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Plutonic rocks of the eastern Bella Coola map area, southwest British Columbia[1]

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Abstract: The abundant plutonic rocks of the eastern Bella Coola map area are mostly of intermediate composition and are interpreted as Jurassic to Eocene. They are subdivided into five intrusive suites, one intrusive complex, and several undifferentiated plutons. The Salloomt suite ((?)Jurassic) is dominated by medium-grained, hornblende-rich diorite. The Kalone suite of biotite-hornblende tonalite is involved in ductile deformation within shear zones adjacent to Jump Across Creek. The Talcheazoone suite consists of uniformly foliated quartz diorite. The Firvale suite comprises altered Early Cretaceous biotite granodiorite. The Four Mile suite comprises pristine biotite-muscovite granite; these plutons truncate a regional pattern of the northwest-trending folds and shear zones. The Crag Creek intrusive complex is diorite and gabbro cut by numerous locally sheeted dykes of granodiorite, rhyolite, basalt, and andesite. Some lens-like sills between screens of country rock may have formed along pre-existing, subvertical structures.

Résumé : Les abondantes roches plutoniques de la partie est de la région cartographique de Bella Coola sont principalement de composition intermédiaire et se seraient formées du Jurassique à l'Éocène. Elles sont subdivisées en cinq suites intrusives, un complexe intrusif et plusieurs plutons non différenciés. La suite de Salloomt (Jurassique?) se compose surtout de diorites à grain moyen riches en hornblende. Les tonalites à biotite-hornblende de la suite de Kalone sont touchées par une déformation ductile dans les zones de cisaillement adjacentes au ruisseau Jump Across. La suite de Talcheazoone est formée de diorites quartziques uniformément foliées. La suite de Firvale comprend des granodiorites à biotite altérées du Crétacé précoce. La suite de Four Mile se compose de granites à biotite-muscovite non altérés. Les plutons de cette suite recoupent les plis et les zones de cisaillement de direction nord-ouest qui déterminent la configuration des unités à l'échelle régionale . Le complexe intrusif de Crag Creek est formé de diorites et de gabbros qui sont recoupés par de nombreux dykes de granodiorite, de rhyolite, de basalte et d'andésite formant par endroits des complexes filoniens. Il est possible que certains des filons-couches de forme lenticulaire entre des écrans de roches encaissantes se soient formés le long de structures subverticales pré-existantes.

[1] Contribution to the Bella Coola Targeted Geoscience Initiative

INTRODUCTION

The geology of the eastern Bella Coola map area (NTS 93 D/7, 8, 9, 10), in southwest coastal British Columbia, is dominated by extensive Middle Jurassic to Early Cretaceous volcanic and sedimentary sequences (Diakow et al., 2002; Struik et al., 2002) intruded by multiple, dominantly intermediate, plutonic rocks. Volcano-sedimentary sequences in the western part of the area were telescoped into northwest-trending, northeast-verging folds. Rocks are also variably dissected by northwest-trending, steeply dipping, augen to mylonitic shear zones (Mahoney et al., 2002). The eastern Bella Coola map area is currently the focus of a new federal Targeted Geoscience Initiative (TGI) project to increase understanding of the geological evolution and assess mineral potential. This report summarizes features of the larger representative intrusive bodies mapped at 1:50 000 scale in the northeast part of the Bella Coola area during the summer of 2001 and is a companion to papers by Struik et al. (2002), Mahoney et al. (2002), and Diakow et al. (in press).

LOCATION, PHYSIOGRAPHY, AND PREVIOUS WORK

The Bella Coola map area (Fig. 1, 2), in the eastern part of the central Coast Mountains, is dominated by rugged topography characterized by dense rainforest, steep slopes, and peaks that are sculpted by alpine and valley glaciers. Because few roads other than Highway 20 lead into the area, geological mapping at 1:50 000 scale requires helicopter support. Above the treeline, nearly continuous rock exposures are generally lichen covered, except in areas of recent, relatively rapid glacial retreat where the rocks are clean.

Baer (1973) mapped the geology of the Bella Coola map area (93 D) at 1:250 000 scale during the 1962–1965 field seasons. This framework was augmented by more detailed recent studies of the tectonic evolution of the region that focus on the Coast shear zone and adjacent structures (Rusmore et al., 2000, 2001; Gehrels and Boghossian, 2000), and magmatism in southeastern Bella Coola area (van der Heyden, 1990, 1991). Baer noted the predominance of quartz dioritic, tonalitic, and granodioritic intrusions in the Bella Coola area, an observation corroborated by this research. Intrusive rocks in this report are divided mainly on the basis of composition,

