CANADA

DEPARTMENT OF MINES AND RESOURCES

MINES AND GEOLOGY BRANCH

BUREAU OF GEOLOGY AND TOPOGRAPHY

122°00' GEOLOGICAL SURVEY 50°00'

# LEGEND

**CENOZOIC**

**TERTIARY**

POST-EOCENE

18,19 — 18–*COQUIHALLA GROUP: basalt and rhyolite tuff and breccia; diorite*
19–*Porphyritic dacite and rhyolite; light-coloured breccias and tuffs*

PALEOCENE OR EOCENE

17 — *HUNTINGTON FORMATION: conglomerate, sandstone, shale*

**CRETACEOUS**

LOWER CRETACEOUS

14,15,16 — 14–*PASAYTEN GROUP: arkose, sandstone, argillite, conglomerate; breccia and tuff*
15–*SKAGIT FORMATION: andesite, minor rhyolite; tuff and breccia; conglomerate. May be Tertiary.*
16–*Basalt, andesite; agglomerate, tuff; minor arkose and greywacke. May be Tertiary.*

13 — *Conglomerate, sandstone, shale; tuff and breccia*

**JURASSIC (?) AND CRETACEOUS**

UPPER JURASSIC (?) AND LOWER CRETACEOUS

10,11,12 — 10–*DEWDNEY CREEK GROUP: tuff, agglomerate; sandstone, argillite, conglomerate*
11–*JACKASS MOUNTAIN GROUP: conglomerate, sandstone, argillite*
12–*TAMIHY GROUP: conglomerate, sandstone, argillite*

**MESOZOIC**

UPPER JURASSIC OR (?) LOWER CRETACEOUS

8,9 — 8– *LADNER GROUP: chiefly slate; greywacke, schist, grit, conglomerate*
9– *AGASSIZ GROUP: conglomerate, argillite, sandstone*

**JURASSIC**

MIDDLE AND UPPER JURASSIC

7 — *Tuff, tuffaceous argillite, argillite;* 7a, *mainly argillite; some sandstone and tuffaceous beds; (may be, in part, Lower Cretaceous)*

MIDDLE JURASSIC

6 — *Lavas; tuff, breccia, and agglomerate*

**TRIASSIC**

UPPER TRIASSIC

4,5 — 4– *TULAMEEN GROUP: chlorite and talc schists; tuffaceous argillite*
5– *CULTUS FORMATION: chiefly argillite; grit, conglomerate*

**PALÆOZOIC AND MESOZOIC**

**CARBONIFEROUS AND LATER**

1,2,3 — 1– *HOZAMEEN GROUP: chert, argillite, phyllite, limestone; intercalated volcanic rocks. Probably Carboniferous or Permian*
2– *Andesite and rhyolite; tuff; related basic intrusions*
3– *Argillite, slate, phyllite, cherty and arenaceous beds, crystalline limestone, conglomerate; intercalated volcanic rocks; micaceous, chloritic, and talcose schists. Comprises CHILLIWACK GROUP (Carboniferous) and younger rocks*

INTRUSIVE ROCKS

**JURASSIC (?) AND LATER**

25,26,27 — 25–*Granite, granodiorite, quartz diorite, and diorite (not all of the same age);* 25a, *Eagle granodiorite (mainly): gneissic granodiorite*
26–*Quartz diorite, diorite. Post-Lower Cretaceous*
27–*Felsitic intrusions. Post-Lower Cretaceous*

**MESOZOIC AND (?) CENOZOIC**

23,24 — 23–*Chiefly serpentine*
24–*Diorite, gabbro, amphibolite, hornblendite, pyroxenite*

**JURASSIC**

20,21,22 — 20–*Custer granite-gneiss: chiefly gneissic granite and granodiorite;* 20a, *granodiorite, quartz diorite, and diorite*
21–*Slesse hornblende diorite*
22–*Vedder greenstone. May be pre-Jurassic.*

