GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF MINES AND TECHNICAL SURVEYS

PRELIMINARY SERIES

92 F/SE

LEGEND

CENOZOIC

QUATERNARY
PLEISTOCENE AND RECENT

17 Glacial and alluvial deposits

CENOZOIC OR MESOZOIC

CRETACEOUS OR TERTIARY

16 Conglomerate, sandstone

15 Porphyritic dacite

MESOZOIC

CRETACEOUS
UPPER CRETACEOUS
NANAIMO GROUP (8 - 14)

14 GEOFFREY FORMATION: conglomerate, sandstone

13 LAMBERT FORMATION: shale, sandy shale; minor sandstone

12 DENMAN FORMATION: sandstone, conglomerate; minor shale

11 TRENT RIVER FORMATION: shale, sandy shale

10 Feldspathic sandstone, grit, conglomerate, coal. Includes EXTENSION FORMATION,(10a)and COMOX FORMATION,(10b)

9 Concretionary shale, silty shale, fine-grained sandstone. Includes HASLAM FORMATION,(9a)and QUALICUM FORMATION,(9b)

8 BENSON FORMATION: boulder conglomerate, gritty and pebbly sandstone

CRETACEOUS AND/OR JURASSIC
COAST INTRUSIONS

7 Granodiorite, quartz diorite; minor granite

TRIASSIC AND (?) JURASSIC
VANCOUVER GROUP (4 - 6)

6 Tuff, volcanic breccia

TRIASSIC
UPPER TRIASSIC

5 Limestone, calcareous shale; 5a, limestone, skarn, hornfels; mafic dykes

UPPER TRIASSIC AND (?) EARLIER

4 Massive basalt, amygdaloidal basalt, pillow basalt, flow breccia, minor andesite, bedded tuff, volcanic breccia

PALAEOZOIC

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

1 2 3
3. Limestone, argillite
2. Greywacke, argillite, conglomerate; banded tuff
1. Volcanic breccia and tuff, altered to greenstone and greenschist; banded tuff, chert

Geological boundary (approximate)
Bedding (horizontal, inclined, vertical, overturned)
Bedding (tops unknown)
Schistosity (inclined, vertical)
Fault (defined, assumed)
Syncline
Anticline
Coal seam
Mineral occurrence ×Au

MINERALS

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

INDEX OF MINERAL PROSPECTS

1. Vancouver Island Gold Mines Ltd.
2. Regina Group
3. Vulcan Group
4. Havilah Gold Mines Ltd.
5. Golden Eagle
6. B. and K.
7. Thistle
8. Black Panther
9. Black Lion
10. J. J. J.
11. Kitchener
12. W. W. W.
13. Sunshine Group

