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GEOLOGY OF THE PORT HOPE SIMPSON MAP REGION, GRENVILLE PROVINCE, EASTERN LABRADOR

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ABSTRACT

The Port Hope Simpson map region is subdivided into four main structural–lithological entities, namely 1) Paradise metasedimentary gneiss belt, 2) White Bear Arm complex, 3) Gilbert River shear belt, including the Alexis River anorthosite, and 4) an area southwest of the Gilbert River shear belt. The Paradise metasedimentary gneiss belt comprises cordierite–sillimanite–K-feldspar pelitic gneiss, minor dioritic gneiss and mafic plutonic rocks, intruded by granitoid plutons. The White Bear Arm complex, which is composed of coronitic gabbronorite, together with lesser monzonite and metamorphic derivatives, can be subdivided into a northern part having primary mineralogies and textures and a southern region made up of strongly deformed and metamorphosed amphibolite intercalated with metasedimentary gneiss. The Gilbert River shear belt consists of interfingering K-feldspar-megacrystic granitoid rocks, pelitic gneiss, orthogneiss and mylonitized equivalents of these. The Alexis River anorthosite, which also includes leucogabbronorite and amphibolite, forms a distinctive unit in the southern part of the Gilbert River shear belt. The southern area is underlain by pelitic gneiss intruded by K-feldspar-megacrystic granitoid rocks. All of these units were affected by the Labradorian and Grenvillian orogenies. Post-Grenvillian units include two small granite plutons, the Gilbert conglomerate and two suites of mafic dikes.

The structure of the region is dominated by the Gilbert River shear belt, a 30-km-wide zone of right-lateral, strike-slip deformation. One major structure in this belt, the Gilbert River fault, marks the southern boundary of a very pronounced positive Bouguer gravity anomaly underlying the White Bear Arm complex and Paradise metasedimentary gneiss belt.

Prospects for economic mineralization include sulfide-rich zones and muscovite-rich pegmatites in pelitic gneiss, and cumulate-related mineralization associated with the layered basic intrusions.

INTRODUCTION

Geological mapping at 1:100,000 scale of the Port Hope Simpson map region in 1986 marks the third year of a 5-year Canada–Newfoundland joint project, aimed at completing mapping of an 80-km-wide coastal fringe of the Grenville Province in southeastern Labrador. The Port Hope Simpson map region comprises six NTS 1:50,000 scale map areas (3D/12, 13, 13A/9, 10, 15, 16), which encompass a land area of approximately 4,700 km². Early geological knowledge of the area is based on descriptions of coastal localities (Lieber, 1860; Packard, 1891; Daly, 1902; Christie, 1951; Douglas, 1953; Kranck, 1939), the 1:500,000 scale mapping of Eade (1962), and reconnaissance mineral exploration activity carried out by British Newfoundland Corporation (BRINCO) Ltd. (Piloski, 1955; Bradley, 1966; Donohue, 1966; Kranck, 1966). More recently, complete aeromagnetic coverage has become available for the region (Geological Survey of Canada, 1974a, b), and the coastal region (3D/12 and most of 3D/13) was mapped at 1:100,000 scale by Wardle (1976, 1977). Reconnaissance geological mapping also has been completed for the adjoining map regions north and northwest of the study area (Gower *et al.*, 1985, 1986).

GENERAL GEOLOGY

Regional Setting

The Port Hope Simpson map region is situated entirely within the Grenville Province, and includes the southeast quadrangle of Figure 1. The region can be divided into four major lithological entities. These are: 1) Paradise metasedimentary gneiss belt, 2) White Bear Arm complex, 3) Gilbert River shear belt, including the Alexis River anorthosite, and 4) an area southwest of the Gilbert River shear belt. In addition, a small part of the Paradise Arm pluton extends into the study area. The ornamentation used in Figure 1 implies that the southwest area is part of the Mealy Mountains terrane, but the name is withheld for the Port Hope Simpson map region pending further consideration of boundary relationships with the Gilbert River shear belt and, farther north, the Lake Melville terrane.

No geochronological data are available within the study area, but extrapolation from similar units that have been dated in the Paradise River region indicates that most rocks probably have ages between 1710 Ma and 1650 Ma.

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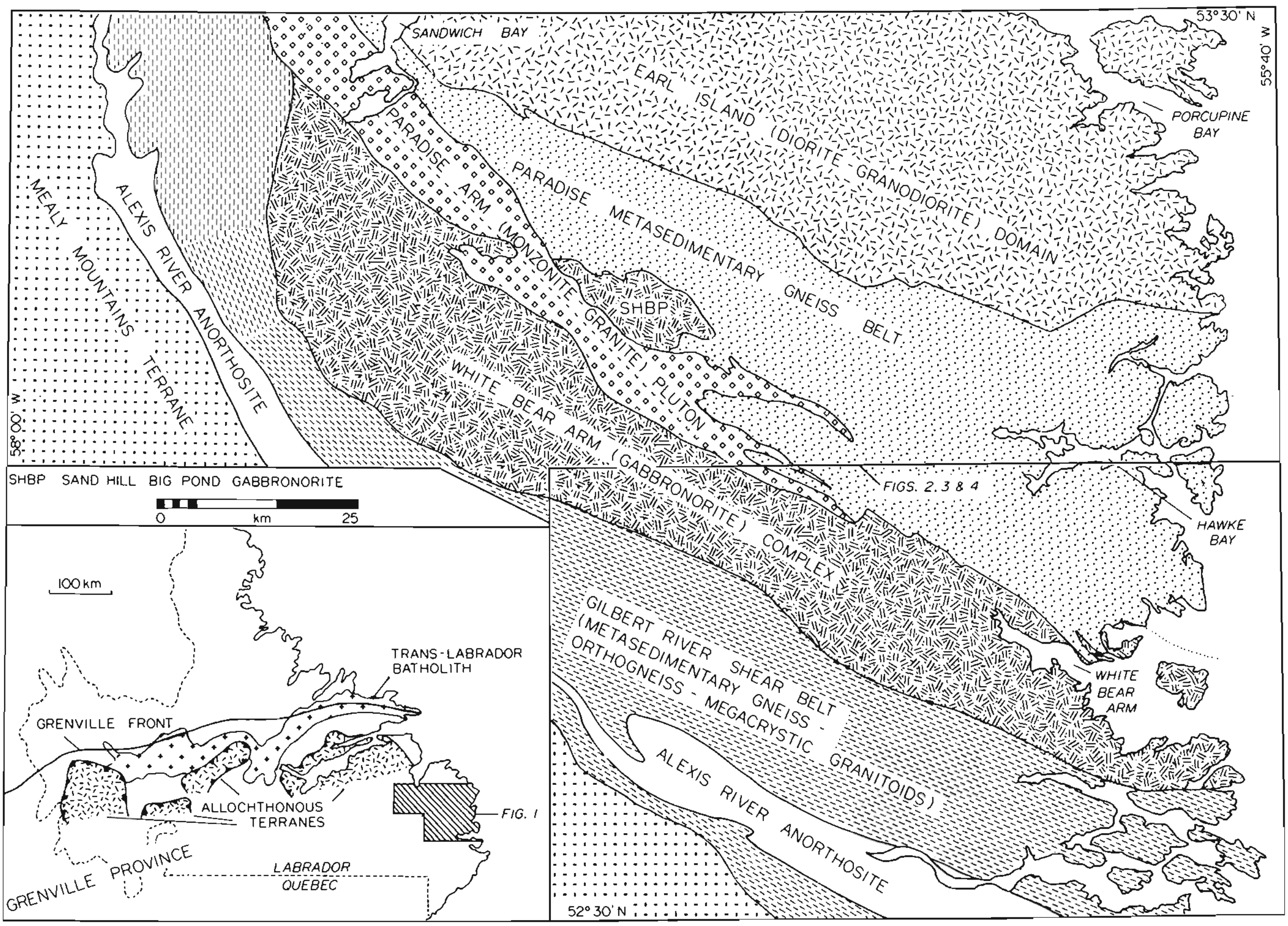

Figure 1: *Regional structural–lithological subdivision of part of the Grenville Province in eastern Labrador. The Port Hope Simpson map region forms the southeast part of Figure 1.*

Paradise Metasedimentary Gneiss Belt

The Paradise metasedimentary gneiss belt underlies a triangular-shaped area in the northeast part of the Port Hope Simpson map region (Figure 2). This area is a small segment of the metasedimentary gneiss mapped as a continuous belt from the southeast Labrador coast to northwest of Sandwich Bay (located on Figure 1), a distance of 175 km (Gower *et al.*, 1982, 1985, 1986). The belt gradually tapers from the southeast, where it is over 40 km wide, to the northwest, where it is attenuated to less than 1 km in a series of thrust slices. The Paradise metasedimentary gneiss belt includes the Triangle Harbour gneiss of Wardle (1977).

