ATTENTION : TRIG Hoy

Geology of the McPhee Property
Castlegar area, southeast B.C.
by C.J. Greig

1998 spring

The following descriptions are intended to complement the 1:10,000 scale field map produced during nine days of mapping in the latter part of May, 1998.

Rocks underlying the McPhee property have been divided into three main packages, two of stratified rocks, and one of plutonic rocks. The stratified rocks occur in what appear to be two large pendants within the plutonic rocks that are close together but not contiguous. One pendant consists almost entirely of siliceous fine grained and foliated metaclastic rocks and the other consists predominantly of foliated mafic coarse grained fragmental volcanic rocks. The plutonic rocks are of various compositions and have been assigned, based on previous regional mapping (by Little of the GSC and by Hoy and Dunne of the BCGS), to the Middle Jurassic Bonnington pluton (or more accurately, plutonic complex). The metavolcanic rocks are probably correlative with mafic volcanic rocks of the Lower Jurassic Elise formation of the Rossland Group, while the metaclastic rocks are of less certain correlation. They may be correlative with clastic rocks of the Hall formation of the Rossland Group, which typically overlie rocks of the Elise formation in the region, but they may also be correlative with older clastic rocks, such as the Paleozoic (and older?) Mt. Roberts formation. Alternatively, the metaclastic rocks may be of Mesozoic age and may therefore be facies variation of the Archibald formation of the Rossland Group, which locally underlies the Elise formation in the region.

A possible link between the pendants of mafic and siliceous rocks are foliated mafic metaigneous rocks (dikes or sills, or possibly flows) which occur found locally within the metaclastic package (mainly in float within the bounds of the grid, but also in outcrop in the northeasternmost part of the property and near Aaron Hill, and as local fragments within the intrusive breccia along the northwestern contact of the potassium feldspar megacrystic quartz monzonite, which otherwise consists exclusively of metasedimentary rock fragments). The fact that the mafic rocks and fragments of same are foliated indicates that they are older than the Bonnington complex plutons, which are of presumed Middle Jurassic age and are generally nonfoliated. Their mafic composition and constituent pyroxene prophyroclasts are suggestive of a genetic link to the mafic metavolcanic package, the rocks of which are typically pyroxene phyric. They may have been feeders to the pyroxene phyric volcanic rocks of the Elise formation, which suggests further that their metaclastic hosts are at least of earliest Mesozoic or older age.

For the most part, contact relations among the various plutonic phases are uncertain. They may represent different phases of a single comagmatic suite, with largely gradational contacts, or some constituents may be older or younger than the other phases--only continued mapping and(or) radiometric dating may resolve such uncertainties.

Stratified rocks on the property were affected by at least one deformational event which predated the emplacement of the plutonic rocks. This event is expressed as a well developed foliation and stretching lineation which typically masks primary structures such as bedding, these were measurable in only a handful of localities on the property. Foliation within the clastic metasedimentary package is not always apparent in outcrop, principally because it predates the emplacement of the Bonnington complex plutonic rocks, which appear to have hornfelsed and

recrystallized rocks of this package. Because of their coarser grain size, phenocryst content, and colour contrast between phenocrysts and matrix, the foliation is much more apparent in the mafic metavolcanic rocks than in the siliceous clastic package. Everywhere on the property the foliation is typically steep, and within the metaclastic rocks it commonly trends WSW-ENE, within the mafic metavolcanic rocks the foliation commonly trends more toward E-W. The difference in trend between the two pendants perhaps reflects emplacement and ballooning of the younger plutonic rocks. The Middle Jurassic(?) and younger plutonic rocks themselves are typically nonfoliated, and dykes within the pendants of stratified rocks clearly crosscut and postdate the ductile deformation event. Both plutonic and stratified rocks are affected by local brittle faulting.

There are several styles of mineralization on the property. Much of it occurs within the stratified rocks but is spatially (and most likely genetically) associated with emplacement of the Middle Jurassic plutonic rocks. Within the mafic package, schistose rocks host locally abundant pyrite and local sphalerite and galena that post-dates, at least in part, the foliation-forming event. The pyrite may contain elevated precious metals contents. The metasedimentary package hosts skarn mineralization and, along its contact with potassium feldspar megacrystic quartz monzonite of the Bonnington pluton, is an extensive (>1 km long and up to several hundred metres wide) intrusive and quartz breccia, containing common pyrite and local massive to semi-massive pyrrhotite, pyrite, and chalcopyrite. Elsewhere within the metasedimentary package, similar massive pyrrhotite bodies may be associated with smaller isolated and(or) underlying breccia bodies. Pending the results of sampling, the breccia and its associated sulphide lenses and skarn mineralization are considered to be the most promising exploration target, with the hope that they contain elevated precious metals contents. Potential for similar styles of mineralization exists to the north and west, and that potential may be tested with prospecting and mapping traverses.

