

GEOLOGY OF THE NORTHERN PART OF THE ARCHEAN HUNT RIVER GREENSTONE BELT, HOPEDALE BLOCK (NAIN PROVINCE), EASTERN LABRADOR (PARTS OF NTS MAP AREAS 13N/10, 13N/15 and 13N/16).

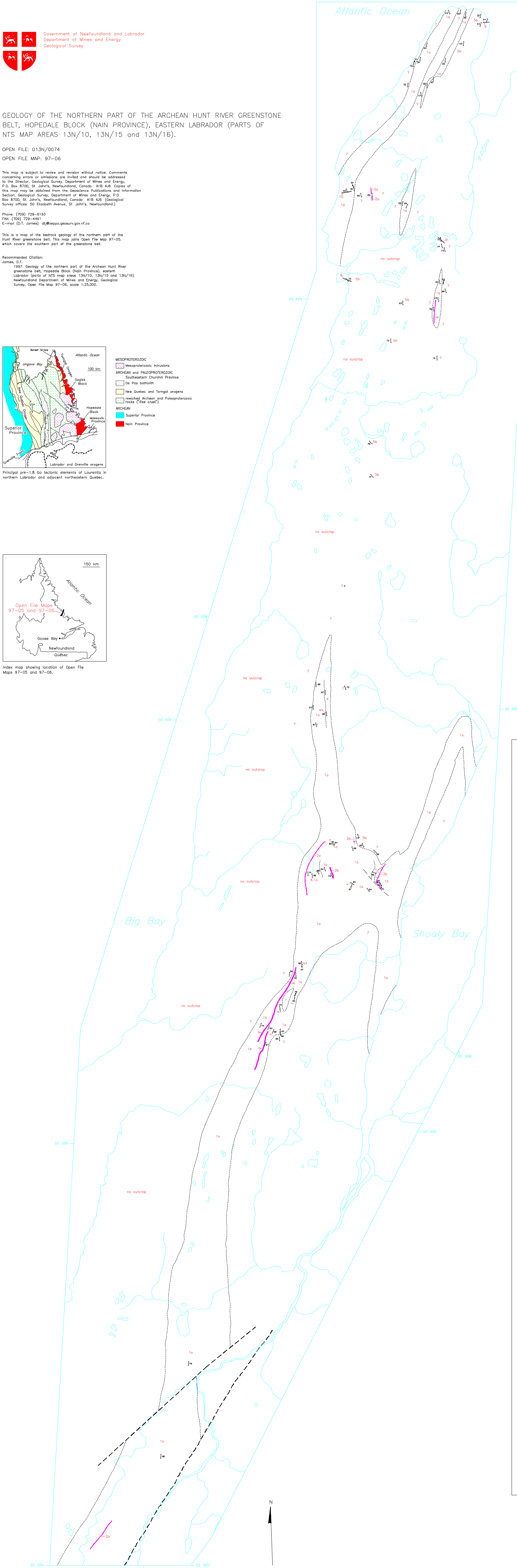
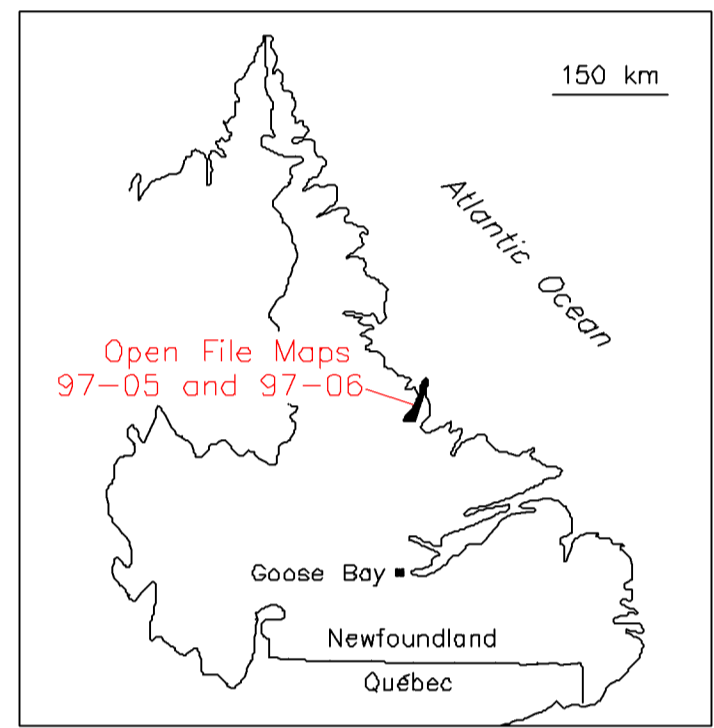
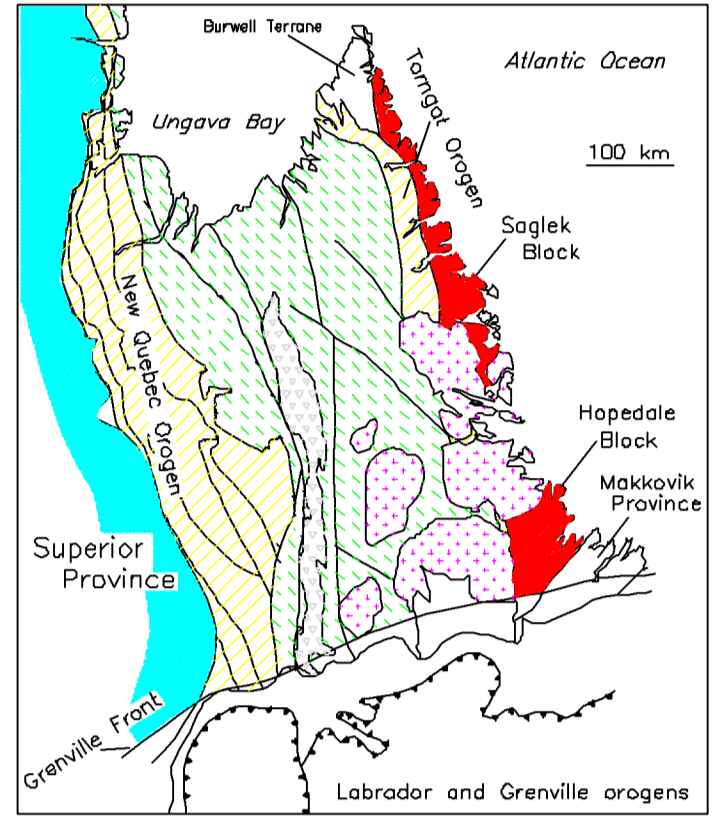
OPEN FILE: 013N/0074  
OPEN FILE MAP: 97-06

