THE GEOLOGY OF ROCHER DE BOULE

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INTRODUCTION

This paper aims to present a generalized description of the Rocher de Boulé range. The information contained in it was compiled during the summer of 1938, in connection with the activities of the Canadian Geological Survey in the Hazelton District of British Columbia. Much information and geological interpretation was afforded by Mr. J. G. Gray, Chief of Party. However, this paper is in no way connected with the Geological Survey's official report on the area to be discussed. Furthermore any statements or geological boundaries contained herein are provisional and subject to change upon office examination of rock specimen and fossil collections gathered in the field.

PHYSICAL FEATURES

a. Location

The Rocher de Boulé range lies directly south of the town of Hazelton, B. C. More specifically, it lies between the meridians 127^0 15' and 127^0 45' and between the parallels 55^0 and 55^0 15'. The range is part of the Bulkley Mountains which in turn is included in the Interior Plateau system. It can be reached either by way of the Prince Rupert branch of the C.N.R. or by the highway which parallels the railway.

b. Size

The length of the range, which runs in a north-south

direction is about 16 miles, while its width approximates 12 miles.

c. Topography

The topography of Rocher de Boulé is typical of the neighbouring mountain bodies. Its abrupt and rugged nature contrasts sharply with the low, wide valleys which surround it. On the east and north lies the Bulkley Valley, on the west the Skeena Valley, and on the south the Kitsigeukla Valley. Into these rivers empty the turbulent streams which arise from glaciers beneath the peaks. The peaks attain an average elevation of about 6500 feet, and a maximum of 8500 feet.

d. Glaciation

Regional glaciation attributed greatly to the topography of Rocher de Boulé. Evidences in the way of erratics, have been found as high as 6000 feet; and the rounded foothills are a result of this type of glaciation. There appears to have been a gathering ground, or converging point, just east of Moricetown; and another in the low area encompassing the junctions of the Kispiox, Skeena, and Bulkley rivers. Most of the present ruggedness of the range, however, is due to the action of valley glaciers, remnants of which are still in evidence. Long moraines are found much lower down than the glaciers now reach. This feature indicates how far down the valleys the glaciers once extended. The lower limit of valley glaciation is also marked by the appearance, low

down in the U-valleys, of deep canyons untouched by glaciers. Below the rugged skyline of horns, are many wide, steep cirques, some of which still hold glaciers up to 1/3 mile across. These glaciers are still active, and vertical walls due to the effects of erosion at limit of Bergershrund action are in evidence. This type of erosion is ~~but~~ best represented in the cirque at the head of the south fork of Boulder Creek.

e. Climate and Vegetation

The low river valleys are uniformly wooded by poplars up to 10 inches in diameter, and by birch, cottonwood, and alder. The creek valleys are densely overgrown by thickets of devil's club and alder. The timber, as found on the mountain slopes, consists mainly of cedar, spruce, and hemlock. At approximately 5000 feet, the timber changes to scrub balsam which extends to the timberline at 5500 feet. Here the balsam gives way to heather and grasses, or base rock. It was noted that on the west slopes, the cedars grew at a higher altitude than on the east, and also that wild flowers and plants grew more abundantly in the meadows on the west side than on the east. This seems to indicate that, in this vicinity, rain comes from the west; a fact which was confirmed by wind observations. The rainfall per year at Hazelton averages about 20 inches. It is estimated that the average maximum depth of snow above timberline on Rocher de Boulé is about 25 feet. Some of this snow often remains throughout the summer months.

GEOLOGY (GENERAL)

Like practically all other ranges of this area, the Rocher de Boulé range stands up conspicuously between wide, low river valleys. It has withstood erosion because it consists of harder rock than that found in the valleys. This rock is hard due to contact metamorphism introduced by the intrusion of a granodiorite stock. It was noticed that the granodiorite is confined to the centre of the range and at no place is cut by the Bulkley or Skeena rivers. The general structure of the range consists of a huge syncline running in a north-south direction. The intruded rocks have a general dip to the east. Hence the rocks on the east side of the range are younger than those on the west, and overlie them.

