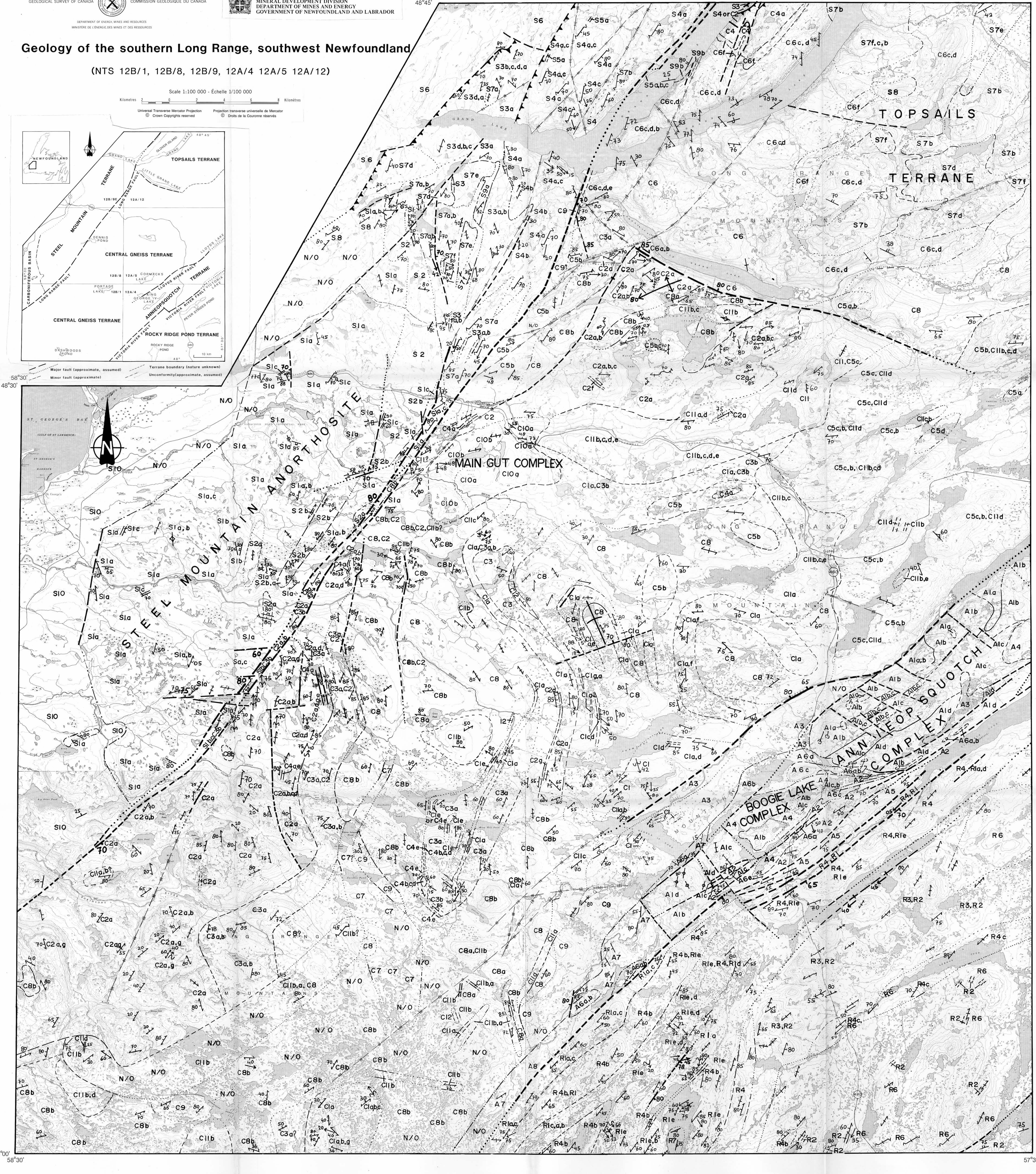
Geology of the southern Long Range, southwest Newfoundland

(NTS 12B/1, 12B/8, 12B/9, 12A/4 12A/5 12A/12)

Scale 1:100 000 - Échelle 1/100 000

Universal Transverse Mercator Projection
Projection transverse universelle de Mercator



DESCRIPTIVE NOTES

INTRODUCTION

The Trans Canada Highway (Route 1), the Burgeo Road (Route 480) which connects the town of Burgeo on the south coast of Newfoundland with the Trans Canada Highway (Route 1), and some privately owned logging roads provide access to portions of the western and central part of the map area. The greater portion of the map area is accessible only by helicopter.