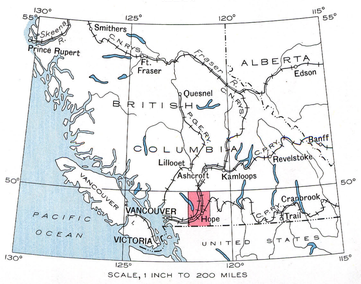
*Area containing many small bodies of basic and ultra-basic intrusive rocks*

*Valley drift*
*Fault*
*Fossil locality* Ⓕ
*Mineral occurrence* ×

| | |
|---|---|
| *Gold* | Au |
| *Gold (placer)* | Au(pl) |
| *Silver* | Ag |
| *Copper* | Cu |
| *Nickel* | Ni |
| *Molybdenum* | Mo |
| *Zinc* | Zn |
| *Lead* | Pb |
| *Iron* | Fe |
| *Arsenic* | As |
| *Tungsten* | W |
| *Asbestos* | Asb |
| *Graphite* | C |

*Geology by C.H.Crickmay, 1924, 1926; H.C.Horwood, 1935; and W.E.Snow, 1938, 1939. Geological compilation and descriptive notes by C.E.Cairnes, 1942.*

PUBLISHED, 1944.




MAP 737A

# HOPE

YALE AND NEW WESTMINSTER DISTRICTS

BRITISH COLUMBIA

Scale, 1/253440 or 1 Inch to 4 Miles

Miles 4 0 4 8 12

*Approximate magnetic declination, 25° East.*

*LEGEND*

*Provincial highway*
*Road well travelled*
*Road not well travelled*
*Trail*
*Post Office*
*Dyke*
*Adit*
*Land District boundary*
*Park and Indian Reserve boundary*
*Limit of Railway Belt*
*Stream (position approximate)*
*Intermittent stream*
*Glacier*
*Contours (interval 500 feet)*
*Contours (position approximate)*
*Height in feet above Mean sea-level* ....6340'

*Base-map compiled by the Topographical Survey, from original surveys and information supplied by the British Columbia Department of Lands. Revised 1942. Cartography by the Drafting and Reproducing Division, 1943.*

# DESCRIPTIVE NOTES

Much of the map-area is extremely rugged and difficult of access, and is clothed to an elevation of over 6,000 feet with an exuberant forest growth and dense underbrush characteristic of coastal vegetation.

The HOZAMEEN GROUP (1) is principally an intimate association of andesitic lavas (greenstone) and ribbon chert with argillaceous partings. No fossils have been found in it but the rocks are lithologically similar to much of the widespread Cache Creek series, from which, in recent years, many collections of Permian marine faunas have been made. The Hozameen beds are probably somewhat younger than those of the CHILLIWACK GROUP (3, in part) as exposed along the International Boundary. This series is predominantly sedimentary and has provided collections of marine forms regarded as most probably of Upper Carboniferous age, though they may be Permian. The extent of the group beyond its type area has not been determined. It is part of a belt of strata (3) which, particularly north and west of Fraser River, is so greatly deformed and altered that it could not be subdivided in spite of the fact that poorly preserved fossil remains indicate the presence of younger beds. For the most part these are probably not younger than Triassic but certain collections of fossils obtained along the southeast shore of Harrison Lake, and along the east side of Long Island in this lake, contain forms resembling crushed *Aucellae* of Lower Cretaceous age. A single fossil locality on Bear Mountain, east of Harrison Hot Springs, provided large and small crinoid stalks from a body of crystalline limestone. They are of late Palæozoic age and are the only fossil evidence that the Chilliwack group may be represented west of the Fraser. A considerable body of volcanic rocks (2) is apparently interbedded with Chilliwack strata at the International Boundary. Related basic dykes and sills intrude lower members of the group.

Upper Triassic marine fossils have been found in the TULAMEEN GROUP (4) east of the map-area. The age of the CULTUS FORMATION (5) is based on a single collection of poorly preserved ammonites obtained south of, but near, the International Boundary in rocks typical of the staple dark grey to black argillite of the formation. The Cultus strata are, however, intersected by many faults and may not all be of the same age.