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This is a map of the bedrock geology of the northern part of the Hunt River greenstone belt. This map joins Open File Map 97-05, which covers the southern part of the greenstone belt.

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**LEGEND**

**MESOPROTEROZOIC**  
15a Harp Dykes: ENE-trending olivine-clinopyroxene diabase dykes

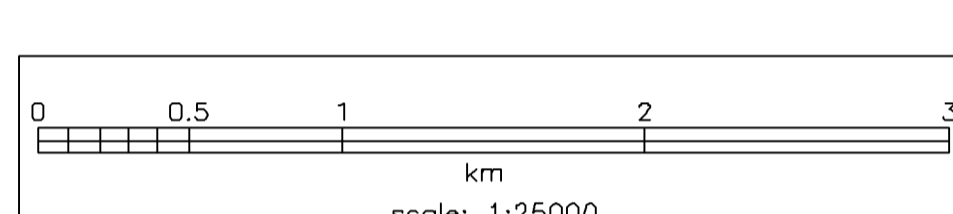
**PALEOPROTEROZOIC**  
9 Kikkertovak Dykes: diabase and gabbro dykes

**ARCHEAN**  
8 Pegmatite, white-weathering pegmatite containing local muscovite, biotite and tourmaline  
7 Monzogranite and granodiorite white- to grey- to pink-weathering, foliated monzogranite and granodiorite containing biotite  
6 Foliated quartz diorite, monzonite and diorite (ca. 2850 Ma)  
5 Orthogneiss and variably deformed granitoid intrusions granitic to tonalite orthogneiss, migmatite and variably deformed granitoid intrusions. This is a composite unit inferred to consist of rocks of several ages. Unit 5 may contain pre-volcanic (i.e. pre-Hunt River greenstone belt) orthogneiss and granitoid intrusions.  
5a Foliated granitoid rocks, locally granitoid to granitoid gneiss.