The map area is dominated by the Long Range uplands, a gently rolling surface with an elevation between 300 and 650 meters, which is deeply dissected by rivers and streams. Much of the map area does not support forest cover above an elevation of 300 to 350 meters, except a more or less dense growth of stunted spruce ("tuckamore") and is characterized by bogs between barren peaks and ridges. The degree of bedrock exposure is high in the barren uplands except in areas underlain by undeformed granite where only the top of large rounded hills have exposed bedrock. Exposure is poor to non-existent in the wooded valleys.

Large portions in the south of the map area (12B/1 and 12A/4) are covered by bouldery till. All of the map area has been glaciated, with ice movements dominantly to the northwest in the western portion and to the southeast in the central and eastern portions.

GENERAL GEOLOGY

The southern Long Range consists of at least four distinct terranes separated by tectonic breaks. West of the Long Range Fault in the Steel Mountain Terrane (Humber Zone), anorthosite (unit S1), tonalite-diorite and norite (unit S2), and hornblende-biotite and psammitic gneiss (unit 3) form a basement of presumed Grenvillian age which is overlain by lower grade pelitic to calcareous schists (unit S4), probably correlative to the Fleur de Lys Supergroup of late Precambrian to early Paleozoic age (Knapp et al., 1979; Martineau, 1980; Kennedy, 1981; Hibbard, 1983; Williams, 1985). Autochthonous Cambrian and Ordovician carbonate units (unit S6) lie northwest of this terrane (Kennedy, 1981; Williams, 1985). To the west Carboniferous sedimentary rocks (unit S10) unconformably overlie or are in fault contact with the igneous and metamorphic rocks (Knight, 1983).

The Central Gneiss Terrane, between the Long Range Fault and the Lloyds River/Victoria River Faults, consists of migmatized psammitic, pelitic and calcareous gneisses (units C1 to C3) intruded by numerous, large plutons of late-tectonic granite to granodiorite (unit C8). The gneisses, some are perhaps equivalent to the Fleur de Lys Supergroup, contain several thin strips of foliated mostly serpentinized ultramafic rocks (unit C4). The northeastern portion of the Central Gneiss Terrane consists mainly of fine-grained diabase and medium-grained gabbro (unit C5) intruded by minor amounts of granite to diorite (units C8 and C11). This region may be a separated portion of the Annieopsquotch Terrane.

Between the Lloyds River Fault and the Victoria River Fault (Annieopsquotch Terrane) the rocks consist mainly of medium-grained gabbro and fine-grained diabase (unit A1) intruded by minor late-tectonic granite to granodiorite (unit A3). A large portion of the mafic rocks has been interpreted to be part of an ophiolite fragment (Dunning and Herd, 1980; Dunning, 1984; Kean, 1983) of Lower Ordovician age (480 Ma; Dunning and Krogh, 1985). These rocks are unconformably overlain by a Silurian sequence of red sandstone, conglomerate and felsic volcanics (unit A6) (Chandler and Dunning, 1983) and the Devonian (Emsian; C. McGregor, pers. comm., 1981, in Chandler, 1982) Windsor Point Group (unit A7). Along the southeastern side of the Annieopsquotch Terrane, a belt of volcanic rocks and sediments was correlated by Kean (1983) with the Ordovician Victoria Lake Group (unit A2). This belt pinches out to the southwest, and should perhaps be considered a separate terrane.

Southeast of the Victoria River Fault (Rocky Ridge Pond Terrane) the rocks consist of medium-grained granoblastic gneisses (units R1 and R3) (including volcanics?) intruded by large plutons of late tectonic granites, many of them megacrystic (unit R6) (Kean, 1983). Large-scale compilation maps (Williams, 1978; Hibbard, 1983) show this region as part of the Central Mobile Belt (Gander and Dunnage Zone) of Newfoundland, but lithologically the rocks (units R1 and R3) at a distance of up to five (in the northeast) or fifteen (in the southwest) km from the Victoria River Fault resemble those of the Central Gneiss Terrane. Further southeast rocks are of typical Dunnage and Gander Zone affinity.

The Topsails Terrane in the northeast corner of the map area was not examined by us, but has been described by Whalen and Currie (1983a and b). The rock units are correlated with those of the Central Gneiss (units C4 to C6) and Steel Mountain Terrane (units S7 and S8).

DESCRIPTION OF ROCK UNITS

At present we consider correlation of units between the four terranes defined above to be quite speculative. We therefore describe the lithologic units in each terrane separately, and subsequently suggest possible correlations.

Steel Mountain Terrane

The Steel Mountain anorthosite (units S1a and b) forms a body 40 by 15 km on the west side of the Long Range Fault. Two small, presumably related bodies of anorthosite occur just to the north of the main mass. The Steel Mountain anorthosite consists mainly of a white to mauve, medium-grained, polygonal, recrystallized anorthosite with a colour index less than 10. Primary igneous textures, including layering are locally preserved. Spectacular anorthositic pegmatites, with pyroxene crystals up to 3 m long, occur west and north of Dennis Pond. Pockets and layers of titaniferous magnetite are often present (Baird, 1943 and 1954). Noritic phases are common. Much of the anorthosite is pervasively epidotized. Two sparse swarms of amphibolite dykes (unit S1c), one trending northwest, the other northeast, cut the anorthosite. The Steel Mountain anorthosite is a massif-type anorthosite and resembles the Grenvillian Indian Head anorthosite located some 15 km to the west.

