LEGEND

CENOZOIC

QUATERNARY

12 — Alluvial, marine, and glacial deposits

GARIBALDI GROUP

11 — Basalt, andesite, dacite, and rhyodacite flows; minor pyroclastic rocks. May include some Tertiary rocks

MESOZOIC

CRETACEOUS AND TERTIARY
UPPER CRETACEOUS, MIDDLE EOCENE, AND LATER

10 — 10a, basalt flows or sills; dykes and minor pyroclastic rocks; 10b, sandstone, shale, conglomerate; minor tuff and coal

CRETACEOUS

9 — 9A. NANAIMO GROUP: shale, sandstone, conglomerate, coal
9B. HELM FORMATION: metavolcanic rocks, conglomerate, limestone
9C. EMPETRUM FORMATION: metavolcanic rocks, conglomerate, limestone
9D. CHEAKAMUS FORMATION: greywacke, conglomerate, arkose; minor argillaceous and calcareous rocks

JURASSIC AND CRETACEOUS (?)
GAMBIER GROUP

7 — Tuff, breccia, agglomerate, andesite, argillite, chert, greywacke, quartzite, conglomerate; minor schist, granulite, lime-silicate rock, scarn

TRIASSIC
UPPER TRIASSIC (mainly or entirely)
VANCOUVER GROUP

3 — Andesite, basalt, quartzite, argillite, limestone, schist. May include some undifferentiated late Palaeozoic rocks

PALAEOZOIC(?) AND MESOZOIC

TRIASSIC OR EARLIER
BOWEN ISLAND GROUP

2 — Mainly greenstone; minor chert and greywacke

TWIN ISLAND GROUP

1 — Hornblende-andesine granulite, gneiss, schist, amphibolite, conglomerate, quartzite, meta-arkose, lime-silicate rocks; migmatite

CRETACEOUS AND/OR EARLIER
UPPER CRETACEOUS AND/OR EARLIER

8 — Quartz-feldspar porphyry

JERVIS GROUP

6 — 6a, basalt, andesite, associated pyroclastic rocks; minor limestone, dolomitic limestone, chert, argillite; 6b, mainly conglomerate, greywacke, sandstone, argillite; minor greenstone; 6c, metavolcanic rocks; metasedimentary rocks; metadiabase

5 — Undivided volcanic and sedimentary rocks equivalent to 3-9: minor migmatite and gneiss; bedded rocks seen from the air

4 — Undivided metamorphic rocks: 4a, gneiss, schist, hornfels, metavolcanic rocks; some quartzite, greywacke; minor slate, argillite; 4b, migmatite, agmatite 4c, migmatite, gneiss, and melanocratic dykes in plutonic rock; observed from the air

PLUTONIC ROCK

MESOZOIC AND (?) CENOZOIC

CRETACEOUS AND EARLIER (mainly)

13 — Undivided; 13a, leucocratic rocks; granodiorite, quartz monzonite, quartz diorite; minor granite and mesocratic rocks; 13b, leucocratic rocks; probably Tertiary; 13c, mesocratic and melanocratic rocks: quartz diorite, diorite, granodiorite; minor hornblende gabbro and leucocratic rocks

Geological boundary (approximate)
Limit of geological mapping
Bedding, top known (inclined, top determined by pillows)
Bedding, top unknown (inclined, vertical)
Gneissosity, schistosity, foliation (inclined, vertical, dip unknown)
Fault, shear zone (approximate)
Syncline
Glacial striae (direction of ice movement known, unknown)
Fossil locality
Mineral occurrence

MINERAL SYMBOLS

Copper	Cu	Lead	Pb
Gold	Au	Molybdenum	Mo
Iron	Fe	Silver	Ag
Zinc	Zn		

Geology by J. E. Armstrong 1948-51; W. R. Bacon 1950-51, 1959; H. H. Bostock 1958-59; A. F. Buckham 1943, 1946; C. H. Clapp 1911; W. H. Mathews 1946-47, 1959; P. Read 1959

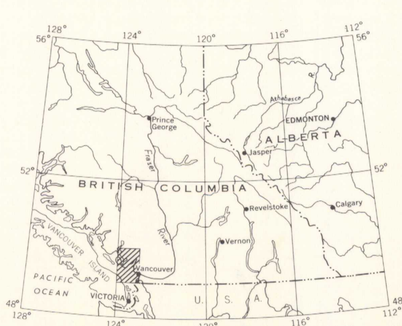
Compilation by H. H. Bostock, 1963

Cartography by the Geological Survey of Canada, 1963

Road, all weather
Other roads
Cart track
International boundary
District boundary
Forest Reserve boundary, Indian Reserve boundary
Railway
Power transmission line
Post office
Intermittent stream
Marsh
Glacier
Sand or gravel
Contours (interval 500 feet)
Height in feet above mean sea-level

Base-map by the Surveys and Mapping Branch, 1959

Mean magnetic declination, 23° 21' East, decreasing 3.0' annually. Readings vary from 24° 01' E in the NW corner to 22° 41' E in the SW corner of the map-area



