CANADA
DEPARTMENT
OF
MINES AND TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

PRELIMINARY SERIES

SHEET 92G (East Half)

LEGEND

SEDIMENTARY AND VOLCANIC ROCKS

CENOZOIC

QUATERNARY
PLEISTOCENE AND RECENT

8 — *Glacial drift and alluvium*

TERTIARY(?) AND QUATERNARY
PLIOCENE(?), PLEISTOCENE AND RECENT
GARIBALDI GROUP

7 — *Basalt, andesite, dacite, and rhyodacite flows; minor pyroclastic rocks*

TERTIARY
EOCENE AND(?) LATER

6 — *Conglomerate, sandstone, siltstone, and fire clay;* **6a**, *basalt*

MESOZOIC

CRETACEOUS
UPPER CRETACEOUS(?)

5 — *HELM FORMATION: chiefly slaty argillite and argillaceous quartzite; minor conglomerate, calcareous sandstone, and sandy limestone; minor fine-grained schists, gneisses, and migmatite*

JURASSIC AND CRETACEOUS
UPPER JURASSIC AND LOWER CRETACEOUS

4 — *Chiefly argillite and poorly sorted arkose; minor porphyrite greenstone, impure, locally fossiliferous limestone, slate, conglomerate, chlorite schist, quartzose granulites;* **4a**, *green greywacke, conglomerate, shale, arkose*

JURASSIC
MIDDLE JURASSIC

3 — *CHEHALIS VOLCANICS: massive andesite and dacitic porphyries characterized by phenocrysts of plagioclase and commonly quartz*

PALÆOZOIC(?) AND MESOZOIC

LOWER AND(?) MIDDLE JURASSIC

2 — *CULTUS FORMATION: argillite and shale; minor greywacke*

UPPER PALÆOZOIC (?) AND LOWER MESOZOIC

1 — *Highly metamorphosed rocks of uncertain age; chiefly hornblendic or quartzose granulites, minor hornfels, fine-grained gneisses and schists, quartzites, feldspathized conglomerate, lime silicate rocks; all commonly dioritized*

GRANITIC ROCKS

The order of blocks is not an age sequence. These rocks appear to have been forming during most of the Mesozoic, particularly during the last half of the era

MESOZOIC

B_{I-III} — *Granitic rocks in which BIOTITE is the only mafic mineral present in appreciable amounts;* B_I, *granite;* B_{II}, *granodiorite;* B_{III}, *quartz diorite*

$Bh_{II,III}$ — *Granitic rocks in which BIOTITE exceeds hornblende, though both are present;* Bh_{II}, *granodiorite;* Bh_{III}, *quartz diorite*

$Hb_{II-IV,M}$ — *Granitic rocks in which HORNBLENDE exceeds biotite, though both are present;* Hb_{II}, *granodiorite;* Hb_{III}, *quartz diorite;* Hb_{IV}, *diorite;* Hb_M, *migmatite (highly complex areas of intermingled pre-granitic and granitic rocks)*

$H_{I-V,M}$ — *Granitic rocks in which HORNBLENDE is the only mafic mineral present in appreciable amounts;* H_I, *granites;* H_{II}, *granodiorite;* H_{III}, *quartz diorite;* H_{IV}, *diorite;* H_V, *diorite-gabbro complex;* H_M, *migmatite*

Geological boundaries (approximate) marking limits of:
1. *glaciers, snow and ice fields*
2. *sedimentary and volcanic rock units*
3. *granitic rock units*

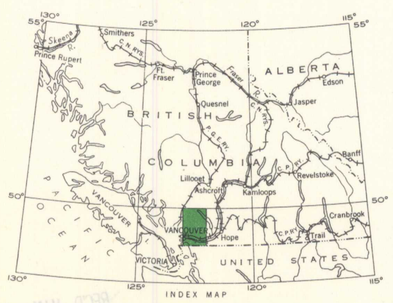
Bedding (inclined, vertical)
Fault (defined, approximate, assumed)
Fossil locality — F
Mineral occurrences (copper, Cu; gold, Au; molybdenum, Mo; silver, Ag) — Au

Geology north of latitude 49°15′ by J. A. Roddick, and south of latitude 49°15′ by J. E. Armstrong, 1953, 1954, 1955