Along its eastern margin, the Steel Mountain anorthosite contains enclaves up to several kilometres across of norite (unit S2a) and tonalite-diorite (units S2b and c). Although the tonalite-diorite locally displays good foliation, the bulk of these rocks are essentially massive. Contacts between these rocks and the anorthosite are very poorly exposed and unambiguous cross-cutting relations were not observed. The tonalite-diorite and norite probably represent facies of the Steel Mountain anorthosite.

Hornblende-biotite gneiss (unit S3a) occurs south and north of Grand Lake. These rocks consist of alternating, plagioclase and hornblende-rich layers, a few mm thick, which may show intricate small-scale folding. Numerous layers of psammitic gneiss (unit S3b) up to 10 cm thick form 10 to 60 percent of the outcrop. Biotite locally veneers the amphibole. Migmatitic "sweats" of granite occur as thin seams, or as spectacular ellipsoids up to 30 cm in diameter. No contact between the hornblende-biotite gneiss and the Steel Mountain anorthosite complex has been observed.

Metasedimentary schists of low metamorphic grade (unit S4) occur near the Long Range Fault in the Grand Lake area. Other units in this sequence, described by Martineau (1980) include marble and calcareous pelitic schists. Most outcrops of this sequence are strongly deformed, so that the schists are phyllitic, or show cataclasis. These rocks have been correlated with the late Precambrian-early Cambrian Fleur de Lys Supergroup (Knapp et al., 1979; Kennedy, 1981; Hibbard, 1983; Williams, 1985).

Serpentinite (unit S5a) (Kennedy, 1981) layers or slivers, partly chloritized, occur northwest of Grand Lake and are surrounded by rocks of the Fleur de Lys Supergroup (unit S4). Serpentinite probably marks thrust faults. Deformed mafic rocks (units S5b and c), probably correlative to the Glover Formation (unit C6) are found on the east side of the Long Range Fault, northwest of Grand Lake (Knapp, 1982).

The hornblende gneiss and metasedimentary rocks are intruded by granites (units S7 and S8) which may be megacrystic (unit S8) massive, or strongly foliated. Locally, these granites are strongly peralkaline (unit S7d) (riebeckite + aegirine +/-aenigmatite) as noted by Whalen and Currie (1984). The most typical feature of the peralkaline rocks is the widespread pseudomorphic replacement of the mafic minerals by ilmenite. Granite types range from one feldspar, peralkaline varieties (unit S7d), through various two feldspar leucogranites (unit S7a), to spectacular hybrid rocks (unit S7e), apparently formed by mixing of acid and basic components. They are correlated with similar (but undeformed) Silurian intrusive rocks of the Topsails Terrane (Whalen et al., in press).

Cambrian and/or Ordovician carbonate units of the Grand Lake Brook and Table Head Groups (unit S6) are in thrust contact with the metaplutonic and metasedimentary rocks to the southeast (Kennedy, 1981; Williams, 1985). These carbonate units were not studied by us. A variably deformed, but weakly metamorphosed conglomerate (unit S9a) (Van Berkel et al., 1986, Fig. 3) contains cobbles of granites resembling those of unit S7. The occurrence south of Grand Lake is probably surrounded by faults. The conglomerate is younger than the Silurian (?) granites (units S7 and S8) and is correlated with Knapp's (1982) Silurian (?) Red Point Formation outcropping along the southwest shore of Glover Island (unit S9b), 13 km to the northeast. Carboniferous conglomerate and sandstone of the Bay St. George Subbasin (unit S10), mainly derived from sources southeast of the Long Range Fault (Knight, 1983), unconformably overlie the Steel Mountain anorthosite in the southwestern corner of the map area. West and northwest of the Steel Mountain anorthosite the contact is discordant (shown on the map) of faulted (Riley (1962) and Knight (1983) showed the contact as a fault along the entire length).

Central Gneiss Terrane

The oldest rocks of the Central Gneiss Terrane comprise tightly folded, medium to high-grade psammitic, quartzo-feldspathic and calcareous gneisses (Van Berkel et al., 1986, Fig. 4), with minor quartzitic, pelitic and marble interbeds (units C1 and C2). Boudinaged amphibolitic layers and inclusions (unit C2g) are common in unit C2 and may be composed entirely of mafic minerals. Trains of these amphibolite inclusions suggest that they are highly deformed and disrupted dykes. In the region south of Dennis Pond, paragneisses are well preserved, but in the west half of Dashwoods Pond map sheet (12B/1) the gneisses are highly recrystallized, and commonly exhibit a medium-grained granoblastic texture with prominent feldspar porphyroblasts (Van Berkel et al., 1986, Fig. 5). Stromatic and nebulitic migmatites exhibit ghost stratigraphy suggesting that they are first cycle migmatites.

