CENTRAL AND NORTHERN BRITISH COLUMBIA

GEOLOGY OF THE MOREHEAD LAKE AREA SOUTH–CENTRAL BRITISH COLUMBIA (93A/12)

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INTRODUCTION

The Morehead Lake area is situated northeast of Williams Lake in south-central British Columbia, and is accessible by road from both Williams Lake and McLeese Lake on Highway 97. The mapped area is in the central part of the Quesnel Trough at its narrowest part, and is underlain dominantly by Mesozoic volcanic rocks and their epiclastic derivatives. This research will be completed as a Ph.D. thesis at Queen's University and has been, in part, supported by the British Columbia Department of Mines and Petroleum Resources. Its aim is to define the petrochemical nature and stratigraphic relations of the volcanic and related rocks, and in particular their relationship to copper deposits in the area. This report summarizes the preliminary results of three months fieldwork carried out during the summer of 1975.

STRATIGRAPHY

On a gross scale the map-area (Fig. 11) can be divided by a northwest-trending lineament whose axis runs immediately east of Morehead and Bootjack Lakes; in general the section on each side dips and youngs toward this central lineament.

The oldest rocks, and also the most distal to the volcanic pile, are mainly calcareous argillites, sandstones, and conglomerates. This unit (Unit A) becomes more volcaniclastic in composition toward the top, and is probably of Norian age as it appears to overlie Karnian rocks to the southwest, outside the map-area. The nature of the contact with the Karnian rocks is not known, but the unit is at least as old as Early Jurassic as fossils of this age were found in stratigraphically higher formations. In the eastern part of the map-area, conglomerates of Unit A contain clasts of calcareous argillite, sandstone, chert, quartz, and minor basic volcanic rocks, and are thought to have been derived from the Upper Paleozoic Cache Creek Group.