**HUNT RIVER GREENSTONE BELT**  
5b gossanous rocks  
F iron formation  
QZT quartzite  
FV felsic volcanic rocks  
4 Quartzofeldspathic metasedimentary rocks: grey-weathering quartzofeldspathic rocks containing biotite and common hornblende and abundant garnet porphyroblasts.  
3 Pelitic and semi-pelitic metasedimentary rocks: brown- to rusty-weathering pelitic and semi-pelitic schists containing biotite, garnet and local cordierite or sillimanite.  
2 Ultramafic rocks  
2a Peridotite brown- to orange-weathering, variably serpentinized peridotite  
2b Ultramafic schist brown- to grey-weathering, recessive talc-carbonate schist and minor amounts of orange-weathering magnetite-rich rocks, felsic volcanic rocks and pelitic metasedimentary rocks.  
1 Mafic volcanic rocks (amphibolite)  
1a Amphibolite: black to grey-weathering amphibolites containing variable amounts of hornblende, plagioclase and local garnet, biotite, and quartz; contains local relict of volcanic pillows and pillow breccia.  
1b Amphibolite equivalent to subunit 1a containing abundant, thin (<2m) layers of ultramafic schist.

**SYMBOLS**

--- geological contact (approximate)  
- - - fault (approximate)  
thin (10-20 m) ultramafic unit (Units 2a and 2b)  
mafic dyke (Paleoproterozoic or Mesoproterozoic)  
falsic: generation 1st, 2nd, vertical faultion  
gossanous, vertical gossanous  
foliation in ductile shear zone  
mineral elongation direction  
minor fold axis  
massive or no structural data



**NOTES ON THE LEGEND**

Stratigraphic markers and detailed geochronological data from the Hunt River greenstone belt are lacking. Thus, stratigraphy is undifferentiated and the numbers assigned to lithologic units in the greenstone belt do not imply stratigraphic order or relative-age relations. Field relations demonstrate that granitoid units 6 and 7 intrude the greenstone belt, although their relative ages to each other is unknown.

Unit 5 is a composite unit that was not mapped in detail. It includes foliated and gneissic granitoid rocks that may be younger than the Hunt River greenstone belt, and possibly equivalent to rocks defined as units 6 and 7, and gabbro rocks that are older than the Hunt River greenstone belt. Pre-Hunt River greenstone belt rocks may be equivalent to the >3.1 Ga Maggo Gneiss. However, some of the granitoid gneisses inferred to be older than the Hunt River greenstone belt are themselves composite units, which may include components of metamorphic leucosome and younger intrusive phases that postdate deposition of the volcanic rocks.

**DESCRIPTION OF ARCHEAN UNITS**

**MAFIC VOLCANIC ROCKS: UNIT 1**  
The Hunt River greenstone belt consists mainly of amphibolite defined as subunit 1a. The rocks are black- to grey-weathering and composed of variable proportions of hornblende and plagioclase. Garnet, biotite and quartz are common accessory minerals. A minor amount of subunit 1a rocks are amphibolites composed almost entirely of hornblende; some rocks have coarse-grained hornblende porphyroblasts. Metamorphic textures in subunit 1a rocks are ubiquitous, although there are rare occurrences of relic volcanic features including pillows and pillow breccia. Subunit 1a rocks are typically fine to medium grained and variably foliated. They occur as massive to weakly foliated amphibolites and as very strongly foliated mafic schists. The fact that relict pillows and pillow breccia occur locally, and that the unit is interpreted with pelitic metasedimentary rocks and local iron formation suggests the majority of subunit 1a amphibolites are derived from mafic volcanic rocks.

Subunit 1b also includes a subordinate amount of mafic medium grained and massive to weakly foliated amphibolite that contain relic gabbroic textures. The metabasaltic rocks occur in well defined 1- to 3-m-thick layers, presumed to be relict dykes that intrude the previously described amphibolites. They also occur in isolated outcrops, which could be parts of relatively small (1- to 5-m-thick) dykes or larger intrusive bodies and/or dykes.