Quartzo-feldspathic gneisses in the southeastern half of the Central Gneiss Terrane contain abundant gedrite-pyrite-magnetite (unit C1) instead of the more usual hornblende-biotite-magnetite assemblage. In the area around Cormacks Lake zones richer in pyrite weather out as conspicuous 1-5 m wide rusty zones (Herd and Dunning, 1979). Some quartzo-feldspathic gneisses east of Dashwoods Pond exhibit similar mineralogies (see also Chorlton, 1980, p. 8 for the southern extension of this unit). At present we are uncertain whether these gedrite-bearing gneisses represent a facies of a single paragneiss sequence.

Granitoid rocks (units C3, C8 and C9) comprise the bulk of the Central Gneiss Terrane. In broad terms, the granitoid rocks fall into two categories, namely inclusion-rich foliated hornblende-biotite granite (unit C3a), and presumably younger, leuco or biotite granite to granodiorite which are massive to weakly foliated (unit C8), or megacrystic (unit C9) with locally preferentially oriented feldspar megacrysts. Presently available information suggests units C8 and C9 are of similar age. Each granite type exhibits a considerable range in composition and structure, and further subdivision of the granite may be possible with additional fieldwork. The hornblende-bearing granite (unit C3a) commonly develops adjacent to metasedimentary rocks, exhibit transitions to migmatites (unit C3b), and contains numerous inclusions of the paragneisses (unit C2) or quartzo-feldspathic gneisses (unit C1). The leucocratic and biotite granites to granodiorites (unit C8) in many cases form discrete, well-bounded plutons which are massive or weakly deformed.

The northeastern part of the Central Gneiss Terrane is underlain by weakly deformed gabbro and diabase, and some ultramafics (unit C5). Diabase has a subophitic texture and contains more plagioclase than the gabbro. Despite poor outcrop, it can be shown that the mafic rocks form large northeast-southwest striking units intruded by sheets and veins of granite to diorite, probably offshoots of units C8 and C11. Coarser-grained gabbro (units C5, C7 and C10) forms bodies throughout the Central Gneiss Terrane, and locally exhibits well-developed igneous layering (e.g. along the Burgeo Road (Route 480), 6 km east of the Long Range Fault). One gabbro body (unit C5b) (16 km north-northeast of Cormacks Lake) contains a 200 m thick serpentinite (unit C4a) layer. Zircon dating (Dunning, pers. comm., 1985) and a K-Ar hornblende date (455 ± 65(!) Ma; R.K. Herd, in Stevens et al., 1982, p. 47) of the gabbro body (unit C10) at and south of the Burgeo Road (Route 480), 5 km southeast of the Long Range Fault, suggest that some of these mafic plutons may have been finally emplaced in the uppermost Lower Ordovician, although the zircons suggest a complex history.

Small diorite-tonalite plutons (unit C11) occur throughout the Central Gneiss Terrane. East of Dennis Pond, such a pluton clearly truncates a massive granite (unit C8). Diorite-tonalite plutons often contain mafic inclusions, possibly derived from the gabbro-diabase complex (unit C5). Dunning (pers. comm., 1985) obtained an uppermost Lower Ordovician age on zircons from these rocks along the Burgeo Road (Route 480), 7.5 km east of the Long Range Fault. A K-Ar determination on hornblende from a deformed tonalite, also along the Burgeo Road (Route 480) but more to the East, gave a similar age (455 ± 14 Ma; R.K. Herd, in Stevens et al., 1982, p. 46).

The most distinctive units of the Central Gneiss Terrane are thin (3-300 m), highly deformed serpentinite layers (unit C4a to d), locally associated with deformed gabbro (unit C4e), in the gneisses (units C1 and C2). Commonly gneisses on opposite sides of such layers appear to be identical. Gneiss-serpentinite contacts are parallel to the foliation in each rock unit. Both units are highly deformed. Internally the mafic-ultramafic layers may be isoclinally folded (Van Berkel et al., 1986, Fig. 6). Chromite and magnetite may occur as thin seams (Van Berkel et al., 1986, Fig. 7) or as dispersed euhedral crystals. Veins of talc and asbestos are common. Serpentinite layers in the northwestern part of the terrane are commonly partially chloritized. The serpentinite layer south of Portage Lake exhibits well preserved igneous texture, and displays an east to west transition from serpentinized dunite to harzburgite with minor pyroxenite to gabbro. Veins of serpentinized dunite intrude the harzburgite and pyroxenite. This occurrence appears to be identical to ophiolitic allochthonous material of the Bay of Islands Igneous Complex of western Newfoundland (cf. Smith, 1958). However, it structurally lies next to a north-trending, steeply-dipping zone of pelitic paragneiss and migmatites. Serpentinite inclusions, lenses and layers hosted by metasedimentary or granitoid rocks appear to be quite common in this part of western Newfoundland. They have been described by Herd (1978) and Herd and Dunning (1979) for the area around the Burgeo Road (Route 480) in the Puddle Pond map sheet (12A/5) and just to the West, by Kennedy (1981) northwest of Grand Lake (unit S5a) and by Chorlton (1983) in the Grandys Lake area (southwest of the map area).