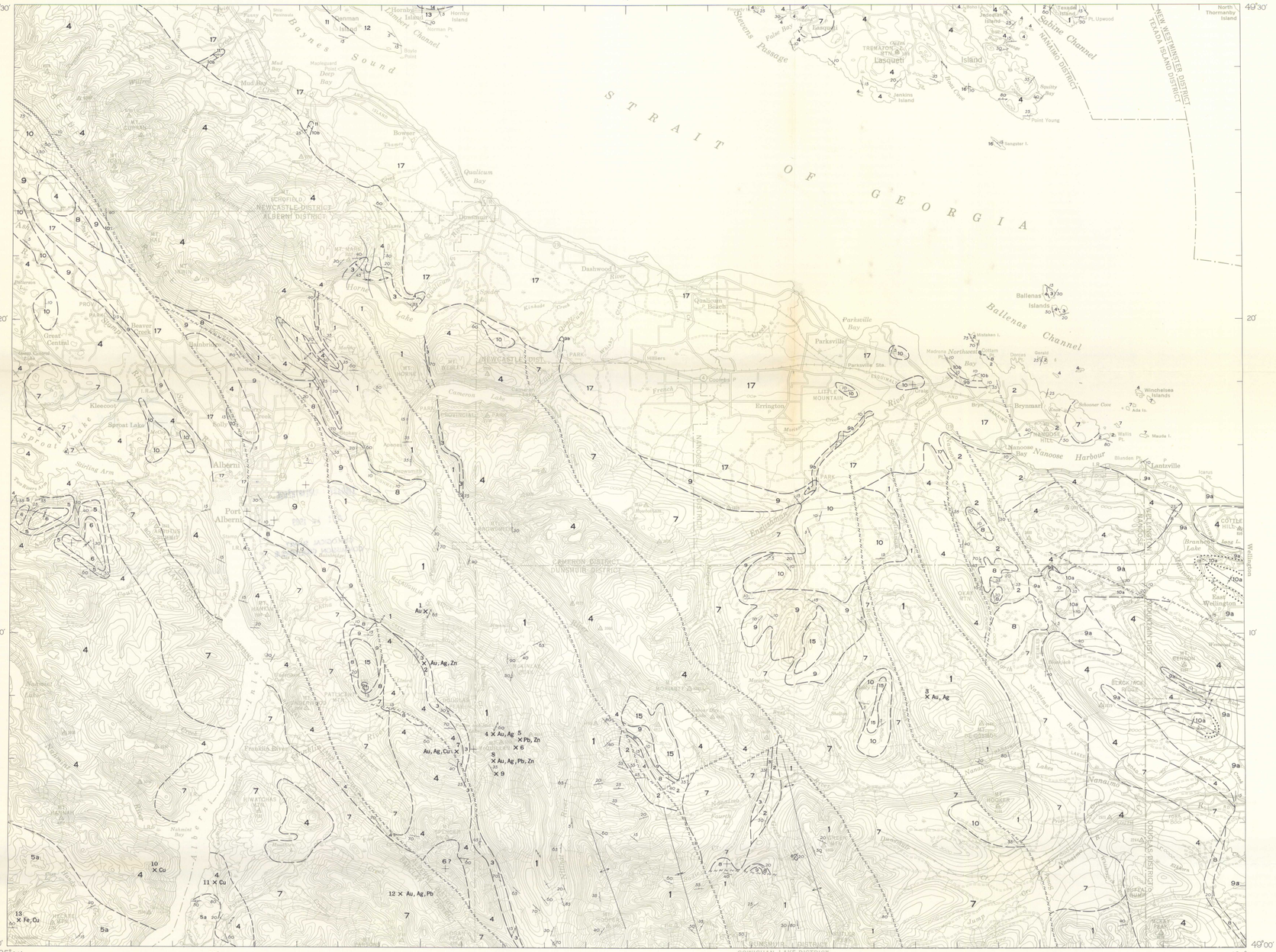
Geology by J. E. Muller, 1963

Geological cartography by the Geological Survey of Canada, 1964

Road, all weather
Other roads
Trail
Railway
District boundary
Park and Indian Reserve boundary
Power transmission line
Post office
Intermittent stream
Marsh
Sand or gravel
Contours (interval 200 feet)
Height in feet above mean sea-level

Base-map cartography by the Geological Survey of Canada, 1964
from maps published by the Army Survey Establishment, R.C.E., 1955, 1956, 1958

Approximate magnetic declination, 23°30' East, decreasing 2.9' annually



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INDEX MAP

MAP 49-1963

GEOLOGY

ALBERNI 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

DESCRIPTIVE NOTES

Most of the area is readily accessible from the "Island Highway" connecting to Alberni, some second-class roads, and many private lumber roads. The southwest corner, west of Alberni Inlet, is reached by boat across the Inlet or by plane to Nahmint Lake. Helicopters may be used to reach a few mountain tops above 4,000 feet elevation. Travel on foot is fair or good in virgin forest and more recent slash, but is arduous in old cuts with second growth.

The lower part of the Sicker Group (1)[1,2] consists of massive tuff and coarse volcanic breccia. The volcanic fragments commonly carry conspicuous dark green mafic phenocrysts. The upper part of the unit contains mainly grey, pale green, and dark red, banded, cherty tuffs. The unit is in many places invaded by dykes and small intrusions of diabase. The rocks of unit 1 are altered to greenstone, and locally to greenschist. The banded tuffs of unit 1 grade upward into a sequence of greywacke, argillite, and tuff, commonly with graded bedding, and minor conglomerate (2).