Within the study area, there are four principal lithological components, namely 1) gneisses of supracrustal origin, 2) granitoid plutons, 3) dioritic gneiss, and 4) mafic plutonic intrusions. The gneisses of supracrustal origin are dominated by pelitic and semipelitic rock types, but amphibolite is an important associated rock type, and calc-silicate units and quartzite or metamorphosed banded chert are distinctive, albeit minor components. The pelitic gneisses are pink, black, gray and buff weathering, medium and coarse grained, and exhibit very variable textures. In many outcrops the rocks appear quite homogeneous or poorly banded. Elsewhere the banding is well developed and may be straight, contorted, discontinuous, irregular, lensy or schlieric. Some rocks have large K-feldspars, giving the rocks a superficially megacrystic granitoid appearance. The mineralogy comprises quartz–plagioclase–K-feldspar–biotite–magnetite ± cordierite ± sillimanite ± garnet ± muscovite. The presence of cordierite is one of the most diagnostic features of the rock, most commonly evident in outcrop as recessive-weathering, pseudomorphed, orange to honey-brown spots and patches, but also occurring as pale- to deep-blue-mauve translucent primary grains. The cordierite pseudomorphs consist of biotite, sillimanite, magnetite and quartz, commonly having a stellate appearance as a result of replacement minerals mimicking the hexagonal twinning habits of cordierite. Sillimanite also occurs as an independent stable phase. Garnet, although rare, is present sporadically as a mauve to blood-red mineral, especially in pelitic gneiss associated with quartzite or amphibolite. Muscovite appears to be a retrograde phase, but as it is usually aligned within a foliation, it is not post-deformational.

Intimately associated with the pelitic gneisses are white-, pink-, creamy- or gray-weathering metasedimentary diatexites that, where less extensively developed, appear as anastomosing granitic veins and pods. These rocks range from fine grained to pegmatitic, and gradation occurs between contrasting grain sizes within a few centimetres. Commonly these rocks contain skialiths or rafts of recognizable pelitic gneiss and dispersed clots of restite made up of biotite, sillimanite, cordierite and magnetite. The diatexites and granitic veins or pods themselves grade into more distinctive pegmatites that are commonly muscovite bearing (see Economic Potential).

The supracrustal amphibolites appear as green to black, homogeneous to well banded, fine to medium grained rocks composed dominantly of hornblende and plagioclase. In many areas the rocks have a lensy or poddy appearance and calc-silicate minerals, such as grossularite or diopside, are developed extensively. Locally there is good evidence that some of the amphibolites were pillowed mafic volcanic rocks (Plate 1), and that the calcareous material represents inter-pillow material, originally calcareous mud. Douglas (1953) noted xenolithic masses in gneiss southeast of Norman Bay (Figure 2) that he considered to have been pillow lava originally. Elsewhere the fragmentary appearance of the rock suggests breccia or pyroclastic material. The effects of subsequent deformation should not be disregarded, however, because the lensoid shapes, in places, record the combined effects of migmatization and shearing.

Plate 1: *Pillowed mafic volcanic rocks in the Paradise metasedimentary gneiss belt; Dead Islands area.*

Calc-silicate rocks and quartzite are rarely extensive enough to be mapped as separate units, the largest quartzite unit having a width of about 4 m. Nevertheless, a mutual association of these rocks is quite common, including pyritic gossans, especially in the Dead Islands and Occasional Harbour areas.

One further noteworthy feature of the Paradise metasedimentary gneiss belt is the presence of mafic dikes that seem to be spatially associated with banded amphibolite (Wardle, 1977). These dikes, although deformed and metamorphosed, are indisputably discordant to the fabrics in the banded amphibolite (Plate 2). In places, especially in the Dead Islands area, they are quite abundant; at one locality 6 dikes occur within a 2-m-wide zone. The widest dike has a width of about 1.5 m.

Plate 2: *Discordant, deformed mafic dike intruding migmatized and fragmental (?) mafic rocks of probable supracrustal origin in the Paradise metasedimentary gneiss belt; Dead Islands area.*

Granitoid rocks emplaced into the Paradise metasedimentary gneiss belt include at least seven distinct intrusions. All are elongate parallel to the regional trend, but individual plutons differ considerably in their length–width aspect. The dominant rock type in all plutons is a pale-pink- to buff-weathering, medium to coarse grained, recrystallized, K-feldspar-megacrystic granitoid rock that includes quartz syenite, granite and granodiorite compositions. The rocks are generally massive to moderately foliated, but strongly deformed zones transect several of the plutons. The typical mineralogy is quartz, plagioclase, K-feldspar, biotite and magnetite. The K-feldspar megacrysts average 2 by 1 cm in size but may be up to 5 by 4 cm locally. They are commonly euhedral, distinctly zoned and twinned, but in seriate-textured

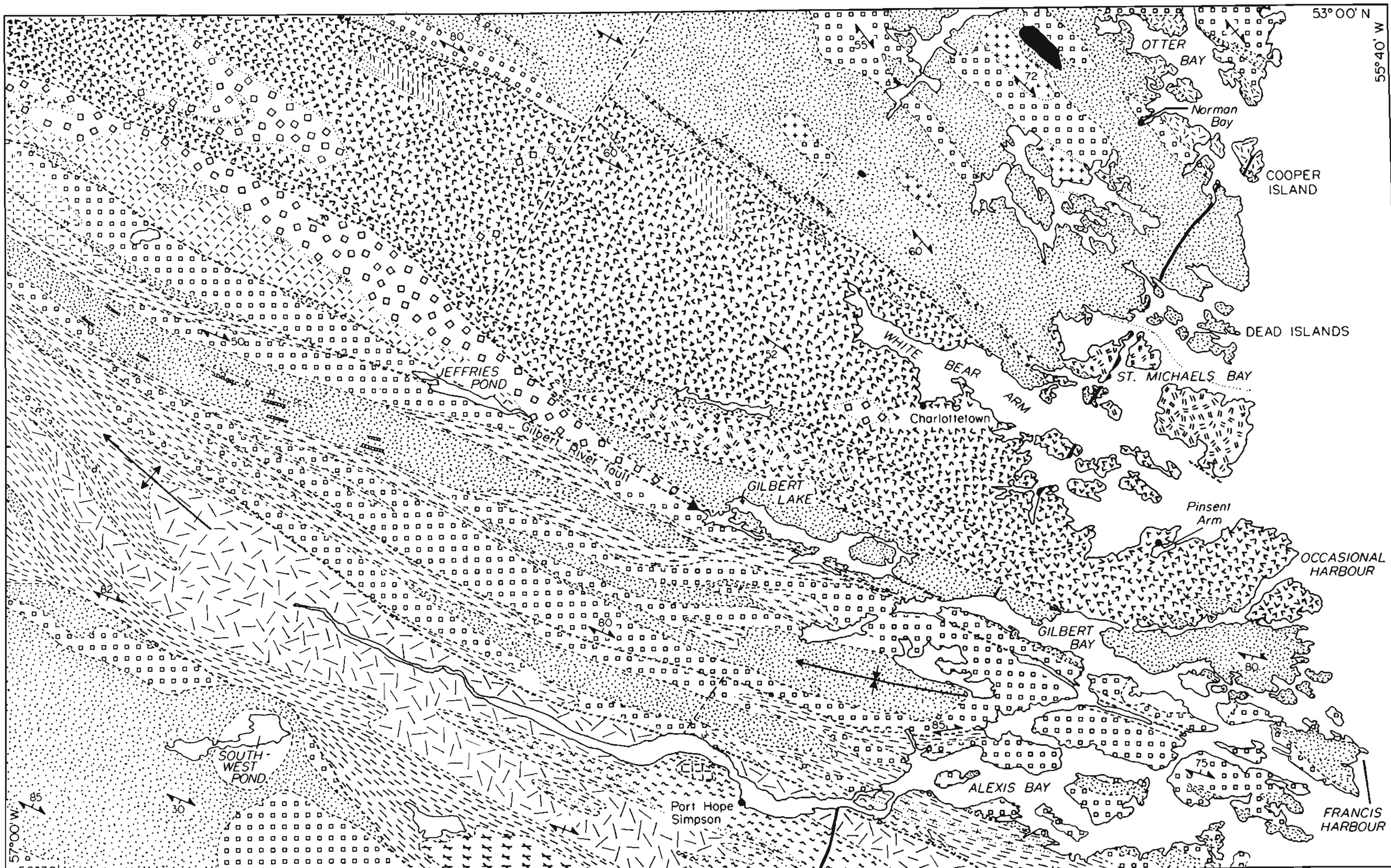

Figure 2: *Geology of the Port Hope Simpson map region.*

LEGEND

LATE PRECAMBRIAN–EARLY PALEOZOIC

Gabbro, diabase

Gilbert conglomerate

Granite (post-Grenvillian)

MIDDLE PROTEROZOIC OR OLDER

Metagabbro, ultramafite

Unnamed Granitoid Plutons

Granite, alkali-feldspar granite

K-feldspar-megacrystic granitoid rocks

Non-megacrystic biotite granodiorite to granite

Biotite–hornblende diorite to granodiorite

MIDDLE PROTEROZOIC OR OLDER *(continued)*

Paradise Arm Pluton

Monzonite, quartz syenite, granite

White Bear Arm Complex

Granite, alkali-feldspar granite

Monzonite, quartz syenite, granite

Fine to medium grained gabbronorite

Gabbronorite, troctolite, commonly coronitic and locally layered; amphibolite in part

Leuconorite, anorthosite

MIDDLE PROTEROZOIC OR OLDER *(continued)*

Metasedimentary Gneiss

Pelitic and semipelitic gneiss, minor calc-silicate rock and amphibolite

Quartzite

Alexis River Anorthosite

Anorthosite, gabbronorite and metamorphic derivatives

Orthogneiss

Biotite granite gneiss

Biotite granodiorite gneiss

Biotite–hornblende granodiorite–diorite gneiss and amphibolite

Quartz diorite gneiss and opdalite

SYMBOLS

Geological boundary; approximate, diffuse

Undifferentiated faults, mostly strike slip

Normal faults

Antiform, synform

Gneissosity, foliation

granitoid rocks, they tend to be subhedral or anhedral, lacking distinct zoning or twinning.