There are six map units, which may be classified as intrusives, extrusives, and sediments. The intrusives are represented by the granodiorite body which forms the backbone of the range. Extrusives are found as two series of porphyries and a series of amygdaloidal volcanics, breccia, and pillow-lavas. While the sediments occur as a series of well-bedded sandstone and argillite, and one of sandstone, argillite, conglomerate, and tuffs.

a. Unit 1. Oldest volcanics

The oldest of the map units is the series of volcanics occurring on the extreme west slope of the range. This series of volcanics is believed to be Jurassic in age. It contains

no true sediments such as sandstone and shale, but includes several pyroclastic forms. For convenience it may be divided into three divisions. The oldest and lowest division consists of brick-red and purple andesites. They are non-porphyritic and differ in composition from any others in the area.

The second division is composed of a green amygdaloidal volcanic which overlies the andesites quite conformably. Finally, at the top of the series occurs a division of brown porphyries which grades into beds of tuffaceous agglomerate. It was noted that the beds throughout the series are relatively thin, being from 5 feet to 10 feet thick; and although these beds are well preserved, they dip more steeply than any other in the area. It is possible to trace the bedding for at least 6 miles along the strike; though in places there is evidence that these beds have been faulted above the overlying series, and are sheared along the Kitsigeukla Valley.

b. Unit 2. Intermediate sediments

Overlying this old volcanic series is an intermediate series, consisting mainly of true sediments. It is thought to be middle Jurassic in age, but this has yet to be confirmed by office inspection of fossils. The lower part of this series consists of tuffaceous agglomerate such as found in the vicinity of Mud Creek and extending westward. The upper division is composed of true sediments. At the top are found argillites which grade downward into sandstone and impure

sandstone. Near the Rocher de Boulé mine, the rocks of this division appear tuffaceous, but thin-section examination may prove them to be metamorphosed sediments. These are the only types of sediments found; limestone and conglomerate being completely absent. For the most part this series is thinly-bedded and badly sheared. There are numerous sills, up to 10 feet in thickness, and a little local structure in the form of small folds. Faults are uncommon and relatively small. Several fossil horizons were found in a fair state of preservation; and ripple marks and cross-bedding helped to decide the attitude. An auterlite schist is confined to the Red Rose Basin. Throughout the series, the predominant color is a striking red or rust, produced by weathering. This intermediate sedimentary series is conformable with the lower volcanic series except where locally disturbed by thrust-faulting.

c. Unit 3. Intermediate volcanics

To the east and above the intermediate sedimentary series lies a series of volcanics. These upper volcanics are divided into two divisions of porphyries separated by a horizon of breccia. The breccia consists of green and purplish-brown fragments in a brown porphyritic ground-mass. The lower division is composed of grey volcanics containing spots of blood-red mineral, possibly amygdules; and a dark grey andesite. The attitude of these rocks can not be discerned due to the absence of banding or any other indicative

features. Also included in this division is a light grey volcanic, heavily mineralized with pyrite, that weathers a bright red. The upper division is one of brown porphyries, mainly a light brown porphyritic rhyolite. This is a dense fine-grained rock, with occasional phenocrysts, which weathers a rusty brown color. In the upper part of the division the brown porphyries grade into acidic flows and tuffs. Intermediate within this brown upper division there occur occasional beds of sediments containing coaly material which is probably a manifestation of continental conditions preceding the Late Jurassic conditions. The rocks of the entire upper volcanic series may be listed in decreasing order of abundance as porphyries, breccias, tuffs, and sediments; and in the ratio 80:15:3:2 approximately.

d. Unit 4. Youngest sediments

Above this series occur the youngest sediments in the area. They are believed to be Lower Cretaceous or Late Jurassic. Lying east of the upper porphyries, these sediments outcrop excellently in the Bulkley canyon. The series consists of the principal types of true sedimentation. There are thin beds of fine-grained conglomerate containing pebbles of bright green volcanic rock. Peculiar beds of rusty, cherty, carbonaceous rock were found, with which are associated thin, broken, laminated coal beds, from 3 to 4 inches thick. Well-bedded coarse grey sandstone occurs abundantly, along with concretionary argillite. Concretions from these

beds usually contain nests of pyrite in their centres. There are also a few coal beds up to 4 feet thick, and a brown sandstone containing fossil leaves. Several clearly exposed sills and small folds are distributed throughout the series. On the whole, the series is conformable though it dips a little more steeply than the underlying porphyritic series.

