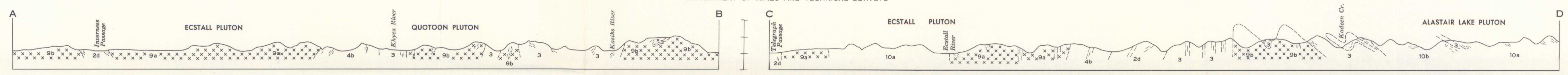
GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF MINES AND TECHNICAL SURVEYS



SECTIONS ALONG LINES A-B, AND C-D

PRELIMINARY SERIES

LEGEND

Note: 8_{10} indicates that both rock types 8 and 10 are present but 8 predominates

CENOZOIC

QUATERNARY

- **13** Till, gravel, sand and alluvium

TERTIARY

- **12** Volcanic breccia

MESOZOIC

JURASSIC (?) AND/OR YOUNGER

- **11** Quartz monzonite
- **10** Granodiorite; minor quartz monzonite and quartz diorite; 10a, poorly foliated or massive; 10b, gneissic and/or contains up to 50% paragneiss
- **9** Diorite and quartz diorite; 9a, poorly foliated or massive; 9b, gneissic and/or contains up to 50% paragneiss
- **8** Diorite, gneissic diorite, amphibolite; minor hornblende and biotite gneiss
- **7** Gabbro, norite, pyroxene diorite

JURASSIC AND CRETACEOUS
UPPER JURASSIC AND LOWER CRETACEOUS
BOWSER GROUP

- **6** Greywacke and argillite

JURASSIC
LOWER (?) AND MIDDLE JURASSIC
HAZELTON GROUP

- **5** Hornblende schist, amphibolite; minor diorite and biotite schist

JURASSIC (?) OR OLDER
(Stratigraphic sequence of units 1 to 4 uncertain)

- **4** Metavolcanic rocks: greenstone, tuff, agglomerate; minor rhyolite, dacite, limestone, and greywacke; 4a, metadacite; 4b, hornblende gneiss, amphibolite, augen-gneiss, gneissic diorite, quartz diorite; 4c, hornblende schist, greenstone mixed with heterogeneous diorite and quartz diorite
- **3** Gneiss complex, almandine-amphibolite facies, in part sillimanite-almandine sub-facies; hornblende-biotite, hornblende-biotite-garnet, sillimanite-garnet-mica gneisses and intimately related migmatite gneiss; commonly contains and grades into gneissic diorite, quartz diorite and granodiorite
- **2** Metasediments of the almandine-amphibolite facies, mainly staurolite-quartz sub-facies; 2a, hornblende-biotite, biotite-garnet, and amphibolite gneisses; minor kyanite-garnet-biotite-muscovite gneiss and intimately related hornblende, amphibolite, and diorite gneiss; 2b, diopside-tremolite-carbonate, diopside-hornblende-plagioclase, biotite-hornblende, and hornblende-garnet-biotite schists and gneisses; minor crystalline limestone, hornblende-plagioclase-idocrase and calcite-diopside-scapolite gneisses; 2c, buff-weathering granular quartz-feldspar gneiss; 2d, hornblende, hornblende-biotite, hornblende-biotite-garnet, staurolite-garnet, muscovite-biotite, hornblende-epidote-garnet schists; minor quartzite, amphibolite, and crystalline limestone.
- **1** Metasediments of the greenschist facies including phyllite, slate, and chlorite-sericite, biotite, biotite-hornblende, biotite-hornblende-garnet schists; minor schists; minor meta-greywacke, intraformational conglomerate, graphitic schists, limestone, and muscovite-chloritoid-garnet schists

Geological boundary (approximate or assumed)
Limit of geological mapping
Metamorphic facies boundary (approximate)
Bedding, tops known (inclined, overturned)
Bedding, tops unknown (inclined, vertical)
Foliation, gneissosity, schistosity or cleavage (horizontal, inclined, vertical)
Foliation or structural trend (in cross-sections only)
Lineation (horizontal, inclined)
Minor fold axes (horizontal, inclined)
Fault (approximate or assumed)
Antiform (approximate)
Synform (approximate)
Structural trend (from air photographs)
Fossil locality ... Ⓕ
Quartz diorite, granodiorite and diorite (in cross-sections only)
Mineral occurrence ... ×

MINERALS

Copper	Cu	Limestone	ls
Gold	Au	Magnetite	mag
Graphite	gf	Sillimanite	sil
Iron	Fe		

Geology by W. W. Hutchison, 1962, 1963 and 1964, A. J. Baer, 1963 and 1964, and J. G. Souther, 1963

