GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF MINES AND TECHNICAL SURVEYS

PRELIMINARY SERIES

LEGEND

CENOZOIC

QUATERNARY
PLEISTOCENE AND RECENT

13	Glacial and alluvial deposits

CRETACEOUS OR TERTIARY

12	Porphyritic hornblende dacite, fine-grained quartz diorite, related breccias

MESOZOIC

CRETACEOUS
UPPER CRETACEOUS
NANAIMO GROUP (9 - 11)

11	TRENT RIVER FORMATION: shale, silty shale, minor shaly sandstone
10	COMOX FORMATION: sandstone, pebbly sandstone; minor conglomerate, shale, coal
9	Boulder conglomerate, minor lithic sandstone

JURASSIC AND (?) CRETACEOUS
COAST INTRUSIONS

8	Granodiorite; minor quartz diorite

TRIASSIC AND (?) JURASSIC
VANCOUVER GROUP (5 - 7)

7	Tuff, andesitic volcanic breccia and lava; argillite, siltstone; includes some rocks of unit 6

TRIASSIC
UPPER TRIASSIC

6	Limestone, calcareous shale; skarn near intrusive contacts
5	Massive, partly amygdaloidal, basalt, pillow basalt, pillow breccia; minor tuff, volcanic breccia 5A: limestone, calcareous siltstone, shale, interbedded in 5
4	Diabase

PALAEOZOIC

PERMIAN AND (?) EARLIER
SICKER GROUP (1 - 3)

3	Limestone, in part with chert nodules
2	Greywacke, argillite, conglomerate
1	Propylitic banded tuff and volcanic breccia, chlorite schist

Geological boundary, approximate
Bedding (horizontal, inclined, overturned)
Bedding (observed from distance or from air photos)
Schistosity
Fault, assumed
Coal mine (shaft, slope, with local number) . . . 4 5
Mineral occurrence (developed, undeveloped) . . . 6 7

INDEX OF MINERAL OCCURRENCES

1. Sumpter: Fe, Cu
2. Iron River: Fe, Cu
3. Iron Hill (Argonaut Mine): Fe
4. Mt. Washington Copper Co. Ltd.: Cu, Ag, Au
5. Gem Lake (Falconbridge Nickel Mines): Cu, Ag, Au
6. Lynx (Western Mines Ltd.): Zn, Cu, Pb, Ag, Au
7. Paramount (Western Mines Ltd.): Zn, Cu, Pb
8. Price (Western Mines Ltd.): Zn, Cu, Ag

MINERAL SYMBOLS

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

Geology by J.E. Muller, 1964; includes previous work by D.J.T. Carson, H.C. Gunning and W.G. Jeffery

Geological cartography by the Geological Survey of Canada, 1965

Road, all weather . . . Route 19
Other roads
Cart track
Trail
Railway
Electric power line
District boundary
Marsh
Contours (interval 500 feet) . . . 3000
Height in feet above mean sea-level . . . 6665

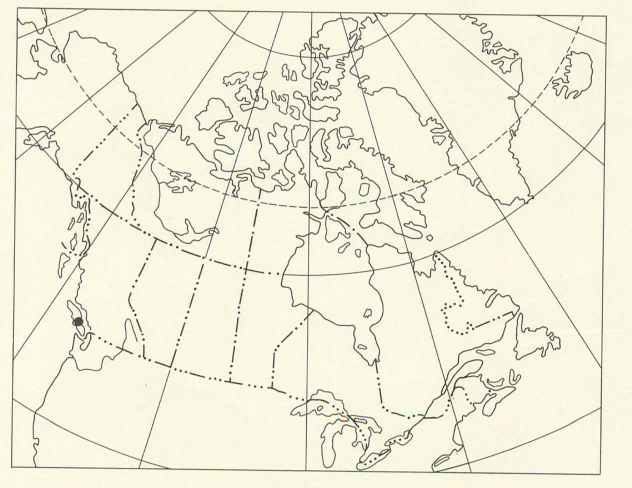
Base-map (Alberni) compiled and drawn by the Department of Lands and Forests, British Columbia, 1961-62

Approximate magnetic declination, 23°25' East, decreasing 2.8' annually

Published, 1965
Copies of this map may be obtained from the Director, Geological Survey of Canada, Ottawa

Printed by the Surveys and Mapping Branch

Adjoins Map 49-1963 "Alberni Area"

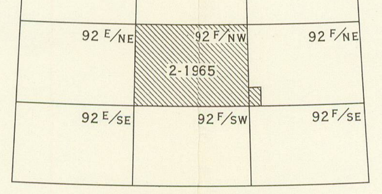


INDEX MAP

MAP 2-1965

GEOLOGY
COMOX LAKE AREA
BRITISH COLUMBIA

Scale 1:126,720
1 inch to 2 miles
Miles 2 0 2 4 6 Miles
Kilometres 3 0 3 6 9 Kilometres



COMOX LAKE AREA
BRITISH COLUMBIA

DESCRIPTIVE NOTES

The eastern part of the area, to points 20 miles inland from the east coast, is readily accessible from the Island Highway by active and abandoned logging roads. Across the northern part of the area a recently opened road leads from Campbell River to Gold River, with a branch to the north end of Buttle Lake, and with logging branch roads in the area west of Strathcona Park.