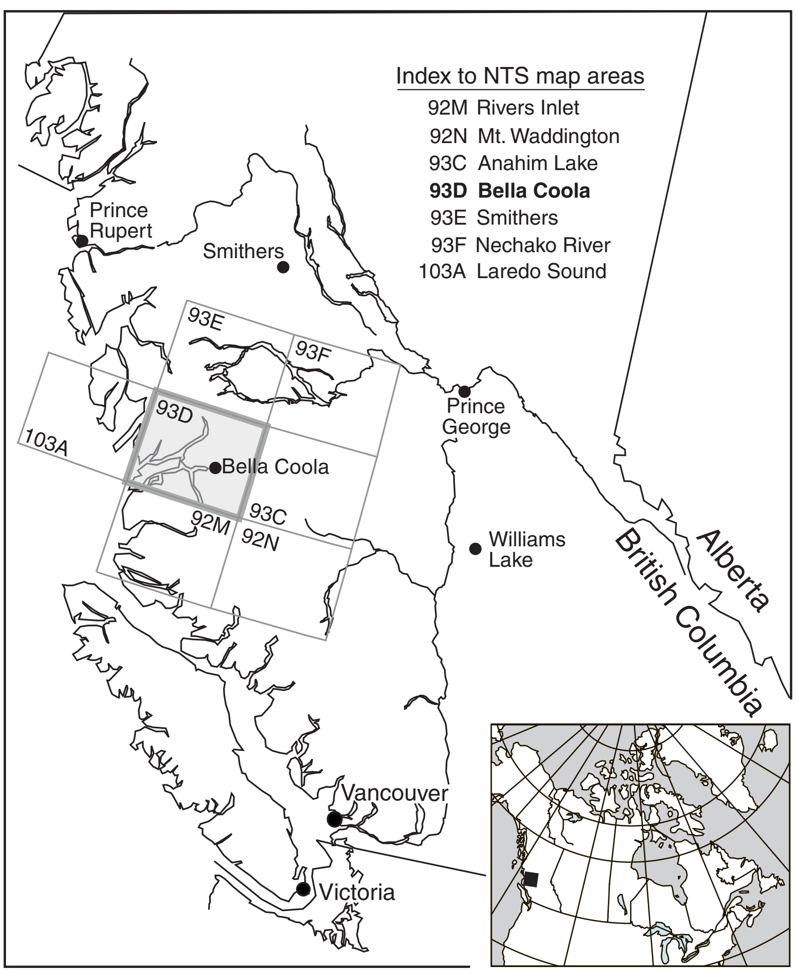

Figure 1.

Location of the eastern Bella Coola Targeted Geoscience Initiative (TGI) project in the south-central Coast Mountains of British Columbia.

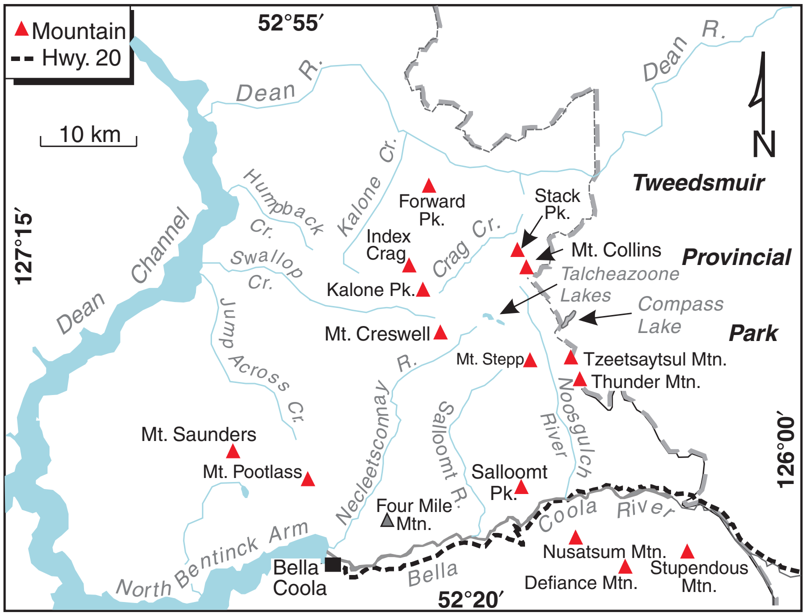

Figure 2.

Northeastern part of the Bella Coola map area showing locations of geographical features.

texture, weathering, alteration, and fabric. These divisions will be tested and modified by ongoing detailed petrographic, geochemical, and geochronological studies.