Geological cartography by the Geological Survey of Canada, 1965

Road, all weather ... ⑯
Private road
Trail
Railway
Telephone line along road
Power line
International boundary
Municipality boundary
Provincial park boundary
Indian Reserve boundary
Post Office ... P
Intermittent lake
Marsh
Contours (interval 500 feet) ... 2500
Height in feet above mean sea-level ... 5215′

Base-map compiled and drawn by the Surveys and Mapping Branch, Department of Lands, Forests, and Water Resources, British Columbia, 1964

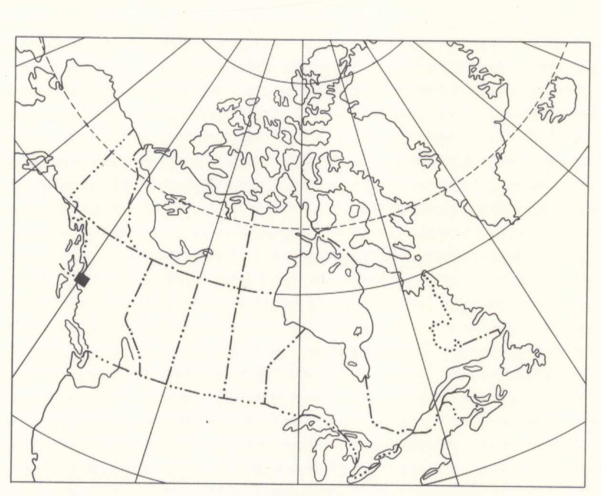
Mean magnetic declination 27° 03′ East, decreasing 3.4′ annually. Readings vary from 26° 39′E in the SE corner to 27° 19′E in the NW corner of the map-area

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

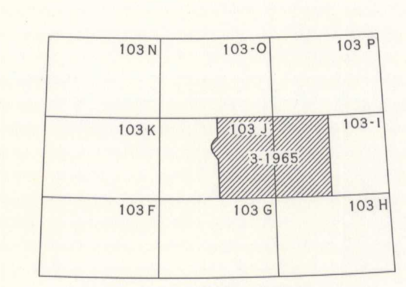
Printed by the Surveys and Mapping Branch

MAP 3-1965
GEOLOGY
PRINCE RUPERT-SKEENA
BRITISH COLUMBIA

Scale 1:253,440
1 inch to 4 miles
Miles 4 0 4 8 12 Miles
Kilometres 6 0 6 12 18 Kilometres



INDEX MAP



PRINCE RUPERT-SKEENA
BRITISH COLUMBIA

DESCRIPTIVE NOTES

The metasediments (1 and 2) and metavolcanic rocks (4) of Tsimpsean Peninsula, Khutzeymateen and Portland Inlets and the outer islands, are part of what was previously called the Prince Rupert Formation (McConnell, 1914). Although no diagnostic fossils have been found, Dolmage (1923) tentatively assigned these rocks to the Triassic or upper Palaeozoic because of similarities with rocks of presumed Triassic age in Alaska. Later Buddington and Chapin (1929) suggested that some of these sedimentary rocks in Alaska could be of Jurassic age. On the other hand, the metavolcanic rocks (4) of the outer islands are probably a southern extension of a well-defined zone of greenstone volcanic rocks in southeastern Alaska that are, in part, Jurassic and/or Cretaceous.

The major outcrop areas of the metasediments cannot be definitely correlated. For example, the metasediments of the Tsimpsean Peninsula (1, 2a,c,d) commonly contain alumina-silicate minerals whereas the metasediments of Khutzeymateen Inlet (2b) commonly contain calc-silicate minerals. This basic lithological difference indicates that the two may not be coeval.

The complex folding and metamorphism of these rocks adds to the difficulties of correlation. On Tsimpsean Peninsula, the grade of metamorphism changes from lower greenschist facies in the west to middle almandine-amphibolite facies in the east. The attitudes in the northern part of the peninsula generally steepen from the lower grade rocks in the west to the higher grade rocks to the east. There is a similar change in the southern part of the peninsula but it is partly obscured in the vicinity of Prince Rupert by the complex, superimposed deformation. A number of successive tectonic events is indicated by the low-grade metamorphic rocks on the western shore of the peninsula where the imprints of at least four deformations are locally exhibited.