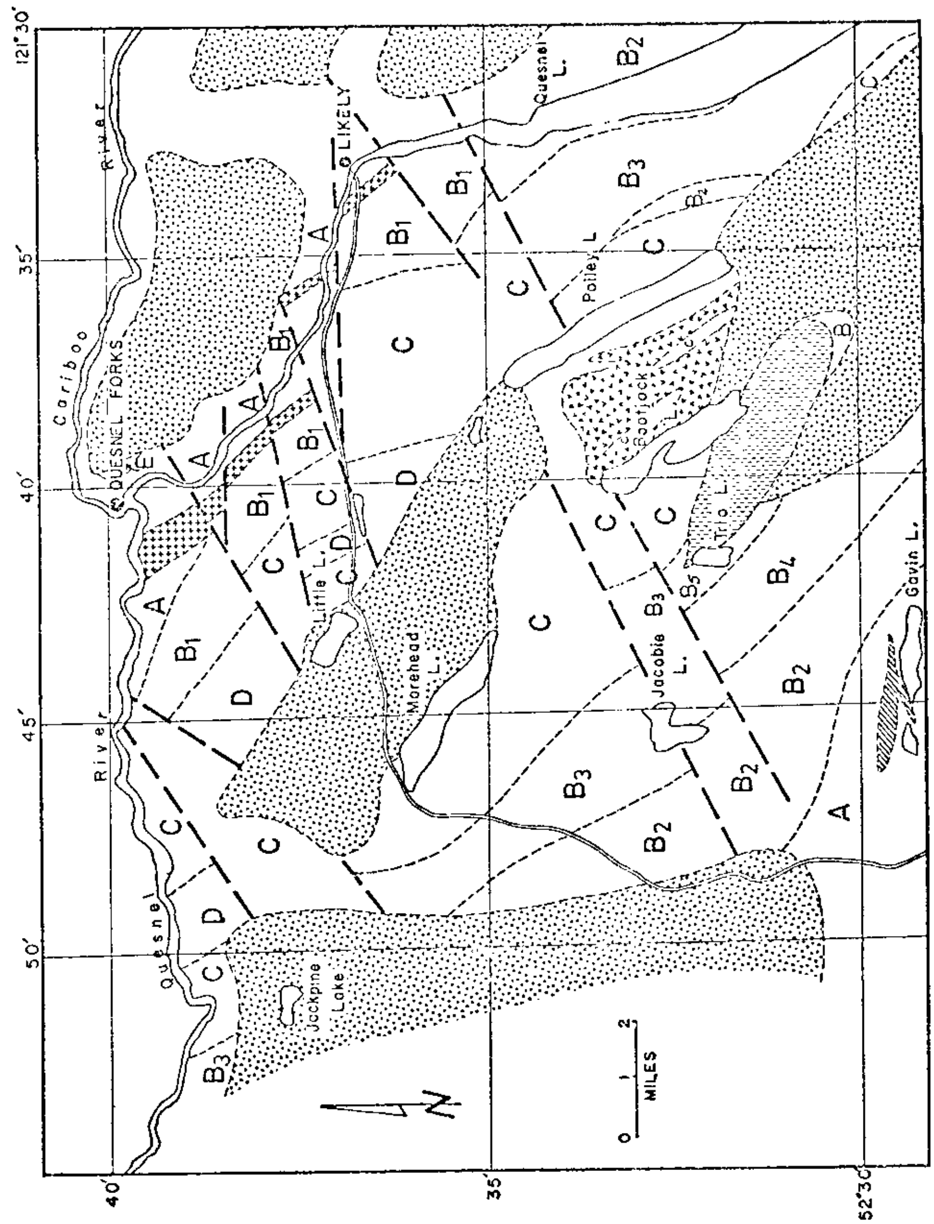

Figure 11. Generalized geology of the Morehead Lake area.

SEDIMENTARY AND VOLCANIC ROCKS

PLEISTOCENE

GLACIAL, FLUVIOGLACIAL, AND FLUVIAL GRAVELS

CRETACEOUS (?)

E — QUARTZOFELDSPATHIC GRITS AND SANDSTONES

MIDDLE JURASSIC (?)

LOWER JURASSIC

D — MAROON TRACHYBASALT FLOWS AND BRECCIAS, GENERALLY ANALCITE BEARING

HETTANGIAN

C — POLYLITHOLOGIC VOLCANIC BRECCIAS, CONGLOMERATES, SANDSTONES, MINOR LIMESTONE

B_5 — HORNBLENDE–PYROXENE BASALT FLOWS AND BRECCIA

B_4 — PYROXENE BASALT SLUMP BRECCIAS

B_3 — MAROON PYROXENE BASALT FLOWS AND BRECCIA, LOCALLY ANALCITE BEARING

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B_2 — GREEN AND GREY PYROXENE BASALT PILLOW LAVAS AND BRECCIAS, LOCALLY ANALCITE BEARING

B_1 — GREEN AND GREY PYROXENE HORNBLENDE BASALT BRECCIA AND HORNBLENDE ANDESITE BRECCIA

NORIAN (?)

UPPER TRIASSIC (?)

A — DARK GREY CALCAREOUS CONGLOMERATES, SANDSTONES, AND ARGILLITES, VOLCANICLASTIC TOWARD TOP

INTRUSIVE ROCKS

GAVIN LAKE STOCK – QUARTZ MONZONITE

BOOTJACK STOCK – MEDIUM TO COARSE–GRAINED LIGHT GREY NEPHELINE SYENITE

MOUNT POLLEY STOCK – FINE TO MEDIUM–GRAINED SYENITE, MONZONITE, AND DIORITE

FINE TO MEDIUM–GRAINED HORNBLENDE DIORITE AND MONZONITE

SYMBOLS

GEOLOGICAL CONTACT

FAULT

MAIN ROAD

Overlying Unit A in the west are green and grey pyroxene and pyroxene-plagioclase porphyritic basalts (Unit B) which grade up into maroon amygdaloidal basalts (Unit B_3). Unit B_3 locally contains analcite-bearing basalts. The basalts of Unit B_2 are pillow lavas and pillow breccias; these overlie volcaniclastic sedimentary rocks at the top of Unit A which are similar in composition to the basal basalts of Unit B_2. The upper part of Unit A, then, represents a gradational phase from non-volcaniclastic sedimentary rocks lower in Unit A to non-reworked volcanic rocks of Unit B_2 above.