GEOLOGY

The eastern Bella Coola map area consists of Jurassic and Cretaceous volcanic and sedimentary rocks and voluminous Jurassic to Eocene and possibly Miocene intrusive rocks. The oldest recognized volcanic and sedimentary assemblage, outcropping mainly in the easternmost part of the study area, is assigned to the Jurassic Hazelton Group (Diakow et al., in press). These rocks are juxtaposed in the west against a younger, Lower Cretaceous volcanic and sedimentary succession informally called the 'Monarch volcanics' by van der Heyden (1990) and the 'Monarch sequence' by Struik et al. (2002). The Cretaceous strata are tightly folded and locally sheared along northwest trends (Mahoney et al., 2002).

The intrusive rocks of the eastern Bella Coola map area are mostly of intermediate composition and, on the basis of field relationships, are tentatively interpreted as Jurassic to Eocene. In this report, they are subdivided into five suites (Salloomt, Kalone, Talcheazoone, Firvale, and Four Mile), one intrusive complex (Crag Creek), and several unassigned plutons (Fig. 3). These intrusive suites are described in greater detail below.

(?) Jurassic

Salloomt suite

Salloomt Peak is in part underlain by a grey- to orange-weathering, dark green to grey, equigranular, fine- to medium-grained hornblende diorite. It is characterized by euhedral pervasively chloritized hornblende (20–25%), euhedral to subhedral sericitized plagioclase (60–70%), and anhedral quartz (~20%). The abundance of chloritized mafic minerals produces a distinct greenish cast on fresh surfaces. Pegmatitic segregations and aplitic dykelets are locally evident. The unit contains rare, prominent breccia zones characterized by angular diorite clasts (2–20 cm) interspersed with actinolite-bearing veins, suggesting late-stage hydrothermal activity. Abundant northeast-trending subvertical fractures and subordinate northwest-trending fractures cut the pluton, leading to blocky outcrops and abundant angular talus. On the lower slopes of Salloomt Peak, near the Bella Coola River and in the Salloomt River valley, the diorite is cut by biotite-hornblende granodiorite resembling rocks more characteristic of the Firvale suite. Similar diorite on a ridge trending easterly from the highest point of the Salloomt massif appears to be younger and forms a series of subparallel sills intruding Lower Cretaceous sedimentary rocks containing scarce rhyolite ash-flow tuff intervals.

Hornblende gabbro and hornblendite

Stocks and dykes of medium-grained, equigranular, massive hornblende gabbro and hornblendite are scattered throughout the map area. Locally, massive enclaves of hornblende gabbro and hornblendite occur in mylonitic shear zones. Because similar rocks are sheared in the Jump Across shear zone and have been subsequently cut by granodiorite resembling that of the Early Cretaceous Firvale suite or tonalite of the Kalone suite, these mafic rocks may have a range of emplacement ages.

Many of these mafic plutons are distinguished by blocky hornblende 3 to 6 mm long and by varying amount of chalky-white-weathering plagioclase. In places, hornblende is pegmatitic, composed of 60 mm long elongate crystals in a finer microcrystalline matte of plagioclase.