The metabasaltic bodies are inferred to represent subvolcanic mafic intrusions that are approximately the same age as the mafic volcanism. Gabbro dykes may have fed mafic flows that were higher in the volcanic sequence.

A minor proportion of Unit 1 consists of compositionally layered rocks having alternating black and tan- or brown-weathering layers and defined as subunit 1b. Layering thicknesses range from a few centimetres up to 1 m. The black rocks are similar to subunit 1a amphibolites, whereas the tan- or brown-weathering rocks have a mafic to ultramafic composition, and may be mafic to ultramafic or diopside and plagioclase. Locally, layers consisting of >80% coarse-grained diopside occur. This layering is inferred to be a metamorphic accentuation of original compositional layering; the protolith being a layered sequence of mafic and ultramafic flows.

**ULTRAMAFIC ROCKS: UNIT 2**  
Ultramafic rocks occur throughout the Hunt River greenstone belt, although they are most common in the southern and central parts of the belt (i.e. in NTS area 13N/7; see Open File Map 97-05). They occur as 10 to 30-m thick layers that can be traced continuously for several kilometres or as lens-shaped units that can be traced for only a few hundred metres.

In general, Unit 2 consists of two types of ultramafic rocks distinguished on the basis of compositional and textural differences. The first and most common type (subunit 2a) is a tan- to brown- to orange- to green-weathering rock that is typically black on the fresh surface. Subunit 2a rocks are massive to weakly foliated, very fine grained and inferred to consist of many of variable proportions of hornblende, pyroxene, serpentine and minor amounts of magnetite. Commonly the rocks are extremely hard and units stand out as prominent ridges. Locally, subunit 2a rocks have a 'layered' structure defined by 1 to 2-cm thick tan or brown or black layers, or they have a structure defined by thin (1 to 2 cm) onsets of talc- or green-weathering zones. The 'layered' and onsets structures are inferred to be a metamorphic feature produced during serpentinization.

Grey- to tan-weathering ultramafic schists defined as subunit 2b are the second type of ultramafic rock present in the belt. These rocks are very fine grained, foliated and are characteristically soft. The schistosity varies in the recesses and commonly occur in narrow valleys or along the sides of valleys. The rocks consist mainly of talc and talc. Thin (1 to 2 cm) layers of orange-weathering magnetite-rich rocks are contained in the ultramafic schists locally.

Unit 2 ultramafic rocks are commonly associated with thin (1 to 2 m) sulphidic pelitic metasedimentary units, which are not shown on the map because of their small size. In addition, a few of the lens-shaped ultramafic units can be traced into sulphidic metasedimentary units, which themselves can be traced for several hundred metres and subsequently into the next lens-shaped ultramafic unit. The common field association between the ultramafic rocks and metasedimentary rocks, and a single occurrence of spinifer textures suggests the ultramafic rocks represent ultramafic flows. The continuous ultramafic units themselves represent widespread sheet flows whereas the lens-shaped units may be restricted, channelized flows. A single occurrence of felsic volcanic rocks, which are interlayered with ultramafic rocks in the southern part of the belt, is consistent with the flow model.

**PELIC AND SEMI-PELIC METASEDIMENTARY ROCKS: UNIT 3**  
Thin (1 to 5 m) units of pelitic and semi-pelitic rocks occur throughout the belt but are most common in the central and southern areas (i.e. in NTS area 13N/7; see Open File Map 97-05). Unit 3 rocks are commonly mafic-weathering, very fine grained, and are composed of quartz, plagioclase, biotite, garnet, and local sillimanite or cordierite. Pyrite and magnetite are common accessory minerals. Relict bedding occurs locally and is defined by 5 to 10-cm-thick layers containing relatively large amounts of biotite alternating with biotite-poor quartzofeldspathic layers. These rocks are interpreted to be derived from waste or wacke - mudstone turbidites.

In several locations the unit includes rocks consisting of relatively high amounts of garnet, magnetite and pyrite (e.g. UTM 640800E, 612460N; see Open File Map 97-05). These rocks are interpreted to be metamorphosed silicate-sulphide facies iron formation.