"Epithermal-type" stockwork mineralization noted by previous workers along a NNW trending brittle fault mapped by previous workers was not examined in detail, although a large outcrop of siliceous stockwork was noted near the contact between mafic metavolcanic rocks and hornblende diorite on the north side of the mafic metavolcanic pendant. The other "stockwork" zones identified in previous work are of a different character. They are hosted in phases of the Bonnington complex, one on the western slopes of Grassy Mountain, and one east of Aaron Hill. In general, they appear to consist primarily of discontinuous cm- to decimetre-scale milky white "bull" quartz veins containing local cubes and blebs of pyrite. Locally, such "veins" appeared to contain feldspar, and it is possible that they have their origin as late pegmatite to aplitic sweats emplaced during the latter stages of the evolution of the felsic magma. The stockwork on the slopes of Grassy Mountain does locally host small scale chloritic, pyritic siliceous zones and fracture zones within the pluton in this area are locally rusty weathering, so this area may hold interest. In addition, the fact that free gold occurs in creeks draining this area suggests that it merits further evaluation.

Much of some parts of the property are covered with glacial drift. Both glacifluvial deposits and clay-rich bouldery basal till were noted during the mapping, and both are locally thick and in places extensive. For example, on many of the northerly facing slopes in the vicinity of Aaron Hill and in the drainage of McPhee Creek, basal till is common and outcrop is scarce.

Stratified rocks

1930's placer mining near W shore

Early Mesozoic (?)

Mafic volcanic fragmental and associated volcaniclastic rocks (Mmfv)(HS [hand specimen]: 6.1 Cordierite schist from east side trenches).

This package consists predominantly of coarse grained, immature pyroxene phyric mafic fragmental rocks: tuff breccia and medium to coarse grained lapilli tuff. Most commonly, the matrix to the fragmental rocks is pyroxene phyric and of similar compostion to the fragments. Less commonly, the matrix appears to be fine grained, phaneritic, and of dioritic composition--in these places an originally aphyric matrix may have been recrystallized during emplacement of the Bonnington complex, or an unrecognized comagmatic high level intrusive may be present and represented by fine grained diorite agmatite zones choked with mafic volcanic inclusions. Cordierite schist or phyllite, commonly containing abundant chlorite and epidote and possibly the metamorphic equivalent of associated volcaniclastic rocks, is subordinate. In general, strain within the mafic rocks increases in intensity toward the north, but the entire package has been ductilely sheared.

Proterozoic to Early Mesozoic (?)

Siliceous metaclastic rocks (metasiltstone to metaconglomerate)

Rocks of this package are characterized by their rusty weathering appearance, their dark colour (dark brownish grey on fresh surfaces), their siliceous composition, and, near contacts with plutonic rocks, by the common presence of fine grained biotite and pyrite (1-2%, particularly common near intrusive contacts). Locally, ragged fine to medium grained amphibole appears to be present in the metasedimentary rocks (hornblende hornfels?). Quartz pebble conglomerate, occurring in several extensive east-northeast trending lens-shaped(?) bodies west of Aaron Hill, is perhaps the most conspicuous lithology, but finer grained rocks are predominant. In most places, bedding, and even foliation, is very difficult to measure. This is due to a combination of the uniformly fine grained nature of the lithologies, the strain associated with deformation, recrystallization during contact metamorphism, the pyritic and rusty weathering character of both the hornfelsed metasedimentary rocks and the commonly fine grained intrusions emplaced into them, and the common cover of lichen. In the few places where compositional layering was measured, it appears to more or less parallel the foliation and, not surprisingly, to parallel the general orientation of the quartz pebble conglomerate bodies.

Foliated quartz pebble conglomerate (HS: 16.2, foliated quartz pebble conglomerate, NNW of Aaron Hill; 44.1 foliated pebble conglomerate, west side of property). Pebbles in the conglomerate are typically siliceous and round to subround and locally angular. Pebbles range in size up to several cm and are commonly on the order of several millimeters to 1 cm in diameter. The conglomerate is poorly sorted and typically matrix supportedm and the matrix is

black, siliceous, and very fine grained.

Foliated metasiltstone, fine grained quartzite, and pelite (HS: 20.1 metasiltstone or finegrained quartzite showing compostional layering, NW of Aaron Hill; 60.2, cordierite bearing pelite, from near northeast corner of property). Foliated metasiltstone, fine grained quartzite, and pelite is typically black, compact, and contains abundant very fine grained biotite and common disseminated pyrite. Locally, cordierite(?) porphyroblasts occur and overgrow the foliation.

Undivided siliceous metaclastic rocks (HS: 30, fine grained quartzite, possibly a siliceous intruive rock?, from west of Aaron Hill)

Plutonic rocks

Middle Jurassic or younger (?)