INDEX MAP

5.1.2 Squamish, B.C. Map 42-1963
A, Geol. Scale - 4 mi. to 1" 1963

C2

GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF MINES AND TECHNICAL SURVEYS

PRELIMINARY SERIES

92G (West Half)

PUBLISHED, 1963
COPIES OF THIS MAP MAY BE OBTAINED FROM THE DIRECTOR, GEOLOGICAL SURVEY OF CANADA, OTTAWA

PRINTED BY THE SURVEYS AND MAPPING BRANCH

MAP 42-1963
GEOLOGY
SQUAMISH
(VANCOUVER, WEST HALF)
BRITISH COLUMBIA

Scale: One Inch to Four Miles = 1/253,440

4 2 0 4 8 12 Miles

DESCRIPTIVE NOTES

Timber line in the map-area reaches about 6,000 feet above sea-level.

Units 1 to 3 comprise more or less isolated bodies of metavolcanic and metasedimentary rock. The Twin Island Group (1) comprises rocks of medium to high metamorphic grade whose contacts with the surrounding plutonic rocks are commonly either complex migmatite zones or faults. This group is overlain by the Gambier Group (7) on Mount Seymour immediately southeast of Squamish map-area. The Bowen Island Group (2) is probably a less metamorphosed equivalent of the Twin Island Group and is characterized by tight folds trending slightly north of west. Rocks of the Bowen Island Group are commonly recrystallized at their contacts with mesocratic plutonic rocks. In the north part of Bowen Island, contact zones between pendant rocks and mesocratic plutonic rocks have later been fractured and intruded by minor leucocratic plutonic rock. The Vancouver Group (3) is composed chiefly of metavolcanic rocks, but cherty and slaty sediments, correlated with the Sicker Series, are exposed in the canyon of Haslam Creek at the extreme southwest corner of the area. Pillow structures are present locally. Rocks of the group are fractured and sheared and seem to have a general northwesterly trend and steep dips.

Gneiss, schist, migmatite, and hornfels (4) occur as isolated pendants or as discontinuous bodies along the margins of pendants. These may be remnants of Twin Island Group rocks, or more highly metamorphosed bodies of later pendant rocks. The Ashlu Creek pendant, a long narrow body that was traversed only locally, contains some volcanic and sedimentary rocks but is composed chiefly of biotite schist and gneiss. The upper part of Cloudburst Mountain is an intrusion breccia consisting of migmatite in numerous angular randomly oriented blocks from a fraction of an inch to scores of feet across in a matrix of unfoliated quartz diorite.

The Gambier Group (7) consists of volcanic and sedimentary rocks less altered than those of the Twin Island and Bowen Island Groups, and characterized by north to northwest trending folds. A conglomerate at the base of the Gambier Group on Gambier Island and at Alberta Bay contains detritus and boulders of plutonic rocks and rocks like those of the Bowen Island Group. The contact between the Gambier Group and the mesocratic granodiorite is therefore considered to be an unconformity. As similar plutonic rocks intrude the Bowen Island Group, the latter is believed to be older than the Gambier Group. An imprint of an ammonite in black slates at the north end of Gambier Island indicates that these rocks are Mesozoic. On the basis of lithologic and stratigraphic similarity, pendant rocks east of Britannia Beach have been correlated with the Gambier Group.

Age relations between the Jervis Group (6) and pendant rocks in the rest of the area are unknown except that all are earlier than some phases of the plutonic rocks. The group is divided into three units in tentative order of increasing age. Granite cobbles are present locally in 6b.

Pendant rocks (5) northwest of Phantom Lake are tilted southwest but are otherwise largely undeformed. These rocks are almost entirely bedded argillaceous quartzite and show ripple marks, crossbedding, and concretions, but are apparently devoid of fossils. The pendant is intruded by quartz diorite sills at the head of Tatlow Creek and a small isolated mass of dense black basaltic rock is present along the northeast margin. A belt of metamorphic rocks (4) perhaps ¼ mile wide extends along the south margin of the pendant and into the plutonic rocks to the east. The lack of intense metamorphism in most of the pendant and the rather consistant moderate southwest dip suggest that it is younger than the Ashlu Creek pendant (4). Volcanic rocks, chert, and argillite (5) on Thormanby Island are tightly folded along the northeast coast, but on the south pillowed volcanic rocks and chert fragment breccias are relatively less deformed. Pendant rocks (5) north of Mamquam River are chiefly volcanic rocks but some chert and argillite is present near the east border of the map-area.

The Britannia Beach, Britannia Range, and Brunswick Point pendants (6) are intruded by dykes, small plug-like bodies, and irregular masses of green to purplish green, grey, or grey-brown, mostly fine-grained to porphyritic rocks commonly showing indistinct crystal outlines. In places these rocks resemble altered quartz diorite and patches of it may be found in some of the finer grained phases. These bodies are characteristically associated with pendants containing andesitic volcanic rocks and may be correlatives of the quartz porphyries of Jervis Inlet (8).