Upper Campbell and Buttle Lake, now interconnected by the raised water-level, are navigable though hazardous due to numerous drifting logs. Good access to all parts of the area is possible by aircraft; helicopter landings can be made on most ridges above 4,000 feet, and on many river bars, and float-planes may land on the larger lakes and some of the small ones in Strathcona Park. Both types of aircraft can be chartered at Campbell River.

An earlier preliminary report on the geology of part of the area was made by H.C. Gunning[5]. Detailed mapping of the Sicker Group, west and south of Buttle Lake, has been carried out by W.G. Jeffery[7].

The Sicker Group (1, 2, 3) contains a lower unit of banded tuff and volcanic breccia (1), metamorphosed to greenschist facies grade. The rocks are mainly massive, but converted to schists in zones of faulting. Greywacke, argillite, and chert-pebble conglomerate (2) overlie the volcanic rocks in a small area east of Buttle Lake. The upper part of the Sicker Group consists of up to 1,000 feet of limestone (3), in part crinoidal and in part with chert nodules, and containing fossils of Early Permian age[13]. Sills of diabase (4), several hundred feet thick, intrude limestone and volcanic rocks of the Sicker Group and are probably related to the Vancouver Group basalts.

The main part of the Vancouver Group (5 - 7), overlying the Sicker Group with inferred disconformity, consists of a pile of basaltic extrusions. The lower part, estimated to be 12,000 feet thick, contains mainly pillow lava with minor tuff and volcanic breccia. The pillows average one foot in diameter and intra-pillow spaces are filled with nests of quartz and serpentine. North of Elk River the upper part consists of massive flows, commonly with amygdaloidal tops. The individual thickness of many flows is 5 to 10 feet but some are in the order of 50 to 100 feet thick, and the total thickness of the flows is probably about 7,000 feet. To the east, in the vicinity of Comox Lake, pillow breccias, consisting of broken pillows in a matrix of "aquagene tuff", take the place of the massive flows. Pillow lavas and breccias from nearby Quadra Island are described in detail by D. Carlisle[2]. Many of these rocks exhibit plagioclase phenocrysts and/or white or dark green amygdules in the hand specimen, and show in thin section ophitic assemblages of labradorite, in places albitized, and augite, with interstitial chlorite, serpentine, and chalcedony. A band of limestone (5A), containing fossils of Late Karnian age, occurs locally in the upper part of the volcanic sequence[4].

Massive grey limestone, and overlying black, thin-bedded carbonaceous limestone (6) have on Iron River an estimated total thickness of more than 1,500 feet and contain fossils ranging in age from Late Karnian to Late Norian[11]. Upper Triassic fossils (writer's field-identification) were also found in a small sequence of black, calcareous argillite, not shown in the map, enclosed in a complex of andesitic sills and dykes (unit 7), that are exposed in the spillway of the Upper Campbell Lake power dam.

On Iron River unit 6 is overlain by a sequence of massive black siltstone and argillite, followed by well-banded, fine-grained tuff, but most of the area mapped as unit 7 is underlain by a complex of massive, fine- to medium-grained, commonly porphyritic, greenish grey hornblende andesite. On weathered surfaces many of these rocks can be seen to be tuff and volcanic breccia, but others appear to be non-clastic, fine-crystalline, porphyritic flows, sills or dykes. On both sides of the north part of Campbell Lake, and near the lower part of Iron River near granitic contacts, septa and irregular masses of silicified sediments, in places mineralized with magnetite, occur within the complex of andesitic rocks. The sediments are in part Triassic, in part perhaps Jurassic in age. The andesite consists largely of andesine with more calcic plagioclase phenocrysts and minor hornblende, and contains commonly clots up to several inches in diameter of mafic minerals. This unit is tentatively correlated with the Bonanza Group[6].

The batholith in the southwest corner of the map-area consists mainly of hornblende-biotite granodiorite. In the central part of the mass the rocks are light-coloured, medium to coarse grained, and commonly with conspicuous quartz phenocrysts. The intrusive contact appears to be steep and rather sharp on the east side, but flat and gradational on the west side. Numerous roof pendants of dioritized volcanic rocks (5), riddled with andesitic dykes, occur. The smaller intrusive complex in the Quinsam Lakes area is of more varied composition, ranging from commonly pink quartz monzonite through hornblende granodiorite to hornblende diorite. In places these rocks are intimately mixed with the andesitic complex (7). Several small intrusive stocks in the Forbidden Plateau region are generally more mafic hornblende quartz diorite and diorite. The Quinsam rocks intrude Upper Triassic to Jurassic (7) rocks and are unconformably overlain by Upper Cretaceous sediments. The western batholith is probably also Jurassic to Cretaceous in age, but the stocks of Forbidden Plateau, though mapped with this unit, may be of the same age as unit 12.