Main highway
Other roads
Trail
Power transmission line
Wharf
Horizontal control point
International boundary
Provincial Park boundary
Indian Reserve boundary
Stream (intermittent)
Marsh
Foreshore flats
Contours (interval 1000 feet) — 5000
Height in feet above mean sea-level — 270

Approximate magnetic declination, 23° 18′ East

Cartography by the Geological Cartography Unit, 1956



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DESCRIPTIVE NOTES

North of the lowlands bordering Fraser River, the map-area is mountainous and extremely rugged. Average relief in this part is 6,000 feet, although less in the south and more in the north. Exuberant forest growth and dense underbrush, typical of coastal vegetation, clothes the terrain up to about 6,000 feet elevation. Except along the southern margin, the mountainous region is not accessible by motor vehicle. Logging roads have been constructed at the north ends of Pitt, Stave, and Harrison Lakes, but these roads are not connected with the network in Fraser valley. Because the upper parts of Seymour and Coquitlam valleys serve as watersheds supplying the Vancouver metropolitan area the general public is forbidden access to them.

Granitic rocks of heterogeneous composition underlie about 85 per cent of the mountainous area. They range from nearly black gabbro to granite almost free of dark minerals, and in many places their complexity is so intricate they defy mapping on any scale. Quartz diorite, containing significant amounts of both biotite and hornblende, is the dominant rock type, followed by biotite-hornblende granodiorite (Bh_{II}) and hornblende diorite (H_{IV}). Commonly, near bodies of pre-granitic rock, the granitic rock is rich in hornblende. Away from these bodies, in the cores of the larger expanses of granitic rock, biotite-rich varieties dominate. Small areas of biotite-rich rock do occur within regions of hornblende-rich rocks and vice versa, but this is not common. The kinship of different varieties of granitic rock containing the same dominant mafic mineral is more pronounced than that based on the ratio of potassium feldspar to plagioclase, from which the conventional names, granite, granodiorite, etc., are mainly derived. Hornblende granite (H_I) is far more likely to be associated in the field with hornblende diorite (H_{IV}) than with biotite granite (B_I). Both field work and laboratory investigations indicate that the granitic rocks form an evolutionary sequence from hornblende-rich to biotite-rich rocks, and that this evolution is effected by metasomatic processes acting over an extremely long period. The least evolved granitic rock of common occurrence is hornblende diorite (H_{IV}), which differs only in grain size from the hornblende-andesine granulites from which most of it formed. Ideally hornblende diorite (H_{IV}) develops through hornblende-biotite quartz diorite (Hb_{III}), biotite-hornblende quartz diorite (Bh_{III}), biotite-hornblende granodiorite (Bh_{II}), to biotite granite (B_I), but the development may follow other paths, ending in such rocks as biotite quartz diorite (B_{III}), or biotite granodiorite (B_{II}). Normally, however, the evolution ceases somewhere in the intermediate quartz diorites containing both mafic minerals. Certain trends are evident in the evolutionary sequence. Average grain-size gradually increases from fine to medium in the hornblende diorites to coarse in the biotite granites; through the same sequence the abundance of mafic minerals decreases from 20 per cent or more to less than 2 per cent and the average content of inclusions of pre-granitic rock decreases from more than 5 per cent in hornblende diorites to less than ½ per cent in the biotite granites. Under the microscope a parallel situation is revealed with regard to inclusions within the constituent crystals of the granitic rocks; crystals in the less evolved rocks contain far more inclusions (of still older minerals derived from the pre-granitic rocks) than do those in the more evolved rocks.

Biotite-rich varieties are younger than nearby hornblende-rich varieties only in the sense that a metamorphic rock is younger than its unmetamorphosed equivalent. Sharp contacts between the major types of granitic rocks are extremely rare in the map-area. Lines separating different plutonic types on the map do not appear as lines in the field, but rather they represent average limits of certain arbitrary mineral ratios (see legend) that experience has shown to be significant. Such 'contacts' can be established only after a statistical evaluation of data gathered at many points.