All the plutons are characterized by sporadic enclaves, mafic dikes and minor granitic intrusions. Angular to rounded amphibolite to diorite enclaves are most obvious, but more diffuse, nebulitic rafts and disoriented blocks of metasedimentary gneiss are not uncommon. In partially assimilated nebulitic enclaves it is not easy to determine their pre-intrusive deformational state, but in blocks that are more or less intact, it is evident that the gneissosity was imparted to the metasedimentary rocks prior to inclusion in the host granite. Both the mafic and metasedimentary enclaves are invaded by anastomosing granitic leucosome.

Both net-veined and rectiplanar metamorphosed mafic dikes are present, mostly comprising fine to medium grained amphibolite. Where contacts between net-veined mafic rocks and host granite are unexposed, it is impossible to determine whether the rocks are mafic dikes or migmatized mafic enclaves. The rectiplanar mafic dikes are fine to medium grained, dark-grayish-green amphibolites, possibly, but not necessarily, belonging to the same suite as those dikes intruding the mafic supracrustal rocks. Minor granitoid intrusions include microgranite, pegmatite and quartz veins. The pegmatites are locally muscovite bearing.

Other granitoid rock types are present in places, particularly in the small plutons. The two smallest were mapped as garnet-bearing granite and non-megacrystic granodiorite to quartz diorite. As these are based only on two to three outcrops in each case, it is questionable whether or not they are really plutons at all. The largest pluton is also the most variable, including rock types such as hornblende quartz monzodiorite and pyroxene-bearing quartz syenite. This pluton is also distinguished by a more nebulitic appearance and diffuse enclaves. At the eastern end of the pluton, an extensive area of non-megacrystic granodiorite, based on mapping by Wardle (1977), is shown in Figure 2.

The dioritic gneiss flanking the north and southeast sides of Otter Bay, and previously described by Gower *et al.* (1986) from Hawke Bay (located on Figure 1), is a texturally complex rock. It includes buff, gray and green, well banded to homogeneous gneiss having fine, sharp laminations or broad diffuse layers that may be straight, wavy, contorted or extensively folded. Amphibolitic to dioritic enclaves and schlieren, lenses and bands are abundant, usually having a very heterogeneous, irregular, agmatitic aspect. Leucosome is pervasive and intimately associated with both the gneiss and the ubiquitous enclaves. The mineralogy typically consists of plagioclase, quartz, K-feldspar, hornblende and biotite with some epidote or orthopyroxene. In addition to being a matrix mineral, hornblende also occurs as large, euhedral grains dispersed throughout the leucosome. Most of Cooper Island (Figure 2) is underlain by a relatively homogeneous to locally migmatitic, gray-brown rock considered in outcrop to be hornblende quartz diorite. Wardle (1977) noted that the unit is orthopyroxene bearing and equated it with similar compositions in the White Bear Arm complex.

Locally the dioritic gneiss grades into K-feldspar augen gneiss and pink granitic gneiss, both of which also contain abundant amphibolitic to dioritic enclaves. Also associated with these rocks are cordierite-bearing metasedimentary gneisses and more homogeneous granitoid rocks that include hornblende-bearing granodiorite, K-feldspar-megacrystic granodiorite and equigranular pink granite. No spatial control on the distribution of any of these rocks is evident, and all may be found without discernable boundaries within a single outcrop.

Neither the age nor the origin of this unit is known. The ubiquitous transitional nature of the contacts with both the metasedimentary gneiss and the granitoid plutons suggests a genetic link with both, although it is known that the granitic plutons postdate some of the deformation that affected the metasedimentary gneiss. The suggestion is advanced here that the granitoid plutons may have been derived as a partial melt from the metasedimentary gneiss and that the dioritic gneiss represents the residuum of melting in which refractory components have been concentrated. Such components include supracrustal amphibolite, mafic dikes and metasedimentary restite in various stages of assimilation.

Mafic plutonic intrusions in the Paradise metasedimentary gneiss belt are minor. Rock types include massive to foliated gabbro, gabbronorite and ultramafite having partially recrystallized ophitic and cumulate textures. Primary layering is evident in some intrusions.

Paradise Arm Pluton

Only a small part of the Paradise Arm pluton is present in the Port Hope Simpson map region, occurring as two fingers at the southeast extremity of the pluton. It extends northwest to Sandwich Bay and has an overall strike length of about 120 km. The pluton is interpreted to have been emplaced by wedging along a fault between the Paradise metasedimentary gneiss belt and the White Bear Arm complex (Gower *et al.*, 1986).

The pluton consists of pale-pink to gray, homogeneous, foliated quartz monzonite to granodiorite showing K-feldspar-megacrystic to seriate textures. The megacrysts average 2 by 1 cm in size but crystals up to 7 by 4 cm occur sporadically. The dominant mafic mineral is biotite, augmented by very minor garnet, hornblende and/or magnetite. In places there are nebulitic, banded enclaves enriched in biotite (or more rarely hornblende), which are interpreted to be almost-assimilated metasedimentary gneiss. The Paradise Arm pluton is intruded by mafic dikes having east–west trends, rectiplanar form and, in one case, a clearly preserved chilled margin. The dikes have been metamorphosed to amphibolite facies but are unmigmatized. Minor cross-cutting quartz–feldspar veinlets are also present.

White Bear Arm Complex

The White Bear Arm complex is a major mafic plutonic body extending from Sandwich Bay to the southeast Labrador coast, a distance of 150 km. Within the Port Hope Simpson map region the body has a strike length of about 90 km and averages 15 km wide (Figures 1 and 2).

Rock types in the White Bear Arm complex can be subdivided broadly into two groups, namely 1) those having primary igneous mineralogies and textures, and 2) recrystallized and hydrated metamorphic derivatives. These groups can be equated in general terms with Units 1 and 2 respectively of Wardle (1977). The first group includes fine to extremely coarse grained gabbronorite (having leucocratic and melanocratic variants), olivine gabbronorite, monzogabbronorite, monzonite–syenite (including quartz-bearing types) and granite. The second group includes amphibolitic and dioritic gneiss associated with lesser tonalitic, monzonitic and granitic gneiss.

The dominant rock type in the first group is a dark-gray-, brown-, buff- or rusty-weathering, coarse grained gabbronorite except in the St. Michaels Bay area, which is largely underlain by leucogabbronorite–anorthosite (Plate 3). Grain size is typically 3 to 6 mm across, but extensive outcrops having rocks whose grain size exceeds 3 cm are present, and locally spectacular gabbronorite pegmatites are developed. Rocks are typically massive to mildly foliated. The primary mineralogy consists of purplish plagioclase, honey-brown orthopyroxene, pale-green clinopyroxene, fresh to serpentinized olivine and an opaque mineral. Red-brown biotite and hornblende are additional primary phases in many rocks. In olivine-bearing rocks, double coronas are ubiquitously developed between olivine and plagioclase, consisting of a white (in hand sample) inner corona of fibrous, radiating orthopyroxene and a green outer corona of clinopyroxene–spinel symplectite. The rocks have cumulus plagioclase and olivine and poikilitic post-cumulus clinopyroxene.

Primary layering is evident in places, and has been previously noted by Wardle (1976, 1977). Generally layers are somewhat diffuse and ill defined. It is in these layered rocks that the more extreme compositions, such as anorthosite or olivine–pyroxene-dominant ultramafites, are found.

The separately mapped fine to medium grained gabbronorites are pale gray to dark gray-brown, homogeneous, massive to moderately foliated, and mineralogically similar to the coarser grained types already described. Their field occurrence differs, however. The fine grained gabbronorites are rarely extensive, and in several localities are rectiplanar

Plate 3: *Coarse grained leucogabbronorite from the White Bear Arm complex; Square Island area.*

dikes intruded into coarse grained gabbronorite and, more obviously, into monzonitic rocks. Commonly the dikes are injected by irregular, anastomosing, agmatitic veinlets of monzonite to granite that rarely exceed a few centimetres in width. The dikes are interpreted here as feeders for later coarse grained gabbronorite units, emplaced through earlier crystallized parts of the White Bear Arm complex. The granitoid veinlets are regarded as residual fluids derived by backveining from the adjacent host rock shortly after its consolidation.

The medium grained monzonitic to granitic rocks in the White Bear Arm complex are pink, gray, red and buff weathering, and exhibit equigranular, seriate or megacrystic textures. In contrast to the massive or weakly deformed gabbronorite, the monzonitic to granitic rocks are typically moderately to strongly deformed, and record deformation in the White Bear Arm complex commonly not evident in (although experienced by) the more leucocratic units. Essential minerals are plagioclase, K-feldspar, quartz, biotite and, in places, hornblende or pyroxene. K-feldspar megacrysts commonly exceed 2 cm in length and in places measure 3 by 2 cm. Amphibolite enclaves occur sporadically throughout the monzonite, and locally gabbronorite enclaves are found also. In coastal outcrops, layered units showing transition from gabbronorite to monzogabbro to monzonite were observed. Locally, contacts between monzonite and gabbronorite are agmatitic, involving monzonite injected into the overlying gabbronorite. Clearly several periods of both gabbronorite and monzonite emplacement have occurred, and a simple chronology of emplacement has no validity.

The metamorphosed parts of the White Bear Arm complex are dominated by dark-gray or black, fine to medium grained, amphibolitic to dioritic gneiss. The more leucocratic gneiss represents metamorphosed leucogabbronorite (and similar rock types), consequently the term 'dioritic gneiss' may not be compatible with plagioclase compositional constraints demanded by Streckeisen's (1976) rock name classification, although it seems most appropriate from field appearance. The gneiss is a strongly foliated, well banded rock containing melanocratic amphibolite or hornblendite boudins and buff to cream quartzofeldspathic leucosome. The leucosome sporadically contains large, black hornblende crystals. The mineralogy comprises amphibole and plagioclase and variable amounts of clinopyroxene, orthopyroxene, quartz, biotite, garnet and K-feldspar. These minerals are similar to those found in the primary gabbronorites, but recrystallized, granoblastic to foliated textures testify to the metamorphic origin of the rocks.