e. Unit 5. Youngest volcanics

Younger than the Bulkley sediments and probably younger than any other map unit in the range, are the extrusive volcanics found in the Bulkley canyon near the south boundary of the sheet. They are quite possibly Late Tertiary in origin, are flat-lying and seem to have been untouched by glaciation. Most abundant is a light green rhyolite with black phenocrysts, which has well-developed chilled-bands and flow structure. There are inclusions contained in it up to 3 inches across, and amygdules of bluish-white chalcedony. These beds along with a flow breccia overlain by a purple andesite, are found where the highway crosses the Bulkley River at Moricetown. Also included in this young volcanic series are a light-colored amygdaloidal rhyolite occurring on the Bulkley River below Beament Station, and extrusive beds of dark green andesite showing pillow-lava structure, and weathering a rusty brown. The latter outcrops in the highway and railway cuts about 500 yards south of Porphyry Creek. It is possible to obtain a fairly accurate observation of the attitude of the beds from the shape and ar-

rangement of the pillows.

f. Unit 6. Grandiorite stock

The last unit in the area is the granodiorite intrusive which forms the backbone of the Rocher de Boule range, and is responsible for its preservation. It is thought to be the youngest body in the whole range and to its period are related all crystalline dykes and sills and crystalline bodies within the range. Whenever the granodiorite is found within the range, it is equigranular, medium-grained, contains horneblende, quartz, hexagonal crystals of biotite, and prismatic phenocrysts of feldspar consistently in this outcrop. There are two factors indicative that this body is the youngest present. Firstly, all the rocks described have been cut by intrusive bodies related to the granodiorite stock. Furthermore, no fragments of granodiorite are found in the conglomerates or extrusives surrounding it. Nearly all the high peaks in the range have developed from the granodiorite body.

g. Summary

Characteristics of Jurassic map units seem to indicate that the period was introduced, at least in this area, by volcanism. This accounts for the occurrence of the lower volcanic division which is dominantly medium or andesitic in composition. Very little acidic material was laid down in Jurassic time, although pebbles in probable Jurassic sediments lean toward acidic, and cherty, in composition. Hence

Triassic was probably a period of acidic intrusion due to the fact that no pebbles of basic composition were found in the previously-mentioned Jurassic sediments. As far as evidence obtained indicates Lower Jurassic or Late Triassic volcanism was followed by sedimentation of limited extent, probably in brackish or marginal waters. This seems to be the case because of the fact that in the intermediate sedimentary series there occur no limestone or conglomerate, only sandstone and argillite, with fossil grasses. This is indicative of an intermediate zone of sedimentation and no major geosyncline, or conditions simulating the requisition of a major geosyncline have been found in the area. The sediments are unconformably overlain by a series of porphyries, breccias, and tuffs in decreasing order of abundance. This seems to imply that the sedimentation was closely followed by uplift and extrusion of porphyritic, brecciated, and tuffaceous volcanic material which appears to grade from andesitic to rhyolite in composition.