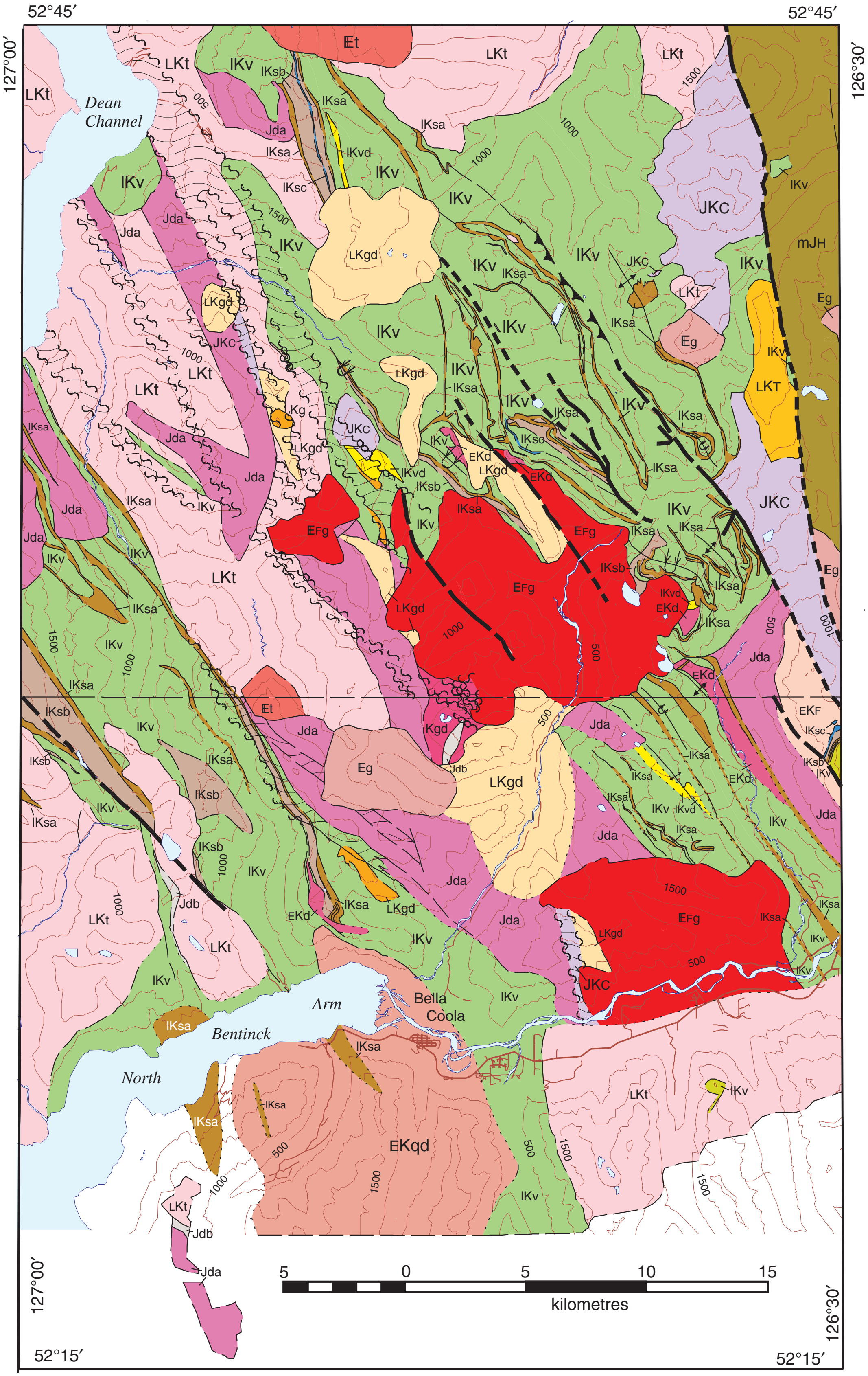

Figure 3. Geological map and legend for NTS map areas 93 D/10 and part of 93 D/07. Contour interval is 500 m.

(?) Cretaceous

Kalone suite

Tonalite bodies are the most voluminous and widespread of the intrusive rocks mapped in the eastern Bella Coola map area. They are medium grained, equigranular, biotite-hornblende- and hornblende-biotite-bearing, and contain phases of volumetrically minor hornblende-quartz diorite. They commonly weather cream-grey, locally with exfoliation joints giving entire mountainsides a slab-like appearance. Tonalite assigned to this suite is informally named after particularly good exposures northwest of Kalone Creek (93 D/10). Elsewhere, large intrusions of tonalite outcrop near Jump Across Creek. A quartz diorite pluton found south of the estuary at Bella Coola is also included in this suite (Fig. 3).

LEGEND FOR FIGURE 3

STRATIFIED ROCKS

LOWER CRETACEOUS

Monarch sequence (lKva - lKvd)

- **lKv** — *Andesite:* mostly fragmental breccia, lapilli and ash tuff, agglomerate, granule conglomerate, sandstone, and greywacke; pyroclastic rocks are dominated by heterolithic intermediate and locally abundant felsic pyroclasts; some flows, aphanitic to plagioclase±rare augite-phyric, locally calcite-chlorite-quartz-amygdaloidal, flow breccia, dykes, small microdiorite stocks; olive to olive-grey, locally maroon
- **lKvd** — *Rhyolite, dacite:* fine grained tuff, sedimentary rocks
- **lKsa** — *Slate, argillite, siltstone, sandstone:* rusty argillite, laminated siltstone, feldspathic sandstone (arkose), minor granule-pebble conglomerate
- **lKsb** — *Sandstone:* feldspathic arkose, argillite
- **lKsc** — *Conglomerate:* rounded granule to cobble, feldspathic, granitic, and volcanic clasts

MIDDLE JURASSIC

- **mJH** — *Hazelton Group:* andesite, basaltic andesite; massive flows, aphanitic to plagioclase±augite-phyric lava, locally coarsely plagioclase-phyric, locally amygdaloidal, fragmentals, dykes, small microdiorite stocks, flow breccia, minor slate and volcaniclastic rock; olive-grey to dark grey, locally maroon

INTRUSIVE ROCKS

(?) EOCENE

- **EFg** — *Four Mile suite:* granite; biotite and muscovite±garnet; medium grained, equigranular; pink, weathers white
- **Eg** — *Granite, granodiorite:* biotite; medium grained, equigranular; weathers yellow
- **Et** — *Tonalite:* biotite; medium grained; white; sheet jointed