Annieopsquotch terrane

The region between the Lloyds River and Victoria River Faults has been studied extensively (Dunning and Herd, 1980; Dunning, 1984; Chandler, 1982; Kean, 1983). According to Dunning (1984) and Dunning and Krogh (1985) the region between King George IV Lake and Victoria Lake comprises a large ophiolite fragment (Annieopsquotch complex, unit A1) of Lower Ordovician age (480 Ma), invaded by younger uppermost Lower Ordovician mafic igneous rocks to the southwest (Boogie Lake gabbro, and related rocks, unit A4). We have examined only selected localities in the Annieopsquotch complex. In the sheeted dyke zone southwest of Loon Echo Pond (see Dunning and Herd, 1980, Fig. 1) we found about 70 percent of the outcrops contain a medium-grained gabbro or diabase host which appears petrographically identical to the gabbro-diabase (unit C5) of the Central Gneiss Terrane. The dykes trend 160 to 190°. Two almost completely exposed sections from the high hills down to Lloyds River expose medium-grained gabbro cut by fine-grained mafic dykes and medium-grained granitic veins. This succession closely resembles that northwest of Lloyds River Fault. The Lloyds River Fault itself forms a narrow ductile shear zone dipping steeply to the northwest. The fault affects both the mafic rocks (unit C5) and later granitoid intrusions (unit C8 and A3). South of Lloyds Lake, it is flanked on both sides by gabbro with minor granite veining.

Sheets and stocks of late tectonic granite to granodiorite and minor tonalite to diorite (unit A3) intrude the mafic rocks. These rocks are unconformably overlain by Silurian redbeds (units A6a and b), with associated felsic volcanics (unit A6c) which have been dated at 431+/-5 Ma (Chandler and Dunning, 1983). These rocks are in turn unconformably overlain by grey sandstones (unit A7) from which Devonian (Emsian, about 372 Ma) spores have been recovered (C. McGregor, pers. comm., 1981, in Chandler, 1982).

Mafic and felsic volcanic rocks with minor clastic sedimentary rocks of the Lower Ordovician Victoria Lake Group (unit A2), outcrop in a narrow zone southeast of the Annieopsquotch complex (Dunning, 1984; Kean, 1983). This zone pinches out to the southwest. A red, intensely flattened conglomerate (unit A5) on the southeastern margin of the zone has been correlated with the Silurian (?) Rogerson Lake conglomerate to the northeast (Kean, 1983). The whole region is intensely deformed and cut by numerous shear zones.

Rocky Ridge Pond Terrane

Southeast of the Victoria River Fault the dominant rock types are migmatitic psammitic paragneiss and subordinate pelitic schist and quartzite (unit R1). Discrete plutons of granitoid rocks (enclosed by unit R1) consist of leucogranite (unit R4a) or medium-grained biotite granite (unit R4b). Near its contact with the paragneisses, the biotite granite tends to be finer-grained and contains hornblende. Unit R1 grades to medium-grained granoblastic quartzo-feldspathic gneisses (unit R3). The grain size of these gneisses is so coarse (5 mm) that they can easily be confused with felsic intrusive rocks. Granite, granodiorite and tonalite (part of unit R3) dominate this neosome (Kean, 1983) forming 50 to 100 m thick sheets in the gneisses. The megacrystic biotite granite (unit R6) is probably of Devonian age (B.F. Kean, pers. comm., 1986). It contain numerous enclaves of Bay du Nord clastic sediments (unit R2) which were also seen in rocks of unit R3. Granites and paragneisses contain narrow, late, biotite-rich shear zones. These shear zones parallel the Victoria River Fault. A diabase body (unit R7) (Kean, 1983), locally with igneous layering, was found in Rocky Ridge Pond.

DEFORMATION AND METAMORPHISM

Northwest of the Long Range Fault, medium to high-grade fabrics (Grenvillian?) occur in the hornblende-biotite to quartzitic gneisses (unit S3). The Steel Mountain anorthosite (unit S1) does not exhibit a pervasive penetrative foliation, presumably because it behaved as a rigid block during deformation. In much of the anorthosite a medium-grained, polygonal, recrystallized fabric is developed. Later metasediments (unit S4) exhibit low to medium-grade mineral assemblages. This later metamorphism has altered much of the medium to high-grade fabrics in the older rocks (units S1 to S3).