Many collections of diagnostic fossils have been made from Jurassic and Cretaceous formations bordering Harrison Lake and Harrison River. The basal member is a thick assemblage of volcanic rocks (6) consisting, chiefly, of massive, commonly porphyritic, lavas of varying composition, associated with coarse agglomerates and breccias. This is overlain, conformably, by a succession of strata (7) whose fossil content indicates they are of late Middle Jurassic or early Upper Jurassic age. Their aggregate thickness is estimated at about 7,000 feet. On the mountain southwest of Harrison Hot Springs strata of early Upper Jurassic age are succeeded, unconformably, by the AGASSIZ GROUP (9), consisting of a basal conglomerate, about 3,000 feet thick, overlain by some 5,000 feet of sandstone and abundant black argillite. No identifiable fossils have been found at this locality, but a narrow fringe of supposedly the same argillaceous beds, on the western edge of Cascade peninsula, in Harrison Lake, yielded an Upper Jurassic ammonite. The Agassiz conglomerate evidently marks a considerable erosional interval, probably in Upper Jurassic time. North of Twentymile Creek, on the west side of Harrison Lake, is an area of chiefly sedimentary rocks (7a), not well exposed, that has yielded no diagnostic fossils but lithologically resembles other Jurassic sedimentary formations farther south.

Resting unconformably on early Upper Jurassic beds, west of Long Island, Harrison Lake, is an assemblage of early Lower Cretaceous strata (13) carrying abundant marine fossils, mostly of the genus *Aucella*. The basal member is a thick, coarse conglomerate made up largely of granitic detritus. It is succeeded by light coloured sandstones and sandy grey argillites and these are overlain conformably by massive, pale green beds of waterlain tuffs and tuffaceous sediments. The entire series is about 5,000 feet thick.

East of Fraser River, the LADNER GROUP (8), composed mainly of slaty argillaceous beds, has provided a few collections of marine fossils of Upper Jurassic or Lower Cretaceous age. It is overlain, in Coquihalla area, by tuffs and tuffaceous strata of the DEWDNEY CREEK GROUP (10). Several collections of marine fossils were obtained from this group and indicate that the strata are more likely of Upper Jurassic than Lower Cretaceous age. Farther southeast, beyond the map-area, Lower Cretaceous marine fossils have been obtained from folded and faulted strata that somewhat resemble the Dewdney Creek and probably represent higher formations in that group. They include an increasing abundance of conglomerate, much of which contains a large proportion of granitic detritus and is similar lithologically to conglomerate beds exposed in small isolated areas along Coquihalla River, between Romeo and Iago Stations, and on either side of Fraser River near Hope. These isolated bodies of granite conglomerate and associated arkose beds have been correlated, tentatively, with the JACKASS MOUNTAIN GROUP (11), partly because it contains beds composed of similar granitic material and partly because marine fossils found in it suggest a Lower Cretaceous rather than an Upper Jurassic age. The TAMIHY GROUP (12) of the International Boundary has provided no fossils within the map-area. Lithologically it closely resembles members of the Dewdney Creek. A single collection of marine shells, apparently Upper Jurassic types, comes from what are possibly Tamihy strata lying south of the Boundary.

The PASAYTEN GROUP (14) of volcanic and sedimentary rocks is in faulted contact with the Dewdney Creek. It has provided collections of fossil plants of late Lower Cretaceous age and is essentially of freshwater origin. The group of chiefly volcanic rocks (16) in the northeast corner of the map-area has provided plants of the same age, and is probably contemporaneous with the SKAGIT FORMATION (15) in which, however, no fossils have been found.

The HUNTINGTON FORMATION (17) has been variously referred to as of Eocene or Paleocene age. Poorly preserved plants have been found in it but are not diagnostic. Presumably the beds are of the same age as those of the widespread Puget group south of the International Boundary.

The volcanic rocks of the COQUIHALLA GROUP (18) cut through and overlie deeply eroded granitic intrusions in Coquihalla Valley and incorporate fragments of these batholithic rocks in their pyroclastic members. The group has a maximum thickness of about 4,500 feet and is but slightly deformed compared with the pre-Tertiary formations of the map-area. Its age relative to a more southerly group of supposedly Tertiary volcanic rocks (19) is not known. The southerly group is characterized by the common occurrence of conspicuous phenocrysts of quartz and plagioclase feldspar. Coarse breccias carrying fragments of underlying Pasayten and Dewdney Creek beds make up a large part of the group.