The major structural trend in the map-area is northwesterly, conforming to the overall pattern of the Coast Mountains, but in the southeast corner it is northeast. Vertical or near vertical attitudes and complex structures are especially common in the oldest rocks (1), wherein beds are rarely traceable from one ridge to another. Most of the younger rocks (2, 3, 4, 5) are less severely deformed, but locally are complexly folded and faulted.

The degree of metamorphism exhibited by the pre-Tertiary rocks is variable. High grades of metamorphism are a common but not universal characteristic of the oldest rocks (1), but no zones of extremely high temperature metamorphism (katazonal) were noted. Although most of the younger rocks (2, 3, 4 and 5) are not highly metamorphosed, some have been converted locally to granulites, schists, gneisses, and even to granitic rocks. Generally, however, only low-temperature alteration products such as chlorite, epidote, and sericite are present. Except for very local contact metamorphism, due to nearby volcanism, the Tertiary rocks (6) are unaltered and little deformed. They lap onto the granitic rocks of the mountainous area, and have gentle southwesterly dips.

No metalliferous mines are operating within the map-area. During the past 70 years a vast number of claims have been staked and restaked, usually by inexperienced persons making short trips from the metropolitan area. Only a few of these claims are legitimate prospects showing at least some mineralization. On the more promising prospects surface exploration has been carried on intermittently, and, in a few instances, underground work has been done but as yet none of the properties has been proved economic. The deposits fall into three general types. The most common type is marked by an abundance of pyrite, filling narrow veins, or replacing large areas of fine-grained, dark hornblende granulites. At scattered localities in these pyritized areas, chalcopyrite, and less commonly, other copper sulphides, sphalerite, and galena are concentrated. Unfortunately these deposits are small, erratically distributed, and discontinuous. Commonly, the principal metal of value is copper, with minor amounts of gold and silver. Properties bordering the upper Indian River, and the southern margins of Pitt Lake belong to this type. The second type of deposit is characterized by white quartz veins (most in non-granitic rock) containing minor amounts of pyrite and other sulphides. Gold is the only metal of value in these veins, but is rarely present in encouraging amounts. On the south slope of Fire Mountain, considerable work has been done on a property of this type. The third type of metalliferous deposit consists of small, rust-coloured pods of molybdenite and pyrite in fine-grained hornblende diorite, or hornblende-rich quartz diorite. These pods are scattered erratically over rather large areas around the northern ends of Pitt and Stave Lakes, and along the upper Stave River.

The distribution of pyrite, as it is associated with ore minerals, can be a guide to prospecting in the Coast Mountains. The maximum concentrations occur in pre-granitic rocks near, or in contact with, biotite-rich granitic rock. In the granitic rocks, pyrite shows a marked tendency to concentrate in hornblende diorite, and to a somewhat lesser extent in hornblende-rich quartz diorite. It is rare in the more highly evolved (biotite-rich) granitic rocks. Although more pyrite occurs in hornblende diorite than in other granitic rocks, the source does not appear to be hornblende diorite but in zones now occupied by biotite-rich granitic rock, in which pyrite is conspicuously absent. In the map-area, the biotite-rich granitic rock seems to represent areas which, during the period of metamorphism resulting in the formation of granitic rocks, were the most permeable to ore-bearing as well as granitizing solutions. Faults or some fortuitous structure seems to be required to bring the formerly permeable zones, represented by the biotite-rich rocks, into juxtaposition with a substantial body of pre-granitic rock, because the biotite-rich rocks represent also relatively highly-evolved areas wherein bodies of pre-granitic rock suitable for ore deposition do not normally survive. In prospecting special attention should be given to those localities where biotite-rich granitic rock is in contact with pendents, or nearly so, such as the northeast slopes of Fire Mountain, the ice-field area east of the head of Stave River, the head of Tipella Creek, and other areas with similar geological patterns.

MAP 8-1956

PITT LAKE

(VANCOUVER, EAST HALF)

NEW WESTMINSTER DISTRICT

BRITISH COLUMBIA

Scale: One Inch to Four Miles = $\frac{1}{253,440}$

4 2 0 4 8 12
Miles

Air photographs covering this map-area may be obtained through the National Air Photographic Library, Topographical Survey, Ottawa, Ontario

8-1956

MAP 8-1956
PITT LAKE
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