In the eastern part of the map-area hornblende and pyroxene-hornblende andesites and basalts (Unit B_1) overlie Unit A. These volcanic rocks grade into pyroxene basalts similar to those in the west.

West of Trio Lake, a sequence of polylithologic basic breccias (Unit B_4) underlies hornblende-pyroxene and pyroxene basalts (Unit B_5).

A thick sequence of polylithologic laharic breccias (Unit C) overlies the basic volcanic rocks of Units B_1 to B_5 and commonly contains clasts of syenite, monzonite, diorite, and extrusive equivalents as well as abundant clasts derived from the underlying basalts. Felsic sandstones and conglomerates, often highly calcareous, are locally intercalated within the laharic breccias and, at Morehead Lake, are associated with a massive, grey limestone lens. Although no quantitative data is available, field observations indicate that the abundance of felsic clasts in polylithologic breccias is greater in the vicinity of felsic intrusions.

Toward the top of Unit C, lenses of calcareous sandstone, mudstone, and grit contain pelecypods, brachiopods, ammonites, solitary corals, and plant debris. These rocks are thought to be Hettangian in age based on the tentative identification of the ammonite *Psiloceras canadense* (T. Poulton, 1975, personal communication), an Upper Hettangian index fossil (Frebold, 1967).

Maroon analcite-pyroxene basalts (Unit D) overlie Unit C. These flows were deposited during a late phase of basaltic eruptive activity and may possibly be Sinemurian in age.

The youngest Mesozoic rocks in the map-area are found in a small outcrop near Quesnel Forks and consist of quartzofeldspathic sandstones and grits (Unit E). The composition of this unit and the marked angular unconformity between it and the underlying rocks suggest that the rocks may be of Cretaceous or Early Tertiary age.

INTRUSIVE ROCKS

Probably the oldest intrusive rocks in the map-area are hornblende monzonites and diorites which are similar mineralogically to the hornblende andesites of Unit B, which they intrude. A large body of this rock crops out along the Quesnel River from Likely to near Quesnel Forks. It is partly sill-like, and partly exhibits crosscutting relations to the intruded rocks.

A second type of intrusion, mainly syenitic and monzonitic in composition, is represented by the Mount Polley stock. Syenitic dyke material from the Cariboo-Bell copper deposit, which lies within this stock, yielded a K-Ar age of 184±5 m.y. (Hodgson, *et al.,* in preparation). The intrusion is a dyke complex rather than a stock, and several phases of felsic intrusion can be recognized. Intrusive breccias occur locally within this complex.

Syenites similar in composition to those in the Mount Polley stock form a small dyke complex at Morehead Lake, a small stock on Morehead Creek north of Morehead Lake, and a stock to the south of Polley Lake. All these intrusions are considered to have been emplaced during an Early Jurassic magmatic event and solidified at subvolcanic levels.

Another complex of quartz monzonite dykes, called here the Gavin Lake stock, occurs in the south of the map-area next to Gavin Lake. This stock is possibly of Late Jurassic or Cretaceous age.

A relatively homogeneous body of coarse-grained nepheline syenite, in places orbicular in texture, occurs at Bootjack Lake, west of the Mount Polley stock. The age of this stock is unknown, but it is a possibility that it is younger than the alkalic rocks of the Mount Polley stock. No nepheline syenite clasts have been recognized in the younger breccias, which contain representatives of all other Lower Jurassic igneous rock types in the area, suggesting that it was at least unroofed after the deposition of all volcanic and epiclastic rocks. The stock is elongate in a northwesterly direction, in contrast to the dominantly north-trending dykes of the Mount Polley intrusive complex.

Numerous small plugs of hornblende monzonite cut all extrusive rock types and may be of Cretaceous age. These, and granite dykes throughout the map-area, probably were emplaced in a Late Mesozoic magmatic event.