The gneiss complex (3) is, in part, the more highly recrystallized equivalent of parts of map-unit 2. The complex is ill-defined because the gneiss commonly grades into the less highly recrystallized metasediments, and in some localities, grades into or is cut by quartz diorite and granodiorite. Characteristic of the gneiss complex is the common occurrence of migmatite which is partly composed of gneissic diorite and granodiorite. Sillimanite in the gneiss complex is mainly restricted to the outcrop area along and south of Skeena River, indicating that the grade of metamorphism may be somewhat higher in the gneiss complex south of Skeena River or that the composition of the paragneiss of the complex is slightly different north of the river.

Within the metavolcanic rocks (4) of the outher islands are complex phases (4c) of diorite, hornblende schist, and greenstone. A long, narrow zone (4b) of gneissic diorite, augen gneiss and amphibolite along the western margin of Quottoon Pluton probably represents a more highly recrystallized zone of metavolcanic rocks. It is not known whether these are correlative with the volcanic rocks of the outer islands or even with those of the Hazelton Group (5) to the east. Also uncertain is the correlation of the meta-dacite (4a) outcropping north of Prince Rupert, with similar volcanic rocks on the outer islands.

The Jurassic age assigned to the volcanic rocks (5) near the eastern boundary of the map-area is based on their continuity with volcanic rocks in the Terrace area which Duffell and Souther (1964) correlated lithologically with the Hazelton Group. These metavolcanic rocks commonly contain intimately related diorite near the eastern boundary of the map-area, and the proportion of diorite increases northwest along strike. This implied dioritization of the volcanic rocks may be the result of recrystallization during metamorphism. As well as becoming more dioritic towards the northwest, the rock also becomes more gneissic. It is possible that some of the gneiss complex (3) north of Skeena River around the mouth of the Exchamsiks River is made up in part of these Hazelton metavolcanic rocks with the implication then that part of the gneiss complex (3) is composed of Jurassic strata.

The greywacke and argillite (6) are part of the Bowser Group which underlies a large area east of the map-area where it contains Upper Jurassic and Lower Cretaceous fossils (Duffell and Souther, 1964). In contrast to those in the western half of the map-area, these sediments are not metamorphosed except near contacts with the granodiorite of the Exstew Pluton.

Gabbro, norite, and pyroxene diorite (7) form a plug-like core in quartz diorite on Smith Island, a small stock on William Island, and two separate masses near the eastern boundary of the map-area. Part of the pyroxene diorite just north of Mount Valpy grades into quartz diorite and granodiorite but part appears to intrude the surrounding quartz diorite. The summit of Mount Valpy itself is composed of nearly horizontal basic dyke swarms that may be related to the neighbouring pyroxene diorite.

Diorite, gneissic diorite, and amphibolite (8) form a marginal phase of the Ecstall Pluton as well as most of Kennedy Island and part of Somerville Island. Most of the outcrops of the Ecstall and Quottoon Plutons and parts of the outer islands consist of diorite and quartz diorite (9a and 9b). Gneissic diorite and quartz diorite (9b) also form most of the large masses that grade into the gneiss complex and appear to have moved with it. Granodiorite and quartz monzonite (10) underlie a central area of the Ecstall Pluton and also appear to form the greater part of the Exstew and Alastair Lake Plutons. Both the Exstew and Alastair Lake Plutons have relatively sharp, intrusive, eastern boundaries but their western contacts are apparently gradational into the gneiss complex (3). Near the south boundary of the map-area the Alastair Lake Pluton not only grades into the gneiss complex but also appears to have overthrust these gneisses towards the west (see cross-section C-D).

Quartz monzonite (11) forms a small stock on Melville Island that cleanly intrudes the surrounding volcanic rocks. Volcanic breccia (12) forms necks and dykes that intrude the metasediments (1 and 2) along the northwest shore of the Tsimpsean Peninsula. They have well-defined, chilled margins and are presumed to be Tertiary.

Pleistocene and Recent (13) sand, gravel, clay, and mud appear on Tugwell Island and in Skeena River Valley. The glacial striae on Tsimpsean Peninsula and also the large erratics from the Quottoon Pluton scattered in the shallow water of some of the bays on the northwest shore of the peninsula, indicate that the last major ice movement has been from the northeast towards the southwest.

The structure is complex. On the west coast of Tsimpsean Peninsula, on Porcher Island (excepting the northern part of Spiller Range), and on Stephens Island, the axial planes of the folds generally have moderate dips towards the east or northeast. The folds are generally similar and asymmetrical with limbs overturned towards the west or southwest. Some evidence indicates that the direction of tectonic transport has been towards the southwest.