The intrusive rocks of the map-area are partly of Jurassic age and partly younger; some may be Tertiary. The Vedder greenstone (22) is included, tentatively, with the older group. It is a highly altered assemblage of igneous rocks, of about the composition of basic diorite or gabbro, that in places is distinctly gneissic. Contact relations are obscure and though the form and, in general, the petrography of the body suggest an intrusive rock, it is possible that the mass may be, at least in part, of volcanic origin.

The Custer granite-gneiss (20) is mainly a light coloured, medium to coarse-grained rock that varies in composition from granite to granodiorite and, for the most part is notably crushed and foliated. On the western slope of Hope Mountain, and also near Haig Station, these gneissic intrusions have supplied detritus for overlying conglomerate beds correlated with the Jackass Mountain group. These beds are, in turn, invaded by younger granitic rocks, indicating two quite distinct periods of intrusion at these localities. Along Fraser Valley west of Silverhope Creek the older intrusions (20a) are, on the whole, less noticeably gneissic and include a greater variety of rock types. Structurally and lithologically they much resemble the older intrusive rocks (25, in part) about Harrison Lake and River. The latter cut strata of Middle Jurassic age yet appear to be the source of granitic detritus in early Lower Cretaceous conglomerate (13, in part). For the present, however, it has not been found practical to map these probable Jurassic intrusions separately from the great bulk of the batholithic rocks west of Fraser Valley, although most of these are likely of post-Lower Cretaceous age. The Slesse diorite (21) is comparatively massive but has been cut off on the east and somewhat metamorphosed by a later batholithic intrusion and for these reasons has been included with the Jurassic intrusive rocks. Much of the northeast corner of the map-area is occupied by distinctly gneissic rocks of the Eagle granodiorite (25a). This intrusive mass may be the source of granitic detritus in the Jackass Mountain conglomerate and arkose along Coquihalla Valley. If so, it is definitely of Jurassic age as it is also intrusive into the Upper Triassic, Tulameen group. To the northeast and southwest the Eagle granodiorite is intruded by massive batholithic rocks of post-Lower Cretaceous age.

The intrusions of the ultrabasic and basic group (23, 24) probably comprise bodies of different age. Many of them are highly altered, mainly to serpentine, but in part to talc, carbonate, and chlorite. In contrast to these, the nickel-bearing irruptive (24) west of Choate is a comparatively fresh, massive, coarsely crystalline pyroxenitic hornblendite.

Large areas of undivided, chiefly acidic intrusions (25, in part) seem to be mainly of post-Jurassic age, as indicated by their intrusive contacts, where observable, with Upper Jurassic or Lower Cretaceous formations. A post-Jurassic age is also indicated by their intrusive and structural relationships with the Custer granite-gneiss and, in general, by their fresh, massive appearance as compared with that of other Jurassic, or probable Jurassic, intrusive rocks. Numerous stock-like masses of quartz diorite and diorite (26) and a few small felsitic intrusions (27) comprise what appear to be the youngest in the map-area. They apparently post-date any structural disturbance of consequence and are probably of Tertiary age.

The structures in the Cascade Mountains are continuous with those of the Coast Mountains east of Harrison Lake. Folds, faults and foliation structures have a general northwesterly trend throughout the greater part of these areas, but swing to the south in the south central part and to southwest in the southwestern part. This arcuate course is in a measure parallel with the eastern flank of a great area of batholithic intrusions constituting much of the Coast Range proper west of Harrison Lake and Lillooet River Valley. Fraser River Valley is of no special tectonic significance as the stream follows an irregular course that crosses rock structures and formations alike.