Unit 3 also includes a 2-m-thick layer of felsic volcanic rocks that is interlayered with pelitic metasedimentary rocks in the southern part of the belt (UTM 641170E, 6131800N; see Open File Map 97-05). The felsic rocks are white on both fresh and weathered surfaces, are extremely recrystallized, very fine grained, and are foliated. The rocks do not contain relict volcanic textures. The felsic layer can be traced for several hundred metres.

**QUARTZOFELDSPATHIC METASEDIMENTARY ROCKS: UNIT 4**  
Quartzofeldspathic rocks defined as Unit 4 occur locally along the contacts between mafic volcanic rocks (Unit 1) and granitoid gneisses (Unit 5), and as 20 to 30-m thick units bound by mafic volcanic rocks. The Unit 4 rocks are grey-weathering and composed of variable amounts of quartz, plagioclase, biotite, garnet and local hornblende. Layering in the rocks is defined by thin (1 to 2 cm) black layers, containing relatively large amounts of biotite and hornblende alternating with 5 to 20-cm-thick quartzofeldspathic layers. The rocks are mainly fine grained and have granoblastic textures, although medium- to coarse-grained garnet porphyroblasts are common.

In several locations, Unit 4 quartzofeldspathic rocks are interlayered with thin (1 to 2 m) mafic-weathering pelitic layers. The pelitic rocks are similar to those of Unit 3, although one outcrop contains abundant muscovite and sillimanite. In the southern part of the belt, Unit 4 rocks are associated with a 2-cm-thick ultramafic unit (e.g. UTM 640780E, 612724N; see Open File Map 97-05), which occurs along the western contact between Unit 4 rocks and Unit 1 mafic volcanic rocks.

The origin of Unit 4 quartzofeldspathic rocks is equivocal, although they are generally interpreted as being of sedimentary origin. The fact that they are locally interlayered with pelitic metasedimentary rocks is consistent with this interpretation. In locations where Unit 4 rocks occur along the contact between mafic volcanic rocks and granitoid gneisses (Unit 5), it is possible that they represent rocks that were deposited unconformably on pre-volcanic basement. However, it may also be possible that some of the Unit 4 quartzofeldspathic rocks could be derived from felsic volcanic rocks. Alternatively, some of the rocks occurring along the contact between the mafic volcanic rocks and Unit 5 gneisses could be highly strained and extensively recrystallized equivalents of Unit 5 rocks.

**Other Metasedimentary Rocks**  
The greenstone belt includes several occurrences of quartzite (e.g. UTM 654600E, 6171674N and 652724E, 6160129N; see Open File Map 97-06). The quartzites are white or grey-weathering. They are extensively recrystallized, extremely fine grained, and consist of >80% quartz. The rocks are commonly massive, although they locally have layering defined by 2 to 10-cm-thick alternating grey- and white-weathering layers. The quartzites are poorly exposed in the field and their field relations are not well understood. In both locations, they occur in contact with ultramafic rocks, although it does not appear that the quartzites occur along basement-cover contacts.

The greenstone belt also includes several occurrences of chart - magnetite iron formation and associated quartz metasedimentary rocks. The iron formation consists of alternating 1 to 2 cm layers of grey- to white-weathering quartz and black-weathering magnetite. The associated cherty metasedimentary rocks are white- to tan-weathering, extremely fine-grained and have layering defined by colour variations, and occur in 1 to 2-m thick layers.

**ORTHOGNEISS AND VARIABLY FOLIATED GRANITOID INTRUSIONS: UNIT 5**  
Unit 5 was not mapped in detail. It is a composite unit including foliated and gneissic granitoid rocks of unknown ages. It consists mainly of white- to grey-weathering granitoid orthogneiss and migmatite composed of variable proportions of quartz, feldspar, biotite and hornblende. The rocks are medium grained and have granoblastic textures. Gneissosity is defined by mafic layers alternating with quartzofeldspathic layers, or by layers of white-weathering, medium- to coarse-grained leucosome. Locally, gneissic rocks are granitoid to foliated metagabbro. The gneisses described above are derived from tonalite to granitoid intrusions that have been metamorphosed to upper amphibolite facies. Some of the gneisses, which do not contain inclusions of Hunt River greenstone belt rocks and are not in obvious tectonic contact with the greenstone belt, are provisionally interpreted to be older than the volcanic rocks. However, some of these 'old' gneisses contain several phases metamorphic leucosome and abundant dykes of variably deformed, pink-weathering leucogranite that may postdate the volcanic rocks. In contrast, there are also occurrences of white-weathering, fine-grained tonalite orthogneiss that unequivocally intrude the greenstone belt.