Only the lower part of the Nanaimo Group (9 - 11) is exposed in the map-area. A basal conglomerate (9) is generally present but varies over short distances from a few inches to more than 500 feet in thickness. It is poorly sorted and contains subangular boulders to about one foot diameter of mainly volcanic rocks and minor granitic clasts in a volcanic greywacke matrix. It occurs mainly in a belt along Oyster River, suggesting an ancient valley deposit.

The Comox Formation (10) consists mainly of medium-grained, thick-bedded arkosic sandstone, well-sorted roundstone conglomerate, and intercalations of shale and coal. Drill-holes and mine workings in the Comox coal field, where unit 9 is thin or absent, have shown the topographic irregularity of the surface of the Triassic basalt beneath the basal unconformity, and the great lateral variation and lenticularity of the sandstone, shale, and coal-seam units within the formation[10]. The thickness, varying between 200 and 1,000 feet, averages about 600 feet. Only fossil plants have been found, suggesting essentially non-marine deposition and indicating Late Cretaceous age[1].

The Trent River Formation (11) is mainly covered by coastal lowland Pleistocene deposits, but is exposed in larger river channels. It consists of dark grey, generally poorly bedded shale with minor siltstone, fine-grained sandstone, and calcareous concretions. The total thickness is about 900 feet and good ammonite and micro-faunas indicate an Upper Cretaceous Campanian and (?) Santonian age[9,12].

The Cretaceous sediments are intruded on Mount Washington by a stock, about one mile in diameter, of hornblende quartz diorite (12). The stock is the probable main feeder of sills of porphyritic dacite, occurring on Mount Washington and in several other places up to ten miles away. Commonly they are tiered, with interveining sediments, and total more than 500 feet in thickness. Similar sills occur in the Nanaimo Lakes area and southeast of Alberni[7]. Related to the stock are breccias, occurring mainly along its margin, and these consist of angular or rounded fragments of the intrusive rocks in a matrix of fine comminuted material, locally mineralized with magnetite and iron-copper sulphides[3]. Cretaceous sediments and Triassic volcanic rocks surrounding the stock have been converted to quartzite, argillite, and hornfels, but little change has occurred in the sediments enclosing the sills. A few smaller stocks of like composition intrude Triassic lavas of Forbidden Plateau.

The structure of the area is governed by block-faulting and tilting; folding is only apparent locally along some fault-zones. Sicker Group volcanic rocks and sediments are perhaps more strongly compressed in some areas than rocks of succeeding groups. A structural uplift accounts for the exposure of an area of Sicker Group rocks west and south of Buttle Lake. This outcrop area matches a widening of the exposure of the western batholith. In this area the Permian limestone is conspicuously offset, in places more than a mile, by several north-trending faults. The thick homoclinal succession of Triassic lavas slopes north and northwest off the uplift with dips of 25 degrees, decreasing northward to 10 degrees and less. Another set of faults strikes northwest, parallel with the island's elongation. One of these extends from the scarp separating Beaufort Range from Alberni Valley into Cruikshank Valley and Forbidden Plateau. Other parallel faults offset Cretaceous rocks in the northeast part of the area. A complex fault-pattern of roughly radial arrangement seems to affect Triassic, Cretaceous and intrusive rocks in the Quinsam area. In the western batholith faults, indicated by strong lineaments, strike west to west-northwest.

Several categories of mineral deposits are present. A northwest striking shear zone in Sicker volcanic rocks contains the complex base and precious metal ores of Western Mines (6), where in September 1964 published estimates of reserves were 1,500,200 tons, averaging 0.063 oz. gold, 2.91 oz. silver, 2.19% copper, 1.21% lead, and 10.49% zinc. Related deposits are 7 and 8, and the occurrences are similar to those of the China Creek area[8].

Skarn at the contact of Triassic limestone and overlying tuffs, with granitic rocks has yielded the magnetite body of the abandoned Argonaut Mine (3), where between 1951 and 1957 more than two million tons of magnetite concentrate were produced. Prospects 1 and 2 are of similar nature, although in the latter no limestone seems to occur. A host of other magnetite-chalcopyrite skarn deposits in or near Triassic limestone are known on the island.

The Mount Washington deposit (4), occurs at the contact of the quartz diorite stock, its related breccias, and Cretaceous sediments. At latest report reserves were 610,000 tons of ore averaging 1.40% copper, 0.015 oz. of gold, and 1.20 oz. of silver and minor molybdenum. A breccia pipe, similar to breccias at Mount Washington, intrudes Triassic lava near Gem Lake (5). It contains disseminated magnetite and chalcopyrite and has recently been drilled by Falconbridge Nickel Mines.

Coal of high volatile A bituminous rank has been mined for many years from a few seams in the Comox - Cumberland area but now only the Tsable River Mine is being worked on a salvage basis.

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[8] Muller, J.E.: Alberni area; Geol. Surv. Can., Map 49-1963 (1963).

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