Bonnington plutonic complex of the Nelson intrusive suite

Fine grained granodiorite (HS: 8.2, fine-grained granodiorite, east side powerline road; 15, new road in drainage north of Aaron Hill, in central part of property; 22.2, NW part of property, near Little McPhee Creek). Fine grained, or more correctly, fine to medium grained biotite hornblende granodiorite, underlies a large portion of the property from Grassy Mtn. on the east to near the crest of the ridge north of Aaron Hill on the west; it's contacts are for the most part ill defined, and contact relations are therefore for the most part uncertain. In several outcrops in the east-central part of the property, the granodiorite contains scattered megacrystic potassium feldspar crystals, suggesting a genetic link and probable gradation into the potassium feldspar megacrystic quartz monzonite. However, if any of the plutonic rocks on the property are younger and unrelated genetically to the others, this phase, or at least a part of this phase, is the most likely candidate. Locally, such as in outcrops along new road north of Aaron Hill, fractures within the granodiorite are coated with pyrite.

Potassium feldspar megacrystic quartz monzonite (HS: 36, potassium feldspar megacrystic hornblende quartz monzonite from west side of property). Hornblende potassium feldspar megacrystic quartz monzonite underlies much of the central part of the property. Potassium feldspar megacrysts range in size up to 3 cm, are strongly zoned, and are commonly poikilitic.

Intrusive breccia (HS: cgbx, from near west side of property; 46.1, not certain if a breccia, siliceous, from between shafts on west-central part of property--where deepest shaft was sunk). Located along the contact between the siliceous metasedimentary pendant and the potassium feldspar megacrystic phase of the

Bonnington complex is a rusty weathering siliceous intrusive breccia containing variable amounts of disseminated, blebby, and fracture controlled pyrite. It also locally hosts massive pyrrhotite mineralization and calc-silicate skarn assemblages. The breccia is characteristically choked with angular metasedimentary fragments on the scale of centimetres to decimetres. Locally it contains metre-scale rafts and larger screens of metasedimentary rocks, and rarely it contains mafic metaigneous fragments of up to 30 cm in diameter; plutonic fragments are conspicuously absent. Selvages of breccia fragments are typically bleached and paler weathering than their interiors. Pegmatite and other dykes of granitic composition commonly cut the breccia and may be associated with emplacement of other phases of the Bonnington complex.

Medium grained granodiorite Medium grained, nonfoliated biotite hornblende granodiorite to quartz diorite underlies much of the southern and southwestern parts of the property, south of the mafic metavolcanic rocks. These rocks have a somewhat higher colour index than the potassium feldspar megacrystic phase of the Bonnington pluton. Contact relations between the two were not observed, but the granodiorite is locally cut by granitic dykes.

Quartz monzodiorite (HS: 60.1 medium grained (biotite?) hornblende (quartz) monzodiorite from near northeast corner of property). Medium grained biotite hornblende quartz monzodiorite(?) occurs only on the northeastern corner of the property, where it intrudes and hornfelses fine grained siliceous metasedimentary rocks. Contacts with adjacent phases of the Bonnington complex were not observed.

Diorite (HS: 23.1, WNW of truck mobilization lot, south-central part of property). These dark green, fine to medium grained rocks, which are rich in hornblende (and locally pyroxene?) appear to be common along the margins of the mafic metavolcanic pendant. They were observed on both its northern and southwestern contacts and most likely represent a more mafic marginal phase of the Bonnington suite. They are locally foliated, but the foliation in most places appears to be a high-temperature intrusive flow-foliation rather than a foliation related to ductile strain, such as that commonly displayed in the stratified rocks. Diorite locally contains abundant inclusions of foliated metavolcanic rocks, and so it was emplaced following ductile deformation. The diorite is crosscut by, and therefore older than, more evolved intrusive phases of the Bonnington complex.

Undivided plutonic rocks The rocks on the property are cut by a variety of dikes, including pyritic hornblende needle feldspar porphyry dikes common in the area of the breccia complex (e.g., HS 37.2), pegmatite, aplite, and felsite dikes, also common in the vicinity of the breccia and within metasedimentary rocks near their contact with the quartz monzonite. Lamprophhyre, andesite, and basalt dikes were also encountered on the property and cut all of the major map units.

Other Hand specimens:
41.2 skarn type mineralization (pyritic very fine grained marble?) near contact of quartz monzonite and the breccia body on the west side of the property.

Adit: rock of uncertain affinity (too wet and rusty to tell in field, needs to be slabbed) from adit wall, lower adit near deep shaft on west-cental part of property). ~massive po

49.1 foliated mafic dike(?), moderately common lithology as fragments in breccia complex, as float and rare outcrop within metaclastic package.

Geologic legend, McPhee Property

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Mafic volcanic fragmental and associated volcaniclastic rocks (Mmfv)

Foliated coarse grained mafic fragmental and associated volcaniclastic rocks (Mmfv)

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Potassium feldspar megacrystic quartz monzonite

Medium grained granodiorite

Quartz monzodiorite

Diorite

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