The amphibolitic to dioritic gneiss is most common either in a zone marginal to the north side of the White Bear Arm complex or in a broad belt flanking the south side, especially near its eastern end. In both regions, the gneiss is interlayered with remnants of metasedimentary gneiss and injected by minor granitic intrusions prior to deformation. The most common metasedimentary gneiss is a biotite–sillimanite pelite, but quartzite or calc- silicate rocks are also associated. Although mapping was not sufficiently detailed to offer proof, we suspect that the 2 to 3 km northern border of the White Bear Arm complex is an interdigitating zone of gabbronorite, amphibolitic gneiss and metasedimentary gneiss. Similarly, we think that the whole of the amphibolitic-gneiss region south of a major southeast-trending fault within the White Bear Arm complex contains much more metasedimentary material than indicated on Figure 2. It seems probable that the dioritic to granitic gneiss interlayered with the amphibolitic gneiss was derived by mixing and partial assimilation between gabbronorite and pelitic gneiss.

Both the primary-textured gabbronoritic to monzonitic rocks and the amphibolitic to dioritic gneiss have been intruded by metamorphosed (to amphibolite) mafic dikes and subsequently by microgranite to pegmatite dikes.

Gilbert River Shear Belt

The Gilbert River shear belt is a new informal name given to a major zone of deformation about 30 km wide that diagonally transects the central part of the Port Hope Simpson map region. It is described here in three parts, namely 1) the 4-km strip between the White Bear Arm complex and the Gilbert River fault, 2) the zone between the Gilbert River fault and the Alexis River anorthosite, and 3) the Alexis River anorthosite and its distinctive gneissic envelope.

Area between the White Bear Arm complex and the Gilbert River fault. One of the principal reasons for considering this region separately from the rest of the Gilbert River shear belt is the presence of a strip of granitoid rocks that underlie the northwestern half of this area. These rocks are lithologically comparable to those in the White Bear Arm complex, although proportions differ. The rocks comprise pink, buff, gray and brick-red, fine to medium grained, quartz monzonite–syenite to alkali-feldspar granite associated with minor sillimanite-bearing metasedimentary gneiss, amphibolite and fine to medium grained gabbronorite. The granitoid rocks can be broadly subdivided into medium to coarse grained K-feldspar-megacrystic rocks and fine grained syenitic to alkali-feldspar granite. The K-feldspar-megacrystic rocks have euhedral to oval megacrysts up to 6 cm in diameter, although 2-cm diameters are more typical. Associated minerals include plagioclase, quartz, biotite, hornblende, garnet, allanite, titanite and opaque minerals. The fine grained syenitic to granitic rocks are either homogeneous or have a diffuse banding defined by biotite schlieren and pegmatitic layers. On careful examination of some granite localities, fine grained sillimanite was found associated with the biotite layers. Our preferred interpretation is that these granites were derived by almost complete melting of a pelitic-gneiss protolith, but associated relicts of more obviously recognizable metasedimentary gneiss may imply assimilation (at various stages) of a metasedimentary country rock.

The associated mafic rocks include dark-weathering, poorly banded amphibolite to mafic granulite and more homogeneous, fine to medium grained gabbronorite. These rocks are comparable to units in the White Bear Arm complex. In addition a few small, rectiplanar, but deformed amphibolite dikes, microgranites and pegmatites were also seen.

The metasedimentary gneiss that makes up the southeast half of the zone north of the Gilbert River fault is similar to that found farther south, hence description is given in the following section.

Area between the Gilbert River fault and the Alexis River anorthosite. Within this zone three rock types dominate, namely 1) K-feldspar-megacrystic granitoid rocks, 2) pelitic and associated metasedimentary gneiss, and 3) orthogneiss. These rocks are intermixed as tectonic slivers or 'fish' that range in size from a few metres to tens of kilometres long. Most abundant is the K-feldspar-megacrystic unit, which is composed of gray-, pink- or rusty-buff-weathering, fine to coarse grained rocks having overall granodioritic to quartz monzonitic compositions. The megacrysts vary (according to the degree of superimposed deformation) from euhedral, zoned, unrecrystallized crystals (Plate 4) to smeared out, lensoid aggregates. Most commonly they are found having pink or gray unrecrystallized cores and white recrystallized rims. Although the average size of the megacrysts is about 2 by 1 cm, they are locally as large as 5 by 4 cm, and may form 40 to 50 percent of the rock. The matrix of the megacrystic granitoid rock varies (again according to extent of imposed deformation) from having a homogeneous, seriate or equigranular aspect to being dark weathering, finely laminated and intensely comminuted, in which the megacrysts remain as rounded porphyroblasts. In places, migmatization has imparted a layered appearance resulting from alternating quartzofeldspathic leucosome and biotite-rich palaeosome.

The mineralogy of these rocks comprises K-feldspar, plagioclase, quartz, biotite and lesser garnet, magnetite, hornblende, allanite and retrograde white mica. Orthopyroxene, locally retrograded to amphibole, occurs in leucosome layers in a particular garnet-rich, megacrystic granitoid sliver west of Jeffries Pond. In this rock the garnet, which is characteristically blood-red, occurs as crystals up to 7 cm in diameter.

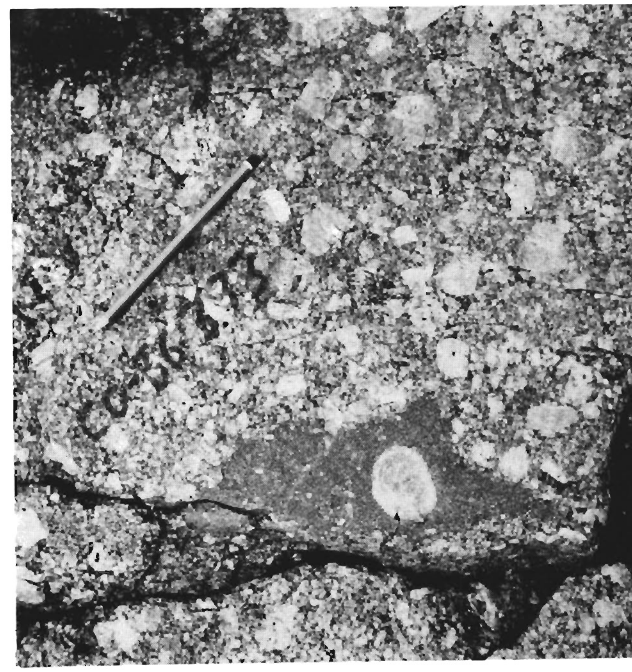

Plate 4: *Tectonic enclave of relatively undeformed K-feldspar-megacrystic granitoid rock from the Gilbert River shear belt; head of Gilbert Bay.*

Enclaves of amphibolite and biotite-rich screens of metasedimentary gneiss are ubiquitous in the megacrystic granitoid rocks, and the granitoid rocks are extensively injected by a wide range of pre- and post-deformation mafic and granitic dikes. Apart from sporadic Phanerozoic dikes (discussed later), all the mafic intrusions are metamorphosed to amphibolite.

Two suites of mafic dikes have been recognized. The early dikes are strongly deformed and have concordant margins to their host rocks. The later dikes, although also strongly deformed and metamorphosed, still show chilled margins and discordance to the fabric in the host granitoid rock. At one locality, 43 parallel amphibolite dikes, belonging to the second suite, were counted in a single outcrop. These dikes are spaced at 1-m intervals and are generally less than 1 m thick. The consistent angle of discordance to the foliation in the host rock precludes isoclinal folding in this instance. Other localities, although less spectacular, show similar features pointing to a widespread swarm of closely spaced mafic dikes within the Gilbert River shear belt.

The pelitic metasedimentary gneiss in the Gilbert River shear belt is gray, pink and black, rusty or brown weathering, and fine to medium grained. Texturally, the rocks vary from well banded gneiss showing obvious alternation of restite and leucosome to units having a more homogeneous aspect and a rather wispy, nebulitic gneissosity. Much of the pelitic gneiss has K-feldspar porphyroblasts. This feature, taken in conjunction with an overall homogeneous appearance, makes these rocks very similar to the K-feldspar-megacrystic granitoid units. Where contacts between granitoid rocks and metasedimentary gneiss are not mylonitized, they are invariably transitional, an observation previously noted by Wardle (1977). Field evidence is compelling that the megacrystic granitoid rocks were derived from the pelitic gneiss by porphyroblastesis of the gneiss and its eventual homogenization.

The mineralogy of the pelite comprises K-feldspar, plagioclase, quartz, biotite, sillimanite, garnet, magnetite and locally orthopyroxene. The garnets commonly have the mauve color characteristic of pelitic gneiss, but are also pink, brown or red, especially in zones adjacent to the melanocratic rocks. A muscovite-rich variant of the pelitic gneiss is extensive in the vicinity of Francis Harbour and occurs sporadically elsewhere.

Associated metasedimentary rock types include quartzite, calc-silicate rocks, metasedimentary diatexite, and quartzofeldspathic gneiss interpreted as derived from psammite. All the quartzite is confined to a single belt of metasedimentary gneiss west of Jeffries Pond, and occurs as massive to thickly layered (bedded?) units, locally interlayered with sillimanite–garnet pelitic gneiss. The distribution of quartzite shown in Figure 2 is based on limited lateral extrapolation from traverses spaced at 3- to 5-km intervals. Clearly, with additional extrapolation, several localities could be linked into a single layer about 20 km long.