The Nanaimo Group (9A) is cut by part of a major northeast trending fault zone that extends along the east coast of Vancouver Island of which only the limiting northeast and southwest faults are shown. Individual faults within the group are chiefly easterly thrusts. Clean breaks are exposed only in the lower formations; in the higher formations dislocation gives way to sharp overturned folds. Except where associated with dislocations, folding in the Nanaimo Group is broad and open. The Upper Cretaceous rocks north of Garibaldi Lake (9B-D) have been dated from Inoceramus sp. in the upper part of the middle member of the Cheakamus Formation. These rocks are intruded by plutonic rocks but include conglomerate beds containing fragments of plutonic rocks.

Plutonic rocks (13) are divided in part into two groups; leucocratic (13a) and mesocratic to melanocratic (13c). They are separated at approximately 15 per cent mafic minerals as estimated in the field. In general this follows the biotite-hornblende classification of Roddick and Armstrong, the darker rocks mostly but not always being characterized by higher proportions of hornblende. The more mafic plutonic rocks (13c) tend to follow the margins of pendants composed in part of volcanic rocks. Leucocratic plutonic rocks (13a) tend to occur in areas remote from such pendants except where they may have been intruded or faulted near or into these rocks. Movement of the plutonic rocks is thought to be mostly during the Upper Cretaceous or earlier and two samples with potassium-argon ages of 95 and 99 million years are reported from plutonic rocks immediately east of Horseshoe Bay. Some phases of the plutonic rocks are however known to be younger than the Upper Cretaceous north of Garibaldi Lake. The lack of marked deformation during and after intrusion of the leucocratic plutonic rocks (13b) near Squamish suggests that these also may be younger than the tilted, block faulted Upper Cretaceous sediments 15 miles to the north. Foliation is common in the older plutonic rocks near contacts with pendants and may be extensively developed elsewhere. In the Jervis Inlet and Howe Sound areas it mostly strikes northwest and dips steeply, but in lower Cheakamus Canyon more westerly strikes are common.

Sediments (10b), with an aggregate thickness near Vancouver of 4,000 feet, thicken southward. The proportion of sandstone and conglomerate to shale also decreases away from the mountain front. Plant fossils in sediments south of Burrard Inlet indicate a Middle Eocene age, but plant microfossils in similar rocks north of the Inlet suggest a probable Upper Cretaceous age. Basaltic rocks (10a) cut sediments and plutonic rocks. An unusual tuff, containing rounded pebbles up to several inches in diameter, outcrops on the south side of False Creek, and fine-grained reddish and orange-banded tuffs have been exposed in several excavations in downtown Vancouver.

The Garibaldi Group (11) is exposed mainly in the northeast corner of the map-area but small bodies and dykes of similar rock are known as far south as Kallahane Creek and as far west as the ridge west of Pokosha Creek. A particularly fresh, non-vesicular, dark purple-blue, fine-grained, volcanic rock forms a dyke-like body along the northeast contact of a small pendant on the east wall of Seymour valley below Balfour Creek. The principal phenocrysts are plagioclase. Small inclusions of altered quartz diorite are present at the north contact where the dyke is chilled against the wall-rock. This body is tentatively correlated with the Garibaldi Group but may be older.

Minerals containing Cu, Fe, Pb, Zn, Ag, Au, and Mo occur within the map-area. The most important deposit, that at Britannia mine, is in chloritic and sericitic schists adjoining the Britannia shear zone. The principal sulphides are pyrite and chalcopyrite which form stringer lodes and massive replacements. Heavy concentrations of sphalerite are present locally. The known important mineral deposits are in or associated with pendants, and the best chances of finding more appear to be by examining pendants northwest of Britannia and perhaps east of Jervis Inlet.

References:

Armstrong, J. E. Field Trip to Illustrate the Geology of the Coast Mountains, North Vancouver, B. C.; Guide Book for Geological Field Trips in Southwestern B. C.; Cordilleran Sect. G. S. A. (1960)
Armstrong, J. E. Preliminary Map, Vancouver North, British Columbia; Geol. Surv., Canada, Paper 53-28 (1958).
Bacon, W. R. Geology of Lower Jervis Inlet; British Columbia Dept. of Mines, Bull. 39 (1957).
Buckham, A. F. Nanaimo Coal Field; Geol. Surv., Canada, Paper 47-22 (1947).
Clapp, C. H. Geology of the Nanaimo Map-Area; Geol. Surv., Canada, Memoir 51 (1914).
James, H. T. Britannia Beach Map-area, British Columbia; Geol. Surv., Canada, Memoir 158 (1929).
Mathews, W. H. Geology of the Mount Garibaldi Map-area, Southwestern British Columbia, Canada; Bull. Geol. Soc. Amer., vol. 69, pp. 161-198 (1958).
Phemister, T. O. The Coast Range Batholith Near Vancouver, British Columbia; Quart. Jour. Geol. Soc., vol. 101, pt. 2, pp. 37-88 (1945).
Roddick, J. A. Armstrong, J. E. Pitt Lake Map-area; Geol. Surv., Canada, Map 8-1956 with descriptive notes (1957).
Rouse, G. E. Plant Micro fossils from the Burrard Formation of western British Columbia; Micropaleontology; vol. 8, pp. 187-218 (1962).

MAP 42-1963
SQUAMISH
BRITISH COLUMBIA