In the Central Gneiss Terrane the gneisses (units C1 and C2), were tightly to isoclinally folded during regional medium to high-grade metamorphism. The axial planes of macroscopic and mesoscopic folds are subvertical and strike northwest to northeast, with a predominance of north to northwest strikes (e.g. Herd and Dunning, 1979). Large gabbro-diabase bodies (units C5, C7, C10) were not much affected by this regional deformation and associated medium to high-grade metamorphism, either because they behaved as rigid blocks (Dunning, 1984), or because they are younger (e.g. unit C10). They only have the later low-grade metamorphic fabric. Serpentinized ultramafic-gabbro sheets (unit C4) have also been highly deformed, but the talc-chlorite-serpentine dominant mineralogy of these bodies demonstrates that they either have undergone extensive retrogression or have experienced only the second phase of low-grade metamorphism, similar to their host rocks. Late tectonic granite, granodiorite (unit C8) and tonalite-diorite (unit C11) bodies exhibit only a weakly-preferred orientation of mafic minerals and may be completely massive.

Ten kilometers south-southwest of Dennis Pond, two narrow north-trending zones exhibit a high concentration of foliation-parallel quartz veins with quartz plates (cf. Piasecki, 1980), indicating that these zones have undergone high strain. We interpret them to be major shear zones. The western zone separates a region of calcareous and psammitic gneisses (unit C2d and a) from psammitic (unit C2a) gneisses. The eastern zone lies within the calcareous and psammitic gneisses, but contains a 5-10 m thick, more than 500 m long, highly deformed serpentinite layer (unit C4a). These shear zones predate the emplacement of the late tectonic granitoid rocks (units C8, C9 and C11) as they are intruded by those granitoids.

Regional northeast to southwest-striking ductile fault zones of low metamorphic grade overprint all earlier fabrics. Foliation-parallel quartz veins and lenses are common. The latest fabrics are high level, brittle deformation zones, such as that exposed south of Grand Lake along the Long Range Fault. Megacrystic granite (unit C9) on the east side of the fault exhibits a pervasive cataclastic fabric, and portions of the rock are reduced to mica-schist along anastomosing shears (Van Berkel et al., 1986, Fig. 8). Garnet schist on the west side of the fault is highly crenulated, and contains numerous tension gashes filled with quartz fibres grown perpendicular to the gashes. Along the Burgeo Road (Route 480), just west of the trace of the Long Range Fault, anorthositic rocks exhibit an earlier medium-grade gneissic fabric overprinted by a low-grade, laminated, fine-grained fabric (Van Berkel et al., 1986, Fig. 9). Both fabrics trend north-northwest. This indicates a very long and complex history for the Long Range Fault. Many small, ductile and ductile/brittle shear zones occur throughout the southern Long Range. They are usually oriented parallel to the major northeast to southwest striking regional faults, but some north to north-northwest trending zones were also observed in the Central Gneiss Terrane.

ECONOMIC GEOLOGY

The Steel Mountain anorthosite contains numerous small pockets of titaniferous magnetite. Baird (1943 and 1954) described large lenses north of Flat Bay Brook, which contained about 7 percent TiO_2. Psammitic paragneisses (units C1 and C2) locally contain accessory amounts of magnetite or pyrite, or both. Gedrite-bearing quartzo-feldspathic rocks (unit C1a) may be particularly rich in pyrite, resulting in a distinctive rusty weathering surface. Gold assays of 12 samples from various localities with "rusty" gneisses show a concentration below detection limit (2 ppb). A concordant magnetite layer 3-20 cm wide and more than 2 m long was observed in quartzitic (unit C2b) and pelitic (unit C2c) gneiss south of Dennis Pond. One outcrop of layered gabbro (unit C10a) on Burgeo Road (Route 480), 7.5 km east of the Long Range Fault, contains layers rich in magnetite.

Serpentinite layers (unit C4) locally contain up to 10 percent chromite and magnetite in the form of thin seams (Van Berkel et al., 1986, Fig. 7) or as dispersed euhedral crystals. Au-Pt-Pd analyses (Van Berkel et al., 1986, Table 1) of various serpentinite layers (units C4a and b) yield up to 27 ppb Au, below detection limit Pt (15 ppb), and up to 8 ppb Pd. A harzburgite (sample 5VM229; unit C4c) with primary igneous textures which occurs together with serpentinite (unit C4b) south of Portage Lake contains 81 ppb Pt, 42 ppb Pd, but below detection limit Au (2 ppb). Assays of serpentinized dunite (unit C4b) from this locality (sample 5VM226) show a concentration below detection limit for Au (2 ppb), Pt (15 ppb) and Pd (2 ppb). A harzburgite (sample 5VM740; unit C5a), 3 km southwest of Little Grand Lake, contains very little Au, Pt and Pd (Van Berkel et al., 1986, Table 1).