Calc-silicate rocks are rare in the Gilbert River shear belt. They are blotchy, gray, green and white weathering, medium to coarse grained, and interlayered with pelitic gneiss. The dominant mineral is diopside, associated with phlogopitic mica and carbonate. Diatexite occurs as a white- or pink-weathering, medium to coarse grained, leucocratic K-feldspar–plagioclase–quartz rock, generally forming a subsidiary part of outcrops that consists mostly of pelitic gneiss. The quartzofeldspathic gneiss, interpreted as derived from psammite, is pink, gray, buff, creamy or rusty weathering, fine to coarse grained, and composed of plagioclase, quartz, K-feldspar, biotite, hornblende and minor garnet and opaque minerals. Associated rock types include amphibolite and minor granitic dikes. The amphibolite is a dark-gray-green-weathering, medium grained, hornblende–plagioclase rock having minor biotite, garnet or clinopyroxene. Much of it can be interpreted as remnants of mafic dikes, but, locally, banded amphibolite occurs associated with calc-silicate rocks, and may be of supracrustal origin.

Rocks mapped as orthogneiss can be subdivided into granitic, granodioritic (in places with K-feldspar augen) and dioritic types. The most extensive and distinctive is the granitic gneiss. This rock type is white, pink, gray or buff weathering, fine to medium grained, and has a sugary texture. Large tracts of the gneiss are relatively homogeneous, having a gneissosity defined principally by biotite-rich schlieren and discontinuous quartzofeldspathic layers of contrasting grain size. The gneiss is typically strongly foliated and finely laminated, and locally is mylonitic. It seems probable that this gneiss type is almost entirely the product of recrystallization and grain-size reduction due to extreme deformation. Where such severe deformation has occurred, it is impossible to distinguish between granitoid plutonic and psammitic metasedimentary protoliths. The less extensive granodioritic augen gneiss is light gray, pink or buff weathering and medium to coarse grained, and consists of K-feldspar, plagioclase, quartz, biotite, magnetite and minor garnet, amphibole and/or orthopyroxene. The augen consist of partially to totally recrystallized K-feldspar. A pink quartzofeldspathic leucosome is normally present. Most of these rocks are the deformed and migmatized equivalents of the K-feldspar-megacrystic units, but some could be derived from the porphyroblastic metasedimentary gneiss.

The granodioritic gneiss without augen and dioritic gneiss are similar in outcrop, in that they are pink, gray or greenish, medium grained, migmatitic, banded quartzofeldpathic rocks. The dioritic gneiss is more closely spatially associated with amphibolite and hornblende-rich enclaves, in contrast to the granodioritic gneiss, which has a high granite leucosome component.

Mafic plutonic rocks are found as isolated outcrops in the Gilbert River shear belt. They are dark green or brown weathering and medium to coarse grained, consisting of two-pyroxene and plagioclase rocks containing minor biotite and amphibole.

Alexis River anorthosite. The Alexis River anorthosite, which is a southeasterly continuation of the unnamed anorthosite unit of the Paradise River map region (Gower *et al.*, 1985), has a minimum strike length of 160 km, but nowhere exceeds 10 km in width and is commonly less than 5 km wide (Figure 1).

The main rock types in the Port Hope Simpson map region are anorthosite–leucogabbronorite, mesogabbronorite and amphibolite. The anorthosite–leucogabbronorite is white to dark gray, brown or rusty weathering, and ranges from medium to very coarse grained (crystals up to 30 cm long occur). Outcrops collectively show a complete gradation from weakly foliated rocks to laminated mylonite or banded gneiss, according to the intensity of subsequent deformation (Plate 5). The least deformed rocks commonly have a mottled appearance due to patchy distribution of (recrystallized) mafic and felsic silicates. Locally, primary layering is evident, and is a factor contributing to compositional heterogeneity in more deformed units. The mineralogy comprises plagioclase, amphibole, pyroxene, olivine, garnet, biotite and opaque minerals. Plagioclase, olivine and pyroxene are primary minerals commonly only present as relict cores rimmed by amphibole or garnet.

The mesogabbronorite and amphibolite represent more melanocratic primary and metamorphic lithological variants respectively. The mesogabbronorite is gray, rusty or black and white weathering, medium to coarse grained, and composed of plagioclase, pyroxene, amphibole, garnet and biotite. In some localities, tectonic enclaves of primary-layered gabbronorite are enveloped in compositionally equivalent gneiss. The amphibolitic derivatives encompass rocks ranging from melanocratic compositions verging on hornblendite, to leucocratic rocks that resemble leucodioritic gneiss. Commonly these rocks have a well banded appearance resulting from concordant quartzofeldspathic leucosome, concordant lenses and layers of texturally distinct amphibolite and minor granitic intrusions.

Plate 5: *Strongly deformed and recrystallized Alexis River anorthosite; Port Hope Simpson area.*

The Alexis River anorthosite is flanked on either side by a granodiorite to diorite gneiss envelope. In this envelope, the rocks are gray, buff, white, pink and green, fine to coarse grained, migmatitic or banded gneiss. They are composed of plagioclase, K-feldspar, quartz, biotite, hornblende, garnet, clinopyroxene, titanite, allanite and opaque minerals. These rocks have been intruded by concordant, pre- and post-deformational pegmatites and microgranite, and by metamorphosed mafic dikes. The gneiss is also characterized by intercalated amphibolite lenses and pods, and, near the southwest margin of the Gilbert River shear belt, some lenses of metasedimentary gneiss.

Southwest of the Gilbert River Shear Belt

A triangular-shaped area in the southwest corner of the Port Hope Simpson map region consists principally of two pre-Grenvillian rock types, namely pelitic gneiss and K-feldspar-megacrystic granitoid rocks.

The pelitic gneiss is buff, gray, pink, brown or rusty weathering and medium grained, consisting of plagioclase, K-feldspar, sillimanite, quartz, biotite, garnet, muscovite and opaque minerals. Apatite is locally abundant. In detail, the rock shows distinct mineralogical variability having patches very rich in sillimanite, biotite or garnet. Sillimanite is locally very coarse grained, locally exceeding 1 cm in length. The pelitic gneiss is also associated with irregular patches and pods of white-weathering diatexite and quartzofeldspathic layers and bands that in part represent deformed diatexite and partly concordant minor pegmatite intrusions. Rare enclaves of amphibolite and outcrop-size gabbro bodies also occur within the pelitic gneiss. The gneiss is sporadically intruded by biotite- and muscovite-bearing pegmatite and microgranite.

The megacrystic granitoids are gray-, pink- and buff-weathering, medium grained rocks that are homogeneous, recrystallized and massive to strongly foliated. Minor pegmatite intrusions are ubiquitous and metamorphosed mafic dikes occur sporadically.

Post-Grenvillian Plutons

Two, small (less than 7 km across), circular to oval plutons have been distinguished from other granitoid rocks in the Port Hope Simpson map region. These are the Gilbert Bay and Southwest Pond plutons. (Southwest Pond is a local name used simply for reference purposes in this report.)

The Gilbert Bay pluton was first recognized by Wardle (1976, 1977). It consists of light-pink- to buff-weathering, medium grained granite that is homogeneous and massive to weakly foliated. Essential minerals are microcline, sericitized plagioclase, quartz, green biotite, secondary muscovite and chlorite, and accessory apatite, magnetite and allanite.

The diagnostic feature that distinguishes it from the surrounding granitoid plutonic rocks is an abundance of angular to subrounded xenoliths of the adjacent country rock (Plate 6). These include metasedimentary gneiss, K-feldspar-megacrystic granitoid rocks and net-veined amphibolite. All of these rocks were strongly deformed (in places mylonitized), migmatized and injected by minor granitic intrusions prior to being incorporated into the pluton.

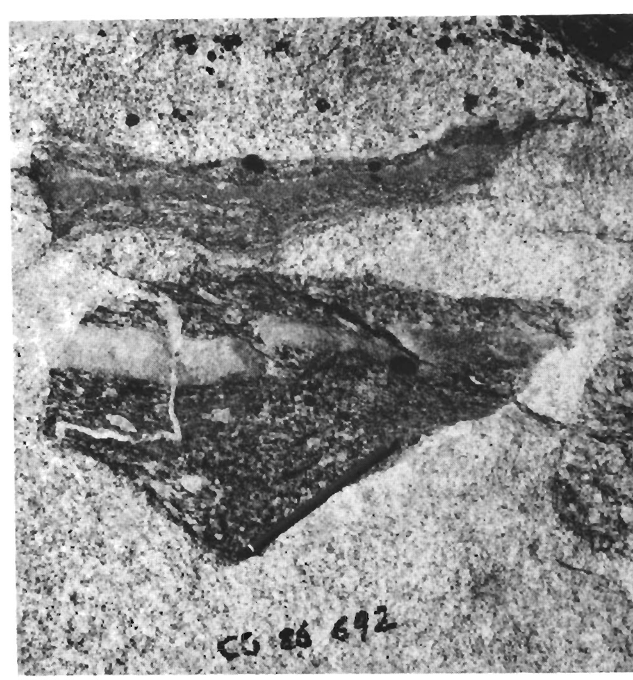

Plate 6: *Gilbert Bay granite pluton containing enclaves of metasedimentary and plutonic rocks from the Gilbert River shear belt; Gilbert Bay.*

The Gilbert Bay pluton has a weak fabric defined by aligned biotite. Our data suggest that this fabric is parallel to the border of the pluton, which, if so, suggests that it is related to pluton emplacement, but it is conceivable that the fabric could be the result of deformation. The pluton is transected by north-northeast-trending closely spaced joints parallel to Late Precambrian–Early Paleozoic mafic dikes (discussed below). No such dikes were seen to intrude the Gilbert Bay pluton, but if the assumption is made that the joints were formed coevally with fractures occupied by north-northeast-trending dikes elsewhere, then the pluton must be Precambrian.