Detrital, crinoidal limestone (3) occurs at the top of the Sicker Group. It is about 20 feet thick and interbedded with argillite on Nanoose peninsula, and about 500 feet thick north of Horne Lake.

The Vancouver Group (4 - 6) is widespread in the map-area. The main part (4) consists of several thousand feet of reddish brown basaltic lava flows. They are massive with minute feldspar phenocrysts, or contain amygdules of calcite, quartz, chlorite, and epidote. Pillow lavas and flow breccias occur abundantly, but tuff is present in minor amounts. Unit 4 is correlative with the Franklin Creek Volcanics[4,9] and the Karmutsen Group[1].

The middle, sedimentary part of the Vancouver Group (5) overlies unit 4 south of Sproat Lake and is there about 500 feet thick. It consists of grey, massive to thick-bedded limestone and black, thin-bedded shaly limestone, overlain by thin-bedded and fissile, soft, black, carbonaceous shale. It contains Upper Triassic fossils. Limestone and minor black shale on both sides of the south end of Alberni Inlet (5a) are probably of the same age, but are heavily intruded by diabasic dykes and locally metamorphosed to hornfels and skarn with small deposits of magnetite. Unit 5 is correlative with the Sutton Limestone[2,3] and the Quatsino Formation[1].

The upper part of the Vancouver Group (6) is a sequence of purplish grey and green, massive, poorly bedded tuff and volcanic breccia which overlies unit 5 south of Sproat Lake, and is probably also present in the headwater area of Museum Creek. It also occurs in Cowichan Lake area[6] and is probably equivalent to the Bonanza Group of northern Vancouver Island[1].

Biotite-hornblende granodiorite and quartz diorite, with minor granite (7) are mainly intrusive into the volcanic rocks of the Vancouver Group (4). They are medium- to coarse-grained, massive rocks without foliation. Contact zones contain hybrid rocks and 'intrusive breccias', consisting of fragments of volcanic rock recrystallized to hornfels and diorite in a granitic matrix.

The Nanaimo Group (8 - 14) unconformably overlies all preceding map-units. The map-area embraces the west edge of the 'Nanaimo Basin', the southeast edge of the 'Comox Basin', the 'Alberni Basin' and several outliers of the group at the heads of Englishman and Nanaimo Rivers. The lower formations (8 - 11) contain in Nanaimo and Comox basins faunas of Upper Cretaceous (Campanian) age, but vary in lithologic succession.

The basal conglomerate (8) or Benson Formation[2,4,10] varies in thickness from only a few feet to several hundred feet. It contains poorly sorted, subangular fragments of pebble to boulder size, mainly of volcanic rocks and chert, with fewer fragments of granitic rocks and sediments, interbedded with coarse-grained sandstone.

The lower shale formation (9) succeeds unit 8 or lies directly on older rocks. A thickness varying between 150 and 800 feet has been reported[7]. It is mainly black-grey, dark brown weathering, silty shale and fine-grained shaly sandstone. Bedding is poor and commonly the rock consists partly or entirely of spheroidal concretions with concentric layering one foot or more in diameter. The Haslam Formation[2,4,10] (9a), the Qualicum Formation[10] (9b), and the basal shale of the Alberni Basin and of the Cretaceous outliers (9) are included in this unit.

Coarse-grained sandstone and conglomerate (10) succeeds unit 9. The thickness of this unit varies between 500 and 1,000 feet[10]. The rocks contain more quartz, chert, and feldspar and less volcanic material than unit 8, and the fragments are more rounded and better sorted. One or more coal seams occur in the lower part of the Extension Formation[2,4,10] (10a) of the Nanaimo Basin and in the Comox Formation[10] (10b) of the Comox Basin. The Comox Formation directly overlies volcanic rocks (4). The unit also includes sandstone (10) overlying shale (9) in the Alberni Basin, and in the outliers.

The shale-formation (11) overlies unit 10b and has been named Trent River Formation[10]. It is more than 1,300 feet thick, contains poorly bedded brownish black shale with thin calcareous beds and concretions, and is exposed in two streams near Mud Bay and on Denman Island.

The succeeding formations (12, 13, 14) have yielded a distinctly younger fauna of Upper Cretaceous (Maestrichtian) age[10]. The Denman Formation (12), mainly sandstone and conglomerate, occurs on Denman Island; the Lambert Formation (13), mainly shale, and the Geoffrey Formation (14), mainly conglomerate, underlie the south part of Hornby Island.