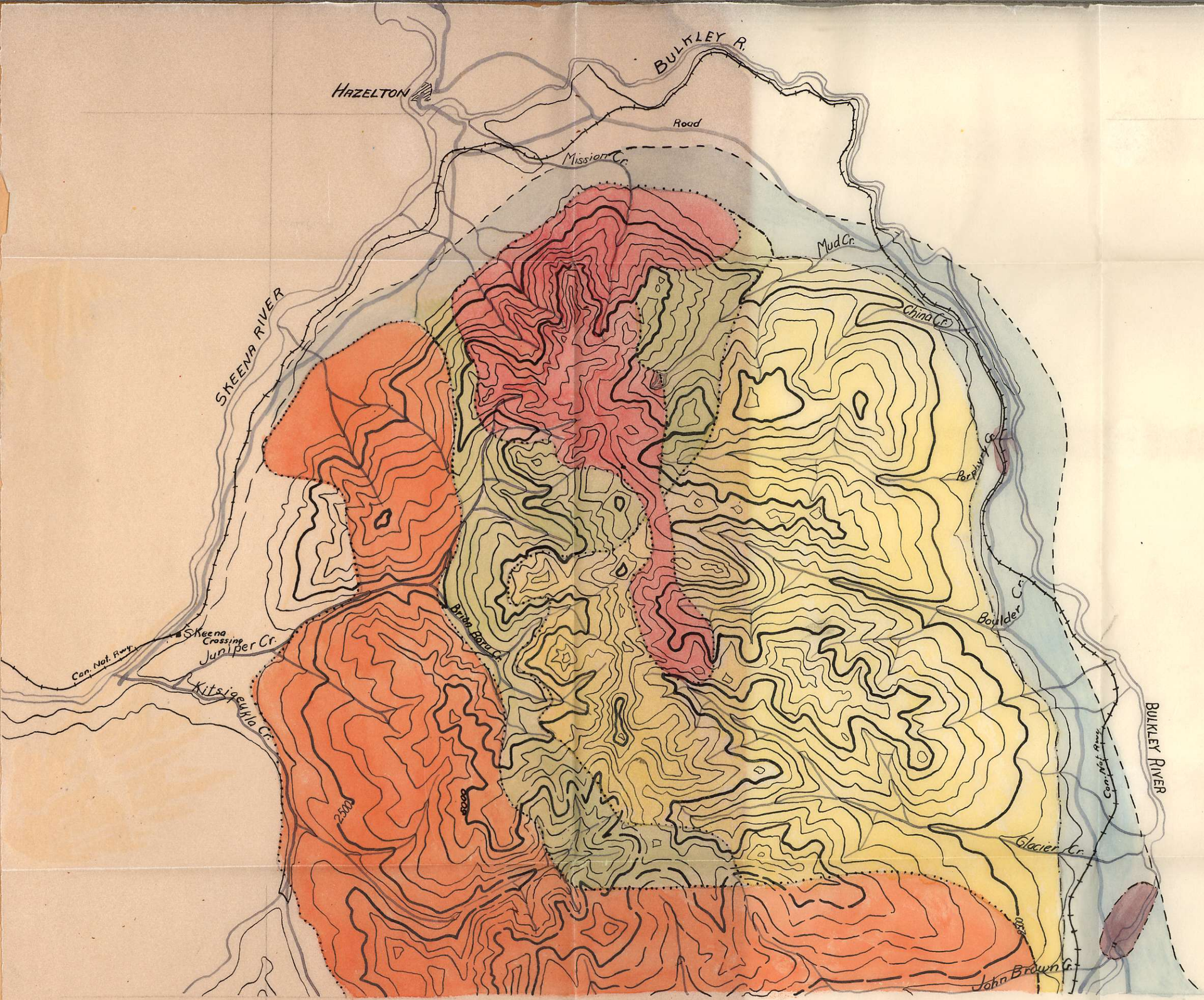
GEOLOGY (ECONOMIC)

The economic geology of Rocher de Boule is extremely interesting and varied, and could be discussed at great length. This paper, however, deals with it very lightly. The ore deposits occur close to the granodiorite intrusive and properties are found on all sides of it. Starting at the south end of the stock and proceeding in a clockwise

direction around it, they may be listed as follows: The Brian Boru mine, up Brian Boru Creek, has a good showing of zinc blende. Farther up Juniper Creek the Rocher de Boule mine is found with chalcopyrite its chief ore and copper its product. West of the Rocher de Boule mine, but at a lesser altitude, the Hazelton View mine contains gold-bearing arsenopyrite and cobalt. On the north-east side of the range, up Mud Creek, is located the Black Prince property containing molybdenite and wolframite. While farther south, up Boulder Creek, is a property showing considerable primary pyrite and tetrahedrite. It is noted that each of these mines is important for different minerals. This seems to indicate zoning due to the variable depth of burial of the intrusive at the different points of mineralization.

View of East side of the Rocher de Boulé Range, showing the Bulkley River Valley, Alpine glaciers, and an un-glaciated stream Canyon. (China Cr.)

View of North end of the Rocher de Boulé Range, showing confluence of the wide Bulkley and Skeena valleys.



Geological Map of the Rocher De Boulé Range

Scale: 1 inch = 2 miles.