The Southwest Pond granite is pink to buff weathering and consists of two separate phases. Most of the pluton is made up of a massive, homogeneous phase that is coarser grained than that seen in the Gilbert Bay pluton. The associated medium grained phase is volumetrically minor. Both types consist of sericitized plagioclase, microcline, quartz, chloritized biotite and accessory titanite, apatite, magnetite and zircon. The abundance of titanite is a notable contrast to the Gilbert Bay pluton.

The country rock surrounding both the Gilbert Bay and the Southwest Pond plutons is intruded by microgranite and pegmatite dikes that, on textural criteria, are clearly related to their pluton parent.

Plate 7: *Gilbert River fault. Location of Gilbert conglomerate is indicated by an arrow; Gilbert River area.*

Gilbert Conglomerate

The Gilbert conglomerate was first reported by Piloski (1955) and has been described subsequently by Eade (1962) and Bradley (1966). Only one outcrop is known, on the north shore of Gilbert River about 800 m west of Gilbert Lake (Figure 2; Plate 7). The rock in this outcrop is a maroon-weathering, homogeneous arkosic sandstone to pebbly grit. The pebbles and grains are rounded to subangular, generally less than 0.3 cm in diameter and consist mostly of quartz and minor feldspar. Bradley (1966) also noted the presence of granitic gneiss fragments. The arkose and conglomerate are confined to a 5-m-wide, parallel-sided, vertical zone that is parallel to the Gilbert River fault. The country rock is interpreted here as a mylonitized K-feldspar-megacrystic granitoid unit, but has been previously described as paragneiss (Piloski, 1955) and flow-banded rhyolite (Bradley, 1966). Field relationships have also been interpreted in various ways. Piloski (1955) considered the arkose and conglomerate to have been infolded with the surrounding paragneiss; Eade (1962) regarded the arkose as unconformably overlying mylonite. Bradley (1966), who appears to have made the most detailed examination to date, interpreted the outcrop as a clastic dike bounded on its south side by a minor fault. Bradley also observed that the arkose and the surrounding country rock are cross-cut by clastic dikes less than 5 cm wide. From our observations, Bradley's interpretation is favoured here.

Late Precambrian–Early Paleozoic Mafic Dikes

One major dike of this suite crosses the northeastern part of the Port Hope Simpson map region and was previously mapped by Wardle (1976, 1977). A small dike (about 2 m wide) mapped on the north side of Gilbert Bay is directly on line with a southerly extrapolation of this dike and may represent an attenuated southward extension. Another major dike of the same suite was discovered on the south side of Alexis River east of Port Hope Simpson. A small dike near the head of Gilbert Bay may be the northward extension of this dike. In addition, two smaller dikes having similar trend were mapped on the south side of St. Michaels Bay and south of Gilbert Bay.

The dikes are brown- to dark-green-weathering, massive rocks having clearly defined chilled margins that truncate the foliation or gneissosity in the surrounding rocks. The dikes lack phenocrysts, except for some larger-than-groundmass plagioclase in quench-textured chilled margins. The coarser grained rocks are composed mainly of plagioclase, clinopyroxene, lesser olivine, opaque minerals and interstitial K-feldspar. Both feldspars and melanocratic silicates show extensive alteration to greenschist-facies minerals.

The dikes lack deformational fabrics, except for one dike at St Michaels Bay that has been transected by southeast-trending, chlorite-filled shears.

Later Phanerozoic Dikes

Ten dikes in the Port Hope Simpson map region are interpreted as postdating the north-northeast-trending mafic dikes. No cross-cutting relationships were observed in the study area, but similar dikes intrude the north-northeast-trending dikes farther north. They are identified in the field by their rectiplanar form and absence of tectonic fabric or metamorphic effects. In thin section, although altered, they lack the pervasive recrystallization characteristic of the older dikes.

Six of the dikes occur in the Gilbert Bay area, one at Dead Islands, two in the vicinity of Norman Bay and one inland close to the western boundary of the map region

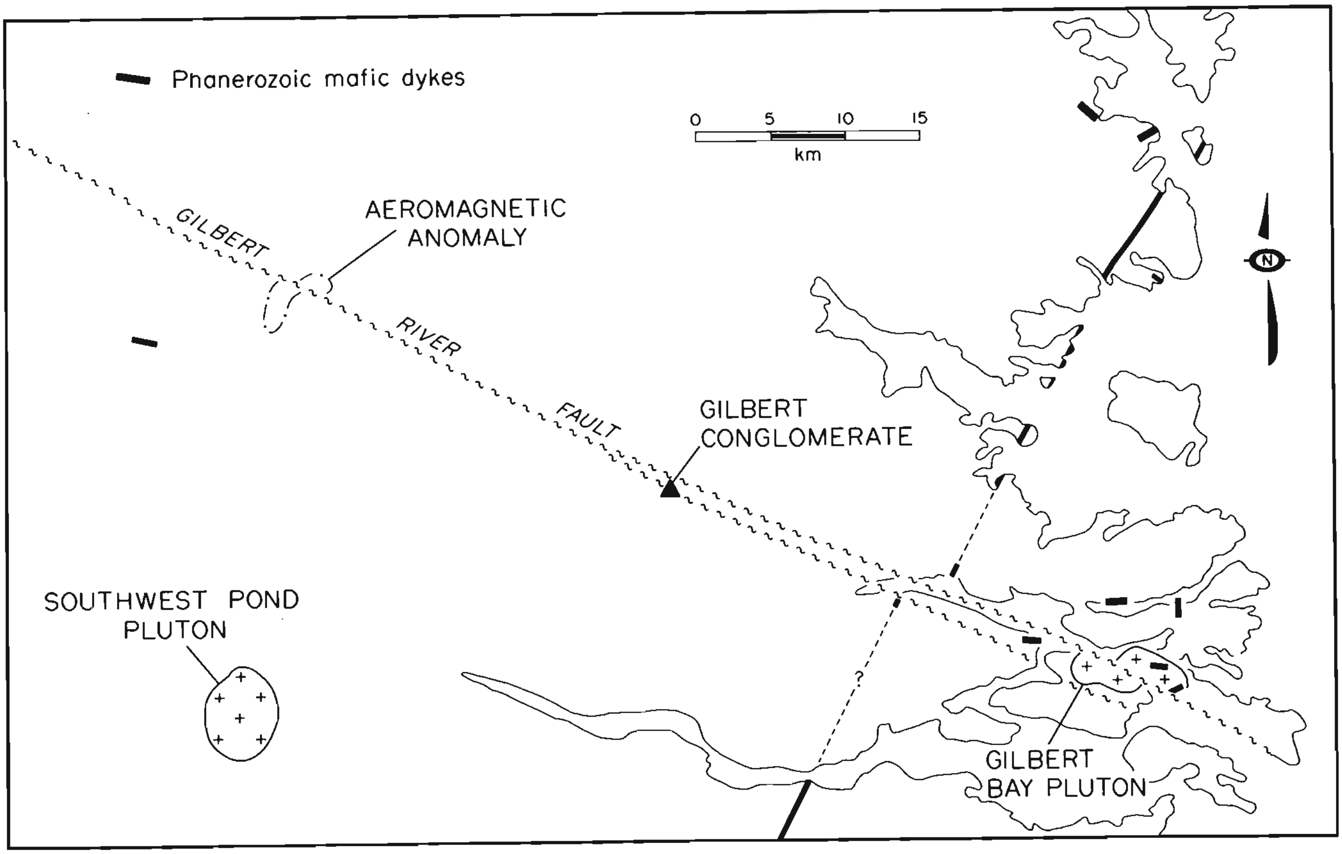

Figure 3: *Post-Grenvillian features of the Port Hope Simpson map region. The shape of the Gilbert Bay pluton, the alignment of north-northeast-trending mafic dikes and the shape of an aeromagnetic anomaly suggest a 2.5-km right-lateral Phanerozoic re-activation of the Gilbert River fault.*

(Figure 3). There is an obvious spatial relationship with the Gilbert Bay pluton, but, as the pluton is probably much earlier, we believe that the location of both the pluton and the dikes is related to structural control by the Gilbert River fault (see Structure).

Three distinct textural groups can be recognized, suggesting that the dikes may, in fact, not all be related to one period of injection. Three of the dikes exhibit ophitic textures, having fresh plagioclase and pyroxene; two are biotite-rich and completely lack pyroxene, or indication of its former presence; four dikes have variolitic or amydaloidal textures, implying very shallow level of emplacement; and one dike has abundant, euhedral plagioclase phenocrysts.

Structure

The regional structure of the Port Hope Simpson map region is dominated by a pervasive west-northwest to northwest trend that is developed in all rocks except the two post-Grenvillian plutons, the Gilbert conglomerate and the post-Grenvillian mafic dikes.

In the Paradise metasedimentary gneiss belt, the structural trends are closer to northwest than west-northwest, giving rise to a slight regional obliquity against the White Bear Arm complex. Gneissosity, in detail, is steep to vertical, without any well defined preferred regional dip. Minor folds plunge mostly to the northwest, and are locally overturned to the south. The distribution of pyritic gossans and amphibolite in the Dead Islands area suggests that major tight to isoclinal folds are present, and probably characterize the whole of the belt. The presence of deformed mafic dikes truncating earlier fabrics indicates that structures are composite.