Sills of grey porphyritic dacite with phenocrysts of plagioclase and hornblende (15), up to 500 feet thick, intrude several outliers of the Nanaimo Group and are probably Tertiary in age.

Arkosic sandstone and cobble conglomerate (16) with clasts of volcanic and granitic rocks, as well as fragments similar to the dacite of 15, and with lenses of shale-breccia, underlie Sangster Island and are perhaps of Tertiary age. Boulder conglomerate, and sandstone (16), overlying basalt (4) on Lasqueti Island is Cretaceous or Tertiary.

A main uplift belt roughly following the island divide is underlain by steeply folded Sicker Group rocks from Nitinat River to Horne Lake and by Vancouver Group volcanic rocks in Beaufort Range. Two lesser uplift zones bring Sicker Group rocks to the surface on both sides of Nanoose Harbour and on the south tip of Texada Island. The north-northwest to north-northeast folding trend in this group appears to be discordant with that in younger formations.

The areas between these uplift zones are underlain by more gently folded Vancouver Group basalts, intruded by granitic batholiths with distinct northwesterly elongation, and locally covered with a veneer of Upper Triassic and Cretaceous strata. Granitic rocks are notably missing in the main uplift belt.

Except in the vicinity of some faults the Nanaimo Group sediments are flat-lying, or exhibit very gentle west-northwesterly folds.

Major reverse faults, commonly offsetting Cretaceous strata, are inferred to traverse the area in a northwesterly direction, and a few cross-faults, perpendicular to these, are shown. The uplift zones are bounded by such faults, in places marked by prominent escarpments and steep tilting of Cretaceous strata, as along the southwest side of Beaufort Range.

Various mineral prospects are known. Sulphide-bearing veins in shear zones of the Sicker Group (1) contain minor amounts of gold, silver, copper, lead, and zinc, and some have yielded small amounts of ore. Triassic limestone occurring in unit 5a or as lenses in unit 4 contains several showings of magnetite and chalcopyrite, probably due to contact metamorphism by nearby intrusions. Highest yield from any of the properties, apparently from the "Thistle", was 6,867 tons of ore, yielding 2,667 ounces of gold, 1,667 ounces of silver, and 626,556 pounds of copper, between 1938 and 1942.

A small part of the subbituminous coal produced in the Nanaimo area came from within the map-area near Wellington.

[1] Clapp, C. H., Southern Vancouver Island; Geol. Surv. Can., Mem. 13 (1912).
[2] Geology of the Nanaimo map-area; Geol. Surv. Can., Mem. 51 (1914).
[3] Clapp, C. H., and Cooke, H. C., Sooke and Duncan map-areas, Vancouver Island; Geol. Surv. Can., Mem. 96 (1917).
[4] Buckham, A. F., Preliminary map, Nanaimo Coalfield, British Columbia; Geol. Surv. Can., Paper 47-22 (1947).
[5] Fyles, J. G., Surficial geology of Horne Lake and Parksville map-areas, Vancouver Island, British Columbia; Geol. Surv. Can., Mem. 318 (1963).
[6] Fyles, J. T., Geology of the Cowichan Lake area, Vancouver Island, British Columbia; B.C. Dept. Mines, Bull. 37 (1955).
[7] Hoadley, J. W., Geology and mineral deposits of the Zeballos - Nimpkish area, Vancouver Island, British Columbia; Geol. Surv. Can., Mem. 273 (1953).
[8] Mackenzie, J. D., Alberni area, Vancouver Island; Geol. Surv. Can., Summ. Rept. 1922A, pp. 51-63 (1923).
[9] Stevenson, J. S., Geology and ore deposits of the China Creek area, Vancouver Island, British Columbia; B.C. Minister of Mines Ann. Rept., pp. 142-161 (1944).
[10] Usher, J. L., Ammonite faunas of the Upper Cretaceous rocks of Vancouver Island, British Columbia; Geol. Surv. Can., Bull. 21 (1952).

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ALBERNI AREA
BRITISH COLUMBIA
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