**QUARTZ DIORITE, MONZONITIC AND DIORITE: UNIT 6**  
The volcanic rocks are intruded by pre-metamorphic intrusions of grey-weathering quartz diorite to monzonite containing hornblende and biotite. The rocks are medium grained, have granoblastic textures and are foliated. A sample of these rocks has been dated by U-Pb zircon to be ca. 2850 Ma (Wastney et al., 1995).

**MONZONITIC AND GRANODIORITE: UNIT 7**  
In the northern part of the greenstone belt (see Open File Map 97-06), the volcanic rocks are intruded by white- to grey-weathering, medium- to coarse-grained granitoid rocks. The rocks are white- to tan-weathering, fine to medium grained and have granoblastic textures.

**PEGMATITE: UNIT 8**  
The volcanic rocks are cut by late syn- to post-metamorphic dykes of pegmatite that are up to 50 m thick. The pegmatite is white-weathering, medium to coarse grained and has a phenocrystic texture. It consists of variable proportions of quartz and feldspar, and contains minor amounts of biotite. Coarse-grained leucosome occurs locally. The pegmatite dykes cross-cut the principal foliation and metamorphic layering in the host volcanic rocks. However, some dykes have a weak foliation.

**STRUCTURE AND METAMORPHISM IN THE HUNT RIVER GREENSTONE BELT**  
Contacts between units in the greenstone belt are characterized by primary compositional layering are overprinted and transposed by a variably developed northeast-trending F2 fold. The F2 fold is a faulted fold designated as F1 and defined by alignment of the metamorphic minerals. Isoclinal closures (F1) of unit contacts and primary compositional layering are observed rarely. The F1 foliation is deformed and folded into open to tight, northeast- and south-southwest-trending F2 folds that are the main, map-scale folds in the belt. Superimposition of F2 folds on F1 structures produced local outcrop-scale Type II and Type III folds of the compositional layering. There does not appear to be a foliation associated with F2 folding. The ages of F1 and F2 folds are unknown, although field relations suggest that both are approximately synchronous with the peak of metamorphism.

The one contact several syn- to late syn-metamorphic high-strain zones which occur locally along the contacts between the greenstone belt and Unit 5 granitoid gneisses. The shear zones overprint the F1 foliation in the volcanic rocks and deform the F2 folds. The shear zones are narrow (10 m), and their kinematics and significance are unclear.

North-northwest- and east-northeast-striking faults deform the greenstone belt and surrounding granitoid units. The faults are mainly unexposed and are inferred from offsets of granitoid - greenstone belt contacts and topographic features. Mylonitic gneiss and highly strained amphibolite occur along one of the north-northeast-striking faults, demonstrating that at least some of these structures are ductile high-strain zones which formed contemporaneous with amphibolite-facies metamorphism.

The greenstone belt is everywhere metamorphosed to amphibolite facies. Mafic rocks contain the assemblage hornblende, plagioclase, garnet and biotite. Clinopyroxene occurs locally in mafic rocks. Pelitic metasedimentary rocks contain garnet, biotite and sillimanite or cordierite; muscovite occurs locally. Metamorphic assemblages are consistent throughout the belt, although rocks in the northern areas (see Open File Map 97-06) are more generally recrystallized and are somewhat coarser grained than those in the south. Primary volcanic features are completely obliterated in the northern parts of the belt. These differences may be due to the fact that the northern part of the belt is principally a narrow septum encompassed by syn- to late-syn-metamorphic granitoid intrusions, which may have locally elevated temperatures and produced slightly different metamorphic textures than seen in the south.

**REFERENCES**  
Wastney, H.A., Wurdle, R.J., Koop, T.E., and Ermakov, I.  
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