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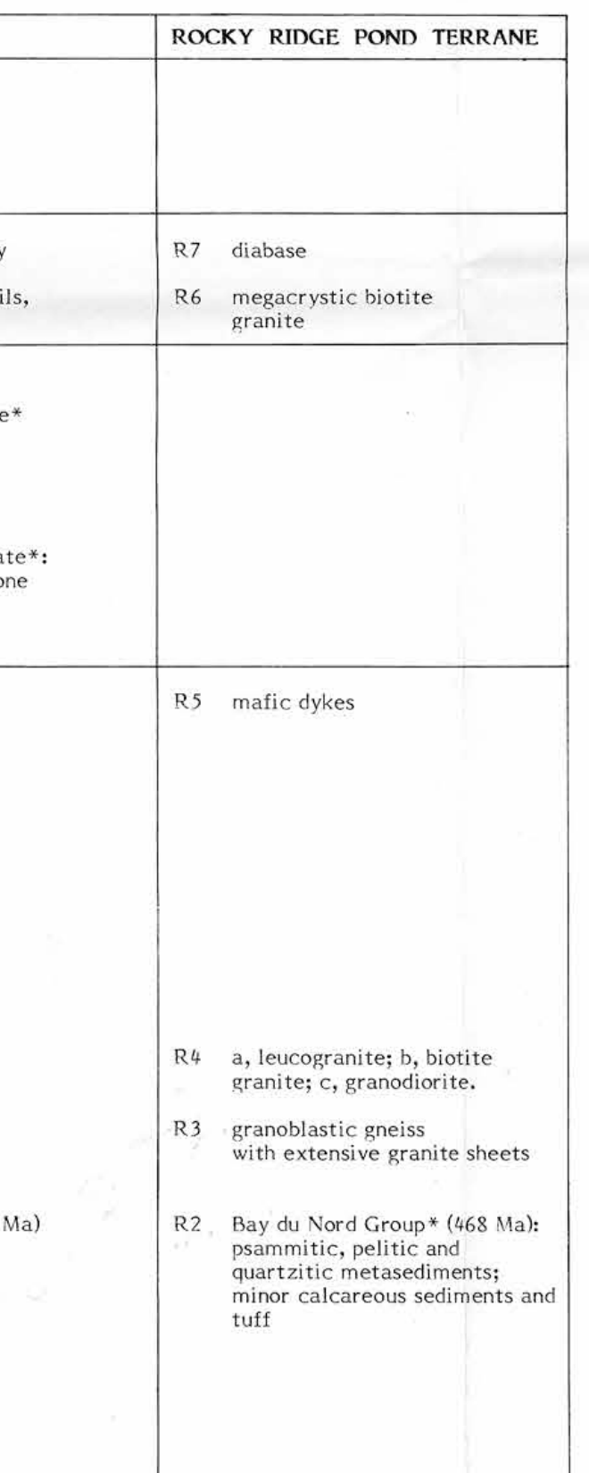
	STEEL MOUNTAIN TERRANE	CENTRAL GNEISS TERRANE	ANNIEOPSQUOTCH TERRANE	ROCKY RIDGE POND TERRANE
CARBONIFEROUS	S10 Codroy* and Anguille* Groups: conglomerate, sandstone; minor, shale, limestone, dolomite, evaporites			
DEVONIAN			A7 Windsor Point Group*: grey sandstone, grit, mudstone, conglomerate (Emsian fossils, ± 372 Ma)	R7 diabase R6 megacrystic biotite granite
SILURIAN	S9 a, metaconglomerate; b, metasandstone and metaconglomerate S8 megacrystic biotite granite S7 a, leucogranite; b, biotite granite; c, granodiorite; d, peralkaline* granite; e, hybrid granite; f, gabbro		A6 a, red sandstone; b, conglomerate; c, rhyolite* (431 Ma); d, pyroclastic rocks; e, mafic flows with minor agglomerate A5 Rogerson Lake Conglomerate*: a, conglomerate, b, sandstone	
ORDOVICIAN	S6 Table Head* and Grand Lake Brook* Groups: limestone dolomite, marble, shale S5 Ophiolite (?): a, serpentinite, partly chloritized; b, greenschist; c, metabasalt	C13 mafic dykes C12 fine-grained leucogranite C11 a, gabbro, b, diorite; c, tonalite* (456 Ma); d, minor granite; e, mafic inclusions. C10 Main Gut Complex: a, gabbro; b, diabase C9 megacrystic biotite granite C8 a, leucogranite; b, biotite granite; c, granodiorite C7 metagabbro, amphibolite C6 Glover Formation* (±480 Ma): a, gabbro; b, diabase; c, basalt; d, felsic volcanics; e, porphyry dyke, sheet; f, schist and metaconglomerate C5 Ophiolite (?): a, harzburgite; b, gabbro; c, diabase; d, troctolite C4 Ophiolite(?): a, serpentinite; b, serpentinized dunite; c, harzburgite; d, pyroxinite e, gabbro	A4 Boogie Lake Complex: gabbro-diorite A3 granite, granodiorite; minor tonalite and diorite A2 Victoria Lake Group* (462 Ma) a, felsic, b, intermediate to c, mafic volcanics; d, sandstone. A1 Annieopsquotch Ophiolite Complex* (± 480 Ma): a, ultramafic rocks; b, mainly gabbro; c, mainly diabase; d, basalt, minor diabase dykes	R5 mafic dykes R4 a, leucogranite; b, biotite granite; c, granodiorite. R3 granoblastic gneiss with extensive granite sheets R2 Bay du Nord Group* (468 Ma): psammitic, pelitic and quartzitic metasediments; minor calcareous sediments and tuff
CAMBRIAN TO LATE UPPER PROTEROZOIC	S4 Fleur de Lys Supergroup*: a, pelitic and b, calcareous schist; c, quartzite	C3 a, granite gneiss; b, migmatite; C2 a, psammitic, b, quartzitic, c, pelitic and d, calcareous gneiss; e, gt-hbl pods; f, marble; g, amphibolite (dykes?) C1 Cormacks Lake Complex: a, quartzo-feldspathic, b, quartzitic, c, pelitic and d, calcareous gneiss; e, amphibolite; f, amphibolite dyke		R1 a, psammitic, b, quartzitic and c, pelitic gneiss; d, amphibolite; e, nebulitic or stromatolitic migmatite
UPPER PROTEROZOIC (GRENVILLIAN)	S3 a, hornblende-biotite gneiss; b, psammitic and c, pelitic gneiss; d, quartzite S2 a, norite; b, diorite; c, tonalite. S1 a, anorthosite*; b, gabbroic anorthosite; c, amphibolite dyke.			