STRUCTURE

The extensional tectonism of the island arc environment and the relatively mechanically homogeneous character of the volcanic rock section have resulted in block faulting rather than folding. A northwest-trending lineament along which all alkalic intrusions occur from Canim Lake in the south, through the Morehead Lake area, to Prince George in the north, is recognized regionally as a major fault system. A cover of Pleistocene gravels and a paucity of outcrop have prevented the recognition of northwest-striking faults where the lineament crosses the map-area, although a lineament can be implied from the alignment of alkalic intrusions.

Northeast-trending faults have broken the map-area into a number of small blocks which show varying degrees of uplift relative to one another. These faults may extend into the Shuswap metamorphic terrane to the east where a number of northeast-trending faults have been recognized (Campbell, 1961; Campbell, *et al.,* 1970).

Folded rocks are uncommon within most of the map-area. A sedimentary section north of Morehead Lake has been faulted and folded, but the lack of penetrative deformation, the presence of 'rip-up' textures, and small-scale stratal displacement suggest that the folding was the result of slumping of semi, or unconsolidated sediments, probably as a consequence of fault movement at the time of volcanism and sedimentation. Fold axes trend northwest, parallel to the regional strike of the rocks.

Rocks of Unit A are highly folded near Quesnel Forks and there is some development of an axial plane cleavage. This deformation extends eastward and is probably the result of tectonism affecting the Shuswap rocks as well as the eastern edge of the Mesozoic Quesnel Trough.

MINERAL OCCURRENCES

Copper is the dominant base metal found in the map-area. Five types of copper deposits have been recognized.

(1) *Alkalic Porphyry Deposits:* Two copper deposits of this type occur within the map-area, Cariboo Bell and a small showing on Morehead Creek north of Morehead Lake. Cariboo Bell comprises three copper zones on Mount Polley. The copper occurs in syenitic and monzonitic dykes, in highly potassium metasomatized extrusive felsic breccias, and in intrusive breccias. Chalcopyrite is the dominant copper sulphide. Wallrock alteration includes a zone of zeolitization closely associated with the copper mineralization, and which is partly surrounded by and partly contiguous with a pyrite zone. Secondary magnetite is ubiquitous and epidote is a common alteration mineral near the copper occurrences.

The copper occurrence on Morehead Creek is located within a monzonite plug and in felsic breccias which the plug intrudes. Epidote and calcite are common alteration minerals, but the relation of alteration to copper occurrences is not known because of the very small amount of copper observed and the limited exposure.

(2) *Stratiform Deposits:* One example of an apparent stratiform deposit is present within the map-area. Near Morehead Lake, chalcocite is found within horizons of felsic sandstone stratigraphically above a carbonate unit. Chalcopyrite and chalcocite are also present within the limestone and in rocks stratigraphically below the limestone. The deposits are non-pyritic and non-magnetic and there is little or no metasomatic alteration of the rocks. The copper may be genetically related to a number of pink syenite dykes which cut all sedimentary rock types.

(3) *Copper Associated with Amygdaloidal Basalts:* Occurring as infillings of vesicles in maroon basalt flows and breccia, copper carbonates and minor copper sulphides are found in a northwest-trending belt from south of Bootjack Lake to northwest of Morehead Lake. Copper occurrences are very small and erratic in distribution within the belt, and are probably syngenetic with the basalt.

(4) *Copper in Hornblende Diorites and Monzonites:* The diorite-monzonite complex stretching from Likely to west of Quesnel Forks contains numerous minor showings of chalcopyrite. Chloritic alteration of the intrusive and intruded rocks is common and a large pyritic zone, increasing in intensity northward, is apparent in the area.

(5) *Copper and Molybdenum in Quartz Monzonite:* The Gavin Lake stock is a calc-alkalic quartz monzonite intrusion containing minor chalcopyrite and molybdenite. The stock comprises a number of quartz monzonite dykes which intrude argillites and sandstones. A small pyritic envelope surrounds, and is partly contiguous with, the zone of quartz monzonite intrusions.

Other Mineral Occurrences: Native copper is present in small quantities in some felsic dykes such as those about 1.5 kilometres east of Little Lake.

Economic deposits of placer gold occur along the Cariboo and Quesnel Rivers.

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