All formations up to and including those of Lower Cretaceous age seem to be about equally deformed though, in general, those of pre-Jurassic age exhibit a greater degree of alteration. Tertiary formations, on the other hand, are relatively undeformed. The principal period, or periods of orogenic disturbance appear, therefore, to have occurred in Upper Cretaceous or early Tertiary time. Connected with it are many steeply-dipping thrust faults, striking parallel with the general formational trend, by virtue of which the oldest formations are brought into contact with much younger rocks. The bodies of Custer granite-gneiss, though trending northerly, have been crushed and foliated in a northwesterly direction in conformity with the regional trend of formations. This structure is abruptly truncated on the southwest by later, massive intrusions that either accompanied or followed the principal period of orogeny.

In the late fifties and early sixties of the last century, the rich gravel bars of the Fraser drew widespread attention to the mineral wealth of the Province. A large quantity of placer gold was rapidly recovered and the bars were soon exhausted. The Fraser and a few of its tributaries, notably Coquihalla River and Siwash Creek, continued to provide small quantities of gold, but interest was early diverted to a variety of lode deposits.

Lode mining began in 1868 with the discovery of rich silver ore on Silver Peak, a few miles south of Hope; a few tons of ore were shipped in the ensuing six years. About 1891-92, placer miners on Siwash Creek investigated gold-bearing quartz veins occurring in, or along the contacts of, porphyry dykes. Stamp mills were subsequently erected on at least three properties but although the deposits have long continued to attract intermittent attention, the aggregate production has been small. In 1894 high-grade silver-lead and zinc deposits were found at Summit Camp at the headwaters of Tulameen River, northeast of Tulameen Mountain, but not much work was done until 1910 and the years following. A large number of showings were opened and in recent years a few hundred tons of ore have been shipped. Some discoveries were also made in the early years on, or near, the shores of Harrison Lake, including a gold-silver deposit on the west shore, north of Twentymile Creek, and two contact-metamorphic copper deposits north of Agassiz. Small shipments have been made from these occurrences.

Commencing about 1915, much interest has been taken in a number of gold deposits in the Ladner slates (8) and adjoining rocks of the serpentine belt (23). The deposits are mainly quartz veins carrying free gold and mineralized with a variety of auriferous sulphides including arsenopyrite, chalcopyrite, pyrite, and pyrrhotite. Other occurrences are rich, gold-bearing talc seams in, or along, the borders of bodies of serpentine. Three shipping mines and several prospects lie north of Coquihalla River and others have been explored south of this stream in the same belt of rocks. A different type of gold deposit, consisting mainly of massive auriferous arsenopyrite in fissure veins cutting quartz diorite, occurs in a small valley tributary to Silverhope Creek southwest of Hope. A small tonnage of ore was mined in 1914.

Farther southwest, on the summit of the Cheam Range south of Wahleach Lake, is a considerable copper deposit in limestone near the contact of granodiorite. The property has been partly explored by drilling, surface, and underground work.

In the basin of Skagit River a great number and variety of prospects were opened up about 1910 and the years following. The ores include: lenses of nearly solid pyrrhotite containing appreciable chalcopyrite; lenses consisting chiefly of magnetite; contact-metamorphic deposits carrying, chiefly, chalcopyrite and sphalerite; and veins in which argentiferous galena and (or) sphalerite are the important minerals and may be accompanied by one or more others including arsenopyrite, pyrite, stibnite, and tetrahedrite. Assays commonly show a little gold. One occurrence of scheelite is known, and in the same prospect the associated pyrrhotite is distinctly nickeliferous. Transportation is a difficult problem in this part of the map-area and only a few small shipments of ore have been made.

Other, mineral occurrences in the map-area include: a molybdenite deposit in pegmatitic granite on the summit northwest of Iago; deposits of long- and short-fibre asbestos, in serpentinized peridotite outcropping in the lower valley of Wahleach Creek, south of Laidlaw; narrow seams of graphite in carbonaceous slates, near the east shore of Harrison Lake south of Cogburn Creek; and numerous talc deposits along shear zones in serpentine bodies in many places in the map-area.

In recent years large nickeliferous deposits have been discovered at the head of Stulkawhits and Emory Creeks, west of Choate. They consist of disseminations of sulphide, chiefly pyrrhotite with minor pentlandite and chalcopyrite, in intrusive hornblendite. The several ore-bodies have been extensively developed by drilling as well as by underground and surface work.