Major fault (ductile and/or brittle) or fault zone (approximate, or defined with lineation, sense of displacement and dip (inclined vertical); inferred; assumed or concealed)

Minor fault (ductile and/or brittle) or fault zone (approximate, or defined with lineation, sense of displacement and dip (inclined vertical); inferred; assumed or concealed)

Thrust fault (ductile and/or brittle) or thrust fault zone (approximate, or defined with lineation, sense of displacement and dip (inclined vertical); inferred; assumed or concealed)

Brittle fractures (inclined, with sense of shear; vertical)

Macroscopic fold (plunging anticline, syncline; vertical fold with closure shown)

Mesoscopic ductile shear zone (inclined with lineation, vertical)

Mesosopic multiple folds (vertical axial plane, inclined axial plane)

S-, Z- shaped mesoscopic folds

Bedding, top know (inclined, vertical), top unknown (inclined vertical)

Foliation (inclined, vertical, with various strike directions)

Lineation (with plunge)

Igneous layering (inclined, vertical)

Sheeted dykes (inclined, vertical)

Pillow lava (inclined, vertical)

Mafic dyke (inclined)

Geologic boundary (defined, approximate, inferred, assumed or concealed)

Unconformity (approximate, assumed or concealed)

Lineament from aerial photos

N/O No Outcrop

Geological compilation by J.T. Van Berkel and K.L. Currie, 1986.

Geology by J.T. Van Berkel, H.P. Johnston, K.L. Currie, J.C. Martin, S. Dawson and M.A.J. Piasecki, 1985.

Some areas compiled from Riley (1957, 12A, west half; and 1962, 12B) Herd (1978; 12A/5 and 12A/12), Herd and Dunning (1979; 12A/5), Knapp et al. (1979; 12B/9E and 12A/12), Martineau (1980; 12B/9E), Kennedy (1981; 12B/9E and 12A/12), Chandler (1982;12A/4 and 12A/5), Kean (1983; 12A/4), Dunning (1984; 12A/4 and 12A/5), Whalen and Currie (1984; 12A/12, Topsails Terrane) and Williams (1985; 12B/9E). An asterisk in the legend indicates that the age of the unit is reasonably well known. All other age assignments are speculative. Zircon ages of units C11, A2 and R2 after Dunning, written communications, 1986.

Information from this publication may be quoted if credit is given. It is recommended that reference be made in the following form:

Van Berkel, J.T. and Currie, K.L.
1986: Geology of the southern Long Range, southwest Newfoundland (12B/1, 12B/8, 12B/9 , 12A/4, 12A/5, 12A/12). Geological Survey of Canada, Open File Report 1328(1:100,000 map with marginal notes).

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