The contact between the Paradise metasedimentary gneiss belt and the White Bear Arm complex is regionally straight and is interpreted here as a fault. The presence of lenses of leucogabbronorite in metasedimentary gneiss (and vice versa), however, indicates an interdigitating contact between the two units, which may mean that they were isoclinally folded together prior to faulting. Complex relationships at the northern boundary of the White Bear Arm complex are also indicated in St. Michaels Bay, but were not completely elucidated during the present study.

The White Bear Arm complex can be divided structurally along its length into two parts separated by a fault, which is perhaps a steep thrust (Figure 2). North of this fault the White Bear Arm complex is composed mainly of massive plutonic rocks containing localized shear zones. In contrast, south of the fault the rocks are intermixed amphibolite and metasedimentary gneiss that exhibit well defined fabrics and ubiquitous signs of intense folding and transposition. We interpret the southern part as having been isoclinally infolded with metasedimentary gneiss and tectonically sliced during southwestward- or westward-directed overthrusting by the remainder of the White Bear Arm complex.

The most significant structural feature in the map region is the Gilbert River shear belt, which is a fundamental crustal feature in the Grenville Province of Labrador (see Regional Geophysics). Within the Gilbert River shear belt several major faults have been indicated on Figure 2. These are the most obvious structures, indicated from ground observation of intense mylonite zones, and extrapolated using aeromagnetic and topographic controls. Probably most sharp contacts between units in the Gilbert River shear belt are faulted.

The attitude of planar fabrics changes along the length of the shear belt from fairly consistently steep to vertical at the southeast end to much more variable farther northwest, where, although steep fabrics persist, there are broad areas in which the fabric dips shallowly to moderately to the northeast. Lineations are subhorizontal and have a preferred shallow plunge to the northwest. Minor folds are generally also west-plunging, as is a major synform northeast of Port Hope Simpson. Kinematic indicators, particularly rotated K-feldspar megacrysts, show a consistent dextral sense of transport in the Gilbert River shear belt south of the Gilbert River fault.

The Alexis River anorthosite is also intensely deformed in places and clearly experienced the same deformation that affected the rest of the Gilbert River shear belt. The dioritic gneiss in the vicinity of Port Hope Simpson is interpreted as the transposed equivalent of leucogabbronorite belonging to the Alexis River anorthosite.

The southwest area, although having the same west-northwest trends as the remainder of the map region, lacks the pervasive mylonitization of the adjacent Gilbert River shear belt, and compares structurally with the Paradise metasedimentary gneiss belt. Layers in the metasedimentary gneiss in this region are deformed into a series of tight to open, west-plunging folds.

Although the Gilbert River fault (Plate 7) originated as a pre-Grenvillian structure, it has also acted as an important post-Grenvillian control. This is indicated by the following features: 1) the proximity of the Gilbert Bay pluton and related minor intrusions to the fault, 2) the spatial association of the Gilbert conglomerate with the Gilbert River fault, 3) the concentration of 'later' Paleozoic dikes close to the fault, and 4) abundant evidence of brittle fracture and low-grade alteration superimposed on earlier ductile deformation.

The distribution of the Gilbert Bay pluton on either side of Gilbert Bay suggests a 2.5-km apparent dextral displacement after pluton emplacement (Figure 3). It is noteworthy that, after restoration of this displacement, the north-northeast-trending dike south of Alexis River is aligned with the dike crossing St Michaels Bay. Furthermore, two halves of a sigmoidal, distinctive aeromagnetic anomaly (cause unknown) straddling the Gilbert River fault northwest of Jeffries Pond become juxtaposed after restoration by the same amount.

Airphoto lineaments in the Port Hope Simpson map region show a dominant north-northeast trend, mimicking the direction of the Late Precambrian–Early Paleozoic mafic dikes. Although it is probable that a close genetic link between the two exists, it should be noted that pre-Grenvillian mafic dikes in the more massive parts of the White Bear Arm complex also have a similar trend. In the southern part of the map region there are several prominent east- and north-northwest-trending lineaments; these are not known to correlate with any local geological feature.

METAMORPHISM

Mineral assemblages in the Port Hope Simpson map region attained amphibolite facies although there are indications that granulite-facies conditions were achieved in the Gilbert River shear belt. The Paradise metasedimentary gneiss belt is characterized by widespread cordierite that has been partially or completely retrogressed according to the reaction (illustrated in Plate 8):

cordierite + K-feldspar = sillimanite (and/or kyanite) + biotite + quartz ± magnetite ± garnet

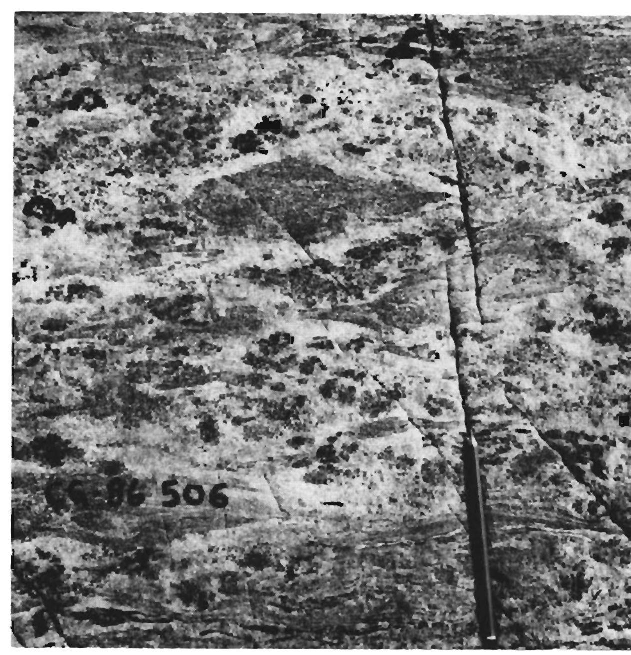

Plate 8: *Migmatized pelitic gneiss from the Paradise metasedimentary gneiss belt. Dark spots of cordierite, sillimanite, biotite and magnetite are dispersed in a K-feldspar-rich neosome. Rafts of paleosome are also present; Dead Islands area.*

Adjacent to an ultramafic intrusive body, garnet occurs as a stable phase mantling cordierite, suggesting that the regional cordierite-bearing mineral assemblage was present prior to the emplacement of the mafic intrusion at which time garnet was formed. In contrast to the Paradise metasedimentary gneiss belt, cordierite was not seen in either the Gilbert River shear belt or the metasedimentary gneiss in the

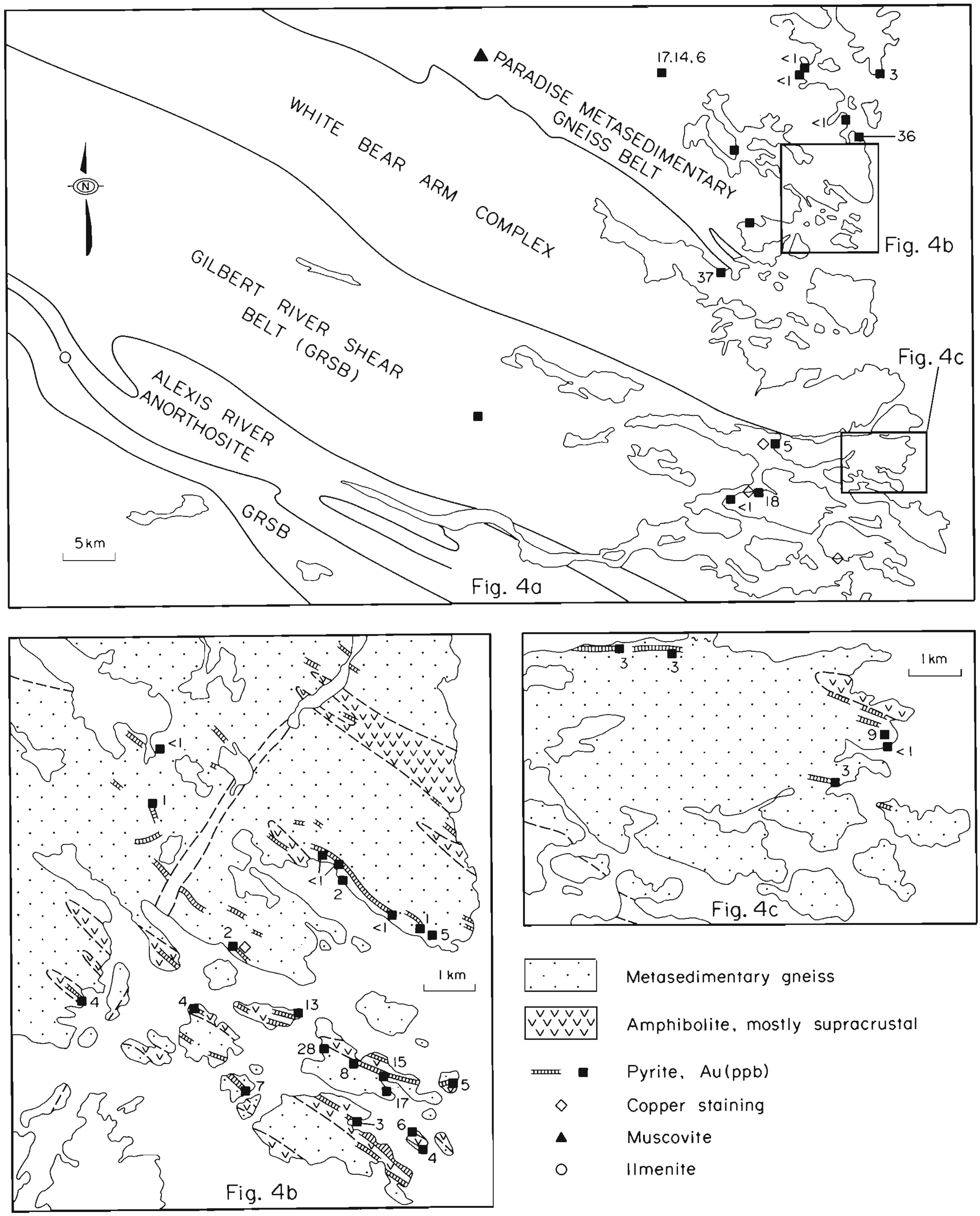

Figure 4: *Mineral occurrences in the Port Hope Simpson map region.*

southwest area. In both these regions, assemblages bearing garnet, sillimanite, biotite and K-feldspar are stable, although locally sillimanite and K-feldspar are retrograded to muscovite and quartz. In the Gilbert River shear belt, orthopyroxene, partially retrograded to amphibole, is found sporadically in leucosome associated with migmatized K-feldspar-megacrystic granitoid rocks. Mafic rocks are characterized by amphibole and garnet, commonly in the form of coronas between relict pyroxene and plagioclase.