(?) CRETACEOUS

- **Kgd** — *Granodiorite:* biotite, hornblende; medium to fine grained, equigranular; grey
- **Kg** — *Granite and granodiorite:* biotite, hornblende; medium to fine grained, equigranular; grey

(?) LATE CRETACEOUS

- **LKgd** — *Granodiorite:* biotite, hornblende; medium grained, equigranular; light grey
- **LKt** — *Tonalite:* biotite, hornblende; medium to coarse grained, equigranular; grey;llocally sheet jointed
- **LKT** — *Talcheazoone pluton:* quartz diorite: biotite, hornblende, medium grained; white; foliated; pendants of amphibolite

(?) EARLY CRETACEOUS

- **EKqd** — *Quartz diorite:* biotite, hornblende; medium grained, equigranular; grey; sheet jointed; ca. 119 Ma
- **EKd** — *Microdiorite:* hornblende, some gabbro and amphibolite, locally subvolcanic to Monarch sequence andesite; equigranular; light grey to grey
- **EKF** — *Firvale suite:* granodiorite: chlorite-epidote-altered hornblende, rare hornblende-quartz monzonite; medium grained, equigranular; off-white to greenish; ca. 134 Ma

JURASSIC AND (?) CRETACEOUS

- **JKC** — *Crag Creek intrusive complex:* ±pyroxene, hornblende diorite, minor quartz diorite and gabbro invaded by hornblende granodiorite to monzogranite and younger rhyolite, plagioclase-phyric and aphanitic andesite and basalt; subvertical and locally sheeted dykes

(?) JURASSIC

- **Jda** — *Diorite:* hornblende, ±biotite; medium grained, equigranular; foliated
- **Jdb** — *Hornblende diorite, gabbro, hornblendite:* heterogeneous, pegmatitic; medium and coarse grained; locally foliated

Figure 4. Curviplanar schlieren in Kalone suite tonalite.

Hornblende is elongate (2–4 mm) and locally can reach 10 mm in length. Biotite is typically pristine, subhedral to euhedral, 2 to 5 mm sheets and books up to 5 mm thick. Plagioclase is rarely porphyritic and forms zoned, euhedral laths. Quartz is typically anhedral and interstitial to other primary mineral grains. Tonalite is generally homogeneous and has elliptical to angular, centimetre-scale plagioclase-porphyritic and hornblende-rich enclaves. Rarely, biotite-rich, curviplanar, wispy schlieren occur in massive rock (Fig. 4).

Contacts of the tonalite with surrounding country rocks are relatively sharp and commonly dip steeply. Near some contacts, steeply dipping sills of fine-grained diorite and microdiorite intrude adjacent layered andesite flows and volcaniclastic rocks. At these sheeted margins, centimetre-scale enclaves of country rock are stoped between anastomosing tonalite veinlets and dykes. Dykes containing abundant hornblende gabbro xenoliths are also found at these margins.

In some intrusions, metre-scale, fine-grained microdiorite dykes project hundreds of metres into the surrounding country rocks. Some plutons have rusty zones containing finely disseminated pyrite that extend up to several hundred metres into the adjacent country rocks. South of Nusatsum Mountain (Fig. 2, 3), an argillite sequence contains well developed, 3 to 5 mm andalusite prisms in a contact aureole with hornblende tonalite.

The age of tonalitic plutons of the Kalone suite is currently unconstrained except for a quartz diorite body on the south side of the estuary west of Bella Coola. This quartz diorite pluton with distinctive exfoliation joints has a reported U-Pb zircon age of 119 ± 2 Ma (Gehrels and Boghossian, 2000). Northwest of Bella Coola, northwest-trending, steeply dipping, augen to mylonitic shear zones, locally more than 1 km wide, deform the biotite and hornblende tonalite bodies believed to belong to the Kalone suite (Mahoney et al., 2002). Undeformed fresh biotite tonalite bodies are interpreted to represent a distinct young suite of tonalite, perhaps of Eocene age. They may represent protracted syn- and post-shear tonalite intrusions (Mahoney et al., 2002). Ongoing detailed petrographic, chemical, and isotope geochronological investigations may better clarify these complex relationships.