Both Khutzeymateen Inlet and the northern part of the Tsimpsean Peninsula are superficially like large asymmetrical synformal structures that plunge gently to the north. The western flanks of these synforms dip moderately or steeply to the east but the eastern flanks dip steeply to the west or are vertical.

Deformation in the gneiss complex (3) has taken place in a different environment from that of the lower grade metasediments. General features indicate that it formed at one time a relatively plastic and mobile core in this part of the Coast Mountains. For example, large recumbent folds are themselees warped and folded, gneiss has evidently flowed around some inclusions, masses of gneissic quartz diorite and granodiorite have flowed concordantly and locally discordantly and small, irregular flow-type folds are common in some migmatites. Nearly horizontal attitudes are common in some parts of the gneiss complex. South of Skeena River and between Exchamsiks and Exstew Rivers these shallow attitudes are in part related to recumbent structures overturned to the west or southwest. The axes of the small folds in the gneiss and in the metasediments of Khutzeymateen Inlet commonly have shallow to moderate plunges to the north. If these small folds are all contemporary then their present widespread distribution suggests that they formed during a regional tectonic event.

The internal foliation in the Quottoon and Ecstall Plutons and the external deformation in the country rock indicates that the northern parts of both plutons have been forcibly emplaced by an upward, and, locally, northward movement. Particularly impressive is the buckling of the metasediments east and south of Prince Rupert due to the Ecstall Pluton having punched northwards into, and partly overridden, the metasediments.

The gross tadpole shape of the Quottoon Pluton is of particular interest. In plan it is similar to the Ecstall Pluton which extends south of the map-area and also to the Captain Cove Pluton on Pitt and McCauley Islands to the south of the map-area (Souther, Baer, and Hutchison, in preparation). The broad northern 'heads' of these plutons have intruded the country rock but the southern 'tails' are in regions of migmatite gneiss. The apparent northward movement of these plutons may represent the horizontal component of an upward, inclined diapiric movement away from a root zone in the gneisses. The apparent upward movement of the plutons away from high-grade migmatite gneisses in the south, the almost consistent plunge of the small fold axes to the north in the gneiss complex and the apparent increase in grade of metamorphism in the gneisses south of the Skeena River, indicate a slight northward tilt so that successively deeper levels are now exposed to the south. Another possibility is that this northward tilting may simply represent the northern flank of the westward extension of the Skeena Arch as interpreted by Souther (in preparation).

Apart from the Exstew Pluton which intrudes argillite and greywacke of Upper Jurassic and Lower Cretaceous age, little is known about the age of the plutons. The movement of the Quottoon, Ecstall, and possibly the Alastair Lake Plutons apparently commenced during the deformation in the gneiss complex but continued for some time afterwards.

Some of the channels that parallel the regional northwesterly trend are along the loci of faults or eroded fault zones. Portland Inlet, which crosses the regional trend, is possibly a major fault but the continuity of some of the map-units across it indicates that the lateral offset is probably less than 5 miles. Although shear foliation parallel with the inlet is common, the rock is neither comminuted nor shattered. By contrast, well-defined shear zones are found parallel with the possible extension of the Portland Inlet fault on the south shore of Dundas Island and on the small islands to the south. This may imply that movement along the fault took place when the rock in Portland Inlet itself, but not perhaps on the outer islands, was still sufficiently plastic for strain to result in recrystallization rather than comminution. Later, dyke swarms were intruded parallel with the shores of the inlet, further indicating that it marks a deep break of considerable persistence, which was latterly tensional in character.

Gold and copper prospects have been known for many years on Porcher Island and during the 1930's gold was produced from two mines. Magnetite occurs in iron-formation close to the eastern shore of Porcher Island.

Buddington, A. F., and Chapin, T.: Geology and mineral deposits of southwestern Alaska; U.S. Geol. Surv., Bull. 800 (1929).
Dolmage, V.: Coast and islands of British Columbia between Douglas Channel and the Alaskan boundary; Geol. Surv. Can., Sum. Rept. 1922, pt. A, pp. 9-34 (1923).
Duffell, S., and Souther, J. G.: Geology of Terrace map-area, British Columbia; Geol. Surv. Can., Mem. 329 (1964).
McConnell, R. G.: Geological section along the Grand Trunk Pacific Railway from Prince Rupert to Aldermere, British Columbia; Geol. Surv. Can., Sum. Rept. 1912, pp. 55-62 (1914).