Metamorphic effects (possibly deuteric) in the Gilbert Bay and Southwest Pond plutons are restricted to chloritization of biotite and sericitization of plagioclase. The north-northeast-trending mafic dikes also show the effects of low-grade metamorphism (presumably Taconic or Acadian) in that pyroxenes are commonly altered to amphibole and plagioclase is extensively saussuritized.

ECONOMIC POTENTIAL

The most obvious prospects for mineralization of economic interest are pyritic zones associated with pelitic gneiss, mafic supercrustal rocks, calc-silicate layers and quartzite or metamorphosed banded chert (Figure 4a). Such zones are particulary abundant in the Dead Islands area (Figure 4b), but are also common south of Occasional Harbour (Figure 4c). Less extensive pyrite localities were discovered inland (along strike) from the Dead Islands area and north of Port Hope Simpson. The Dead Islands pyritic zones were examined by Kranck (1939) and Donohue (1966) and both the Dead Islands and Occasional Harbour areas were mapped and described by Bradley (1966). During the present study grab samples were collected from several localities and analysed for Au, Ag and base metals. The Au analytical values are indicated in Figure 4; although background is locally high, no significant prospects were discovered. Analytical results for Ag and base metals were equally negative. Douglas (1953) also reported very low values for Au and Ag from a pyritic sample from the Dead Islands area.

In addition to pyrite, a few of the gossans show minor Cu staining. The staining is not extensive and prospects of economic interest seem unlikely. Traces of Cu mineralization were also found in narrow screens adjacent to mafic layers in K-feldspar-megacrystic granitoid rocks of the Gilbert River shear belt south of Gilbert Bay. These occurrences are only a few centimetres wide and have a strike length of less than 5 m. One grab sample from this area has an analysed copper value of 4300 ppm.

The metasedimentary gneisses, particularly those of the Paradise metasedimentary gneiss belt, also host muscovite-bearing pegmatites. Individual books of muscovite are found up to 10 cm across and 3 cm thick. Mica-bearing pegmatites have also been described from the St Michaels Bay area, where they intrude gabbronorite of the White Bear Arm complex (Christie, 1951; Douglas, 1953; Wardle, 1977). Biotite crystals up to 50 cm in diameter have been reported but the plates were noted as bent or broken and probably of little commercial value.

The mafic plutonic rocks of the White Bear Arm complex and Alexis River anorthosite may have some potential for Co, Cr, Cu, Ni and Pt-group metals. No opaque-mineral cumulate layers were found in the White Bear Arm complex, but pods and boudinaged layers of an opaque mineral, thought to be ilmenite, were found in the Alexis River anorthosite (occurrence located on Figure 4a). The largest pod found measures approximately 3 by 2 m.

No anomalous radioactivity was detected anywhere in the map region.

REGIONAL GEOPHYSICS

In Figure 5 attention is drawn to a major positive Bouguer anomaly coincident with the White Bear Arm complex and the Paradise metasedimentary gneiss belt. This anomaly is one of the most pronounced in Canada. Of particular note is the very sharp gradient along the southern margin of the anomaly, the base of which coincides with the Gilbert River fault. The anomaly is too pronounced to be explained by near-surface geology and is interpreted to reflect elevated, north-sloping mantle resulting from uplift along thrusts and faults along the northern flank of the Gilbert River shear belt and within the southern part of the White Bear Arm complex. It should be emphasized that this zone of uplift is interpreted to be predominantly north of the Gilbert River fault. South of this fault, lineations and kinematic indicators demonstrate that movement was sub-horizontal and dextral, resulting from northwestward transport of the Mealy Mountains terrane relative to terranes farther east. The Gilbert River fault itself was probably the locus of both vertical and horizontal ductile movement, as well as being subsequently active as a post-Grenvillian brittle structure.

An aeromagnetic profile (uncorrected for regional gradient) is also presented in Figure 5. Generally low values correspond with the Gilbert River shear belt, in contrast to much higher readings over the White Bear Arm complex, Paradise metasedimentary gneiss belt and the southern part of the Earl Island domain. These features can be generally related to magnetite content in surface rock types. The low values in the Gilbert River shear belt are probably related to hematite alteration of magnetite as a result of fluid introduction during shearing. Similarly, many of the troughs in the aeromagnetic profile farther north are known to correlate with major faults.

ACKNOWLEDGEMENTS

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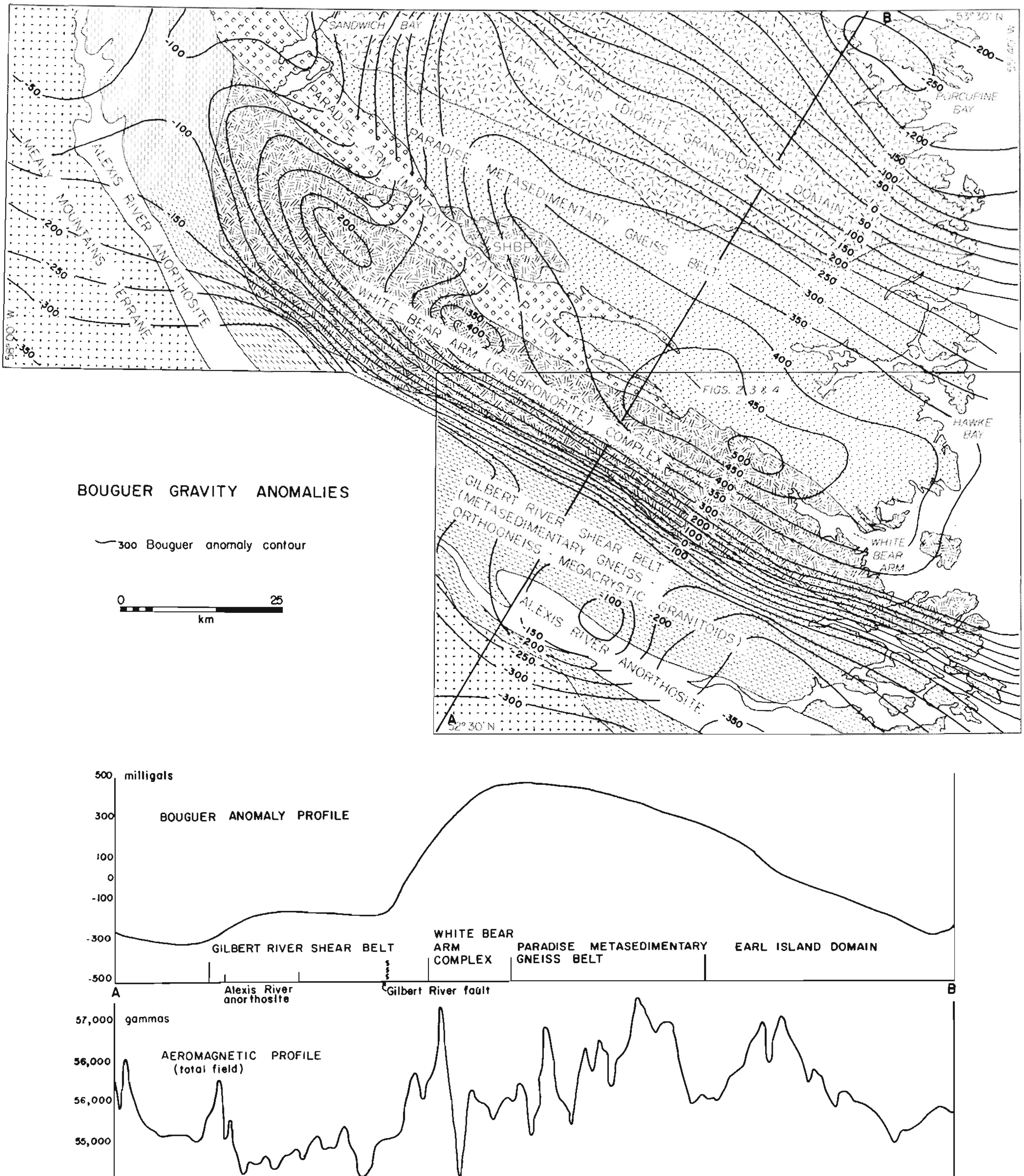

Figure 5: *Bouguer gravity anomalies and aeromagnetic profile in southeast Labrador showing, especially, the positive gravity anomaly underlying the White Bear Arm complex and the Paradise metasedimentary gneiss belt, and the sharp gravity gradient coincident with the northern margin of the Gilbert River shear belt.*

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