Talcheazoone suite

Intrusive rocks assigned to the Talcheazoone suite are exposed directly west of Talcheazoone Lakes and form a north-trending, elongate body rimmed by high bluffs (Fig. 3). This suite comprises weakly to generally moderately foliated, white-weathering, medium-grained, equigranular biotite-hornblende-quartz diorite. Plagioclase is subhedral (2–3 mm); hornblende is elongate (1–8 mm) and variably altered; and biotite (2–3 mm) forms 5% to 10% of the rock. This quartz diorite is distinguished mainly by its penetrative foliation from other plutons of similar composition in the area. Several generations of dykes are recognized and include an older set of synplutonic hornblende diorite to gabbro that is dismembered and ductilely deformed. These dykes along with main-phase quartz diorite are cut by younger, north-trending, rusty-weathering basalt to andesite dykes presumed to be of Cretaceous age (Fig. 5). Fine-grained amphibolite pods scattered throughout the pluton are locally 150 to 200 m across, with concordant, penetrative, north-trending foliation and discordant contacts. Amphibolitic enclaves several tens of centimetres long occur in localized clumps.

A steep north-trending fault forms the eastern contact of the Talcheazoone pluton exposed near Talcheazoone Lakes; the steeply dipping western contact is intrusive. South of Swallop Creek, light-grey-weathering Talcheazoone biotite-hornblende-quartz diorite to hornblende-biotite tonalite is moderately to strongly foliated and sheared. The rock is medium grained, with anhedral plagioclase augen (3–7 mm, 60%). Quartz (2–4 mm, 20%) occurs as elongate knots in the foliation, with euhedral biotite (1–3 mm). Hornblende is chloritized, flattened, and elongated parallel to the foliation. Massive andesite dykes cut the relatively strong fabric.

Figure 5. Late andesite dyke (near bottom of photograph, dipping to the right) cutting gabbroic dykes in Talcheazoone foliated quartz diorite.

Crag Creek intrusive complex

The Crag Creek intrusive complex was informally defined to encompass areas of undifferentiable, multiple crosscutting intrusive phases, mainly of intermediate to mafic composition. Components of this complex are well exposed north and west of Crag Creek, between Forward Peak and Index Crag, and southeast of Mount Creswell (93 D/10). The Crag Creek intrusive complex comprises an older diorite and gabbro cut by numerous dykes of granodiorite, rhyolite, basalt, and andesite (locally sheeted). All these rocks are locally sheared and mylonitized in the Jump Across Creek shear zone. Some areas mapped as Firvale pluton by van der Heyden (1990, 1991) appear to be components of the Crag Creek intrusive complex.

The main mafic phase is composed of pyroxene and biotite-hornblende diorite. It is medium to coarse grained and rarely contains xenoliths of plagioclase-phyric andesite. Plagioclase (25–50%) and either pyroxene or hornblende (1–2 mm, 50%) make up the diorite. The hornblende is commonly partly altered to biotite. The diorite is locally heterogeneous and pegmatitic. It grades to gabbro and can have highly varied concentrations of mafic minerals, schlieren textures, and pods and lenses of hornblendite. This phase forms approximately 30% to 35% of the Crag Creek complex and is intruded by all other phases.

Quartz diorite grading into tonalite is coarse grained, equigranular, and forms a minor component of the Crag Creek complex. It intrudes the diorite as irregular dyke-like apophyses and contains xenoliths of diorite.

Biotite granodiorite is medium to coarse grained, equigranular, and locally contains xenoliths of diorite. It intrudes the diorite and quartz diorite in steeply dipping dykes up to tens of centimetres across that have sharp contacts. The biotite (15–20%) is commonly chloritized. In most places, the biotite granodiorite forms approximately 25% of the Crag Creek complex. These dykes are interpreted as belonging to the Early Cretaceous Firvale plutonic suite and are common in the area near Firvale and Salloomt Peak.

Post-diorite intrusive phases of the Crag Creek intrusive complex consist of a variety of dykes. Basalt and mainly andesite dykes form approximately 30% to 60% of the intrusive complex. Dykes range in thickness from 0.05 to over 5 m and have sharp contacts. They occur in en échelon, parallel sets, generally northerly trending and steeply dipping, and give a layered, 'striped' appearance to outcrops. They are commonly internally banded, grading inward from aphyric margins into a plagioclase-phyric core. In general, more differentiated aphanitic dacite to rhyolite dykes cut hornblende-plagioclase-phyric basaltic andesite to andesite dykes. Rhyolite dykes are 0.1 to 1.5 m thick, anastomosing, solitary, fine grained to mainly aphanitic, and locally have flow-banded margins. The dyke contacts may have a jigsaw fit across the dyke suggesting formation by extension perpendicular to the dyke walls (Fig. 6).

Figure 6. *Extensional character of the andesite dyke walls within the Crag Creek intrusive complex. The dyke appears to be a late synplutonic feature.*

In general, areas of highly concentrated andesite dykes alternating with tabular diorite phases are cut by late granodiorite dykes. The granodiorite is interpreted to be part of the Early Cretaceous Firvale suite, whereas the andesite dykes are interpreted to be Early Cretaceous or younger.

Upper crustal extension recorded by the dykes appears to be substantial in various parts of east Bella Coola map area. As a working hypothesis, the Crag Creek complex and other similar intrusive rock associations mapped nearby (Diakow et al., in press) are interpreted to be subvolcanic and possibly comagmatic with mafic to intermediate extrusive rocks of either the Lower Cretaceous Monarch sequence or the Jurassic Hazelton Group.

Firvale suite

The Firvale suite comprises granodiorite that was mapped in reconnaissance fashion and locally dated in the Bella Coola valley (van der Heyden, 1991). The granodiorite includes medium-grained, equigranular, hornblende granodiorite, biotite-hornblende granodiorite, and rare hornblende-quartz monzonite stocks. These rocks weather grey to rusty-tan and commonly have a cream-coloured fresh surface. Intrusions are generally massive and locally weakly to moderately foliated. East of Salloomt River, granodiorite is pervasively altered to epidote and chlorite.

Plagioclase (2–12 mm) occurs as variably saussuritized subhedral to euhedral laths. Hornblende and biotite are generally altered to chlorite or form discrete grains up to 5 mm long. Alkali feldspar (2–5 mm) is typically anhedral, and quartz forms anhedral, interstitial grains. Epidote occurs as irregular mats on weathered surfaces and also lines fractures cutting the rock.

Along the ridge north of Salloomt Peak, zircons from Firvale granodiorite have yielded U-Pb ages of ca. 134 Ma (van der Heyden, 1991). At this locality, granodiorite is nonconformably overlain by granodiorite-bearing cobble conglomerate, arkose, and deformed Lower Cretaceous ammonite-bearing sandstone, slate, and andesite flows. The age of the pluton and the nature of cover rocks imply a rapid sequence of events including pluton crystallization, exhumation, and shallow marine deposition (van der Heyden, 1991).

(?) Eocene

Four Mile suite

Biotite-muscovite granite is typical of the Four Mile suite. Excellent exposures of these rocks form the massif of Four Mile Mountain north of the Bella Coola valley, near Hagensborg (Fig. 2, 3). Granite exposures extend northwest of the Salloomt River, and another similar pluton flanks Necleetsconnay River. These granite bodies have a well developed, steeply dipping pattern of parallel joints, giving them a sheeted or layered look. Locally, they intrude rocks of the Lower Cretaceous Monarch sequence.

These granite bodies are inequigranular, coarse grained (Fig. 7), and typically weather light tan with greyish fresh surfaces. Limonitic alteration occurs locally in circular, 1 cm blebs. Plagioclase (1–5 mm, 25%) is commonly subhedral, and quartz (1–3 mm, 35%) is anhedral, interstitial, and locally up to 10 mm in diameter. Alkali feldspar (1–5 mm, 30%) locally shows graphic texture with intergrown quartz. Scattered maroon to red, semi-opaque garnet crystals (0.3–1.5 mm) are a diagnostic minor component.

The Four Mile granite contains relatively scarce elliptical to subspherical hornblende diorite xenoliths, ranging from 7cm to 50 cm in diameter. They are composed of felted acicular hornblende and plagioclase grains.

Northwest of Salloomt River and at the headwaters of Jump Across Creek, the upper margin of the pluton dips shallowly beneath country rocks composed of andesitic fragmental rocks and lesser argillite. The contact is sharp, lacking significant alteration. Dykes and sills project into the surrounding country rocks. At several localities, within 150 m of the intrusive margin, a carapace of phyllite and argillite contains andalusite porphyroblasts.

Figure 7. *Texture of the Four Mile two-mica granite. Can tab is 2.5 cm long.*

Tonalite

Near Mount Saunders, a medium-grained, equigranular biotite tonalite clearly truncates the Jump Across shear zone. The tonalite contains xenoliths of sheared microdiorite and has discordant apophyses (10–30 m) cutting the sheared rock. The contact is locally concordant with the shear fabric for about 10 m along strike. Discontinuous biotite-rich bands form wispy layers adjacent to the concordant contact. The tonalite contains pristine, subhedral to euhedral, 3 to 5 mm biotite books (10–15%). Similar biotite tonalite near Dean River yielded a conventional K-Ar age of ca. 47 Ma (Baer, 1973).

Biotite-hornblende granodiorite and biotite granite

North of Talcheazoone Lakes, a stock of biotite-hornblende granodiorite and biotite granite and granodiorite is well exposed. It intrudes a succession of mafic flows and volcaniclastic rocks belonging to the Jurassic Hazelton Group. Similar stocks are exposed in a cirque east of Kalone Peak, and between Necleetsconnay Creek and Jump Across Creek.

Near Talcheazoone Lakes, the intrusion is fresh, fine to medium grained, and characteristically weathers yellow-tan. Plagioclase (1–4 mm, 30–40%) forms euhedral to subhedral laths, alkali feldspar (10–40%) is subhedral, and quartz (20–40%) is fine grained and interstitial. Biotite (1–5 mm) is pristine to chlorite altered, forming subhedral sheets and books, and hornblende (1–2 mm, 10%) is chlorite altered. The rock is generally macroscopically homogeneous, with rare, fine-grained, elliptical mafic enclaves scattered in otherwise massive rock.

Directly northeast of the eastern of the Talcheazoone Lakes, the upper contact of the intrusion is well exposed along steep slopes surrounding a south-facing cirque. This contact is sharp and dips shallowly north. In the north, the contact is a broad zone of thermally altered mafic volcanic country rocks belonging to the Hazelton Group. The east and west margins of the intrusion dip steeply, at least 60º. Rocks with rusty-weathered surfaces caused by local concentrations of finely disseminated pyrite locally extend for tens of metres beyond the intrusion. Dykes and sills of plagioclase-phyric dacite and white-weathering rhyolite project outward from the intrusion into the country rocks for hundreds of metres. These intrusive rocks are well exposed along the lower west-facing slope of Stack Peak and on the peaks directly north of the western of the Talcheazoone Lakes.

COMMENTS ON PLUTON GEOMETRY AND INTRUSION EMPLACEMENT

With excellent exposure on steep rock walls, and in areas of rapid melt of permanent snow pack, there are excellent opportunities to examine general three-dimensional pluton geometry in the region and to make inferences about the modes of emplacement of these intrusive rocks. Commonly, intrusions appear to follow planar fabrics that typically dip steeply throughout the study area. This is evident in Kalone tonalite near the mouth of Jump Across Creek at the Dean Channel, where steeply dipping screens of siliceous slate and argillite are found, with cleavage concordant with the intrusive margins. On and near the west ridge of Mount Pootlass (Fig. 2), siliceous slate is intruded by hornblende-quartz diorite sills up to 200 m wide along steeply dipping, northwest-striking bedding.

Eocene intermediate to felsic intrusions mainly have steeply dipping contacts and commonly relatively flat-lying roofs overlain by Lower Cretaceous volcanic rocks (Struik et al., 2002), giving some intrusions pipe-like shapes. Thus, whereas intrusions may have laccolithic geometry, they appear to scavenge steeply dipping fabrics rather than shallowly dipping planes.

Early Cretaceous and older plutons, interpreted to have intruded prior to deformation, appear to be relatively unaffected by structural shortening, both internally, and in overall geometry. Northwest of Salloomt Peak, granodiorite of the Firvale suite is nonconformably overlain by folded strata, and thus it clearly crystallized and was emplaced prior to structural shortening. It shows neither penetrative fabric nor evidence of discrete deformation in its map pattern or internal structure. Shortening in the Lower Cretaceous volcano-sedimentary succession is thus at least partly detached from the pre-existing crystalline rocks.

CONCLUSIONS

Intrusive rocks of the eastern Bella Coola map area (93 D/7, 8, 9, 10) range in composition from gabbro to granite and are interpreted to be mainly Cretaceous and Eocene, although some plutons are suspected to be Jurassic. On the basis of their compositions, fabrics, and crosscutting or disconformable relationships, they are subdivided into five suites, one intrusive complex, and a number of undesignated plutons.

The oldest known intrusive rocks, perhaps of Jurassic age, consist of diorite bodies that appear to have been intruded prior to deposition of the Lower Cretaceous Monarch sequence. The Firvale suite includes isotopically dated Early Cretaceous granodiorite north of Salloomt Peak. This Early Cretaceous pluton and older rocks of the Salloomt suite are interpreted or can be demonstrated to have intruded prior to folding of the overlying Monarch sequence, showing no macroscopic evidence of deformation. These plutons are in part detached from the overlying regionally folded and thrust-faulted package. The Kalone suite is composed of tonalite locally involved in ductile deformation that affects fossil-bearing Lower Cretaceous sedimentary rocks interleaved with the Monarch sequence. Fresh granite bodies of the Four Mile suite are interpreted to be of Eocene age. These bodies apparently crosscut contractional structures and truncate ductile fabrics in regional shear zones. Intrusions locally have andalusite-bearing contact aureoles in Lower Cretaceous country rocks. The Crag Creek intrusive complex is one of several diorite-dominant tabular intrusions spatially associated with thick accumulations of both Jurassic and Lower Cretaceous volcanic rocks. Cut by several generations of subparallel dyke swarms, these complexes are tentatively interpreted to have been emplaced at a high level in distended crust. A genetic link between these complexes and nearby volcanic rocks is suspected.

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