TBS → Clisbako

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Tertiary volcanic stratigraphy of the Clisbako River area, central British Columbia

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ABSTRACT

Clisbako Baez

Eocene volcanic rocks exposed in the Clisbako River area of central British Columbia host potentially economic epithermal alteration and mineralization. Two major assemblages were identified by mapping and petrography. Weakly plagioclase+augite phyric intermediate volcanics are exposed throughout the area. This assemblage comprises flow breccias grading laterally and upsection into colonnade-forming and flow-laminated lavas.

Baez Clisbako

The second assemblage is identified by euhedral biotite phenocrysts and comprises rhyolite flow-domes and pyroclastic units. The latter contain accidental blocks of plagioclase+augite phyric dacite. In the central area rare exposures of quartz porphyry contain relict biotite phenocrysts.

The Eocene volcanic rocks form a circular highland area, 50 km in diameter. Biotite-phyric pyroclastic rocks occurring in the centre and southeast are interpreted as the products of a large pyroclastic eruption. The area is interpreted as the erosional remnant of a large caldera, partially filled with basaltic lavas of the Chilcotin Group.

INTRODUCTION

This paper summarizes current results of reconnaissance geological mapping, sampling and petrologic analysis of Tertiary volcanic rocks in the Clisbako River area of central British Columbia. This project, to identify and correlate Tertiary volcanic rocks in the Clisbako area, is part of the Canada-British Columbia Agreement on Mineral Development (1991-1995) (van der Heyden et al., 1993, 1995).

A preliminary study of Tertiary volcanic stratigraphy in the Clisbako area of central British Columbia (Fig. 1) began in September 1993. A second period of fieldwork was conducted in June and July of 1994. The purpose was to determine the stratigraphic succession and petrologic relationships of the Early Tertiary felsic volcanic rocks which host epithermal mineralization discovered on the BAEZ and CLISBAKO claim groups (MINFILE numbers 093C-015 and 093C-016, respectively), near the headwaters of the Clisbako River.

The study area is part of the Chilcotin Plateau and comprises four 1:50 000 map sheets (93B/12, B/13, C/9, C/16), bounded by latitudes 52°30'N and 53°00'N and by longitudes 123°30'W and 124°30'W (Fig. 2). Relief is gentle and the area is forested. Outcrop is not abundant. The area is accessible by means of numerous logging roads, west from Quesnel and northwest from Alexis Creek.

Findings from this study area will be compared with information from Tertiary volcanic rocks exposed to the north in the Nechako River area (93F) (Green and Diakow, 1993; Diakow et al., 1993; Diakow and Webster, 1994) and to the south in the Taseko Lakes area (92O) (Hickson et al., 1991; Hickson, 1992, 1993; Hickson and Higman, 1993). A final report for the project, including petrographic and geochemical data, will be produced in March of 1995.

GEOLOGY OF THE CLISBAKO AREA

Older volcanic rocks

The basement to the Clisbako area consists of intermediate fragmental rocks which differ from other lithologies examined in that a schistose foliation is present. Scarcity of outcrop precluded comprehensive structural mapping. Tipper (1959, 1969) assigned this assemblage to the Lower Jurassic Hazelton Group, based on lithological similarity. These older volcanics were not examined in detail.

Clisbako volcanic assemblage

The basement rocks are overlain by a succession of intermediate to felsic volcanic rocks which are the subject of the present study. The approximate area underlain by the assemblage is shown in Figure 2. The Eocene rocks underlie all higher ground in the study area and were identified by Tipper (1959, 1969) as part of the Ootsa Lake Group. Hydraulic brecciation, epithermal alteration and mineralization are locally abundant in this assemblage.

The Eocene felsic and intermediate volcanic units which outcrop in the study area include four lithologic assemblages, identified on the basis of fieldwork and petrography. Contacts are rarely exposed and the precise stratigraphic relationship between the assemblages has not yet been determined. The relationships observed, at seven sections in the study area, are shown in Figure 3.

Plagioclase+augite bearing assemblage

The most commonly exposed assemblage is weakly to moderately porphyritic, containing plagioclase phenocrysts and/or augite phenocrysts. Both phenocryst phases are usually less than 3 mm in size and comprise, at most, 15% of the rock. Where both occur, plagioclase is early. Plagioclase is subhedral to euhedral and commonly exhibits strong oscillatory zoning. Epidote alteration is common but rarely pervasive. Augite phenocrysts are euhedral to subhedral, often altered to amphibole and, less commonly than plagioclase, exhibit oscillatory zoning.

Several sections are shown in Figure 3. The lowest part of the plagioclase+augite assemblage is exposed mainly in the west of the study area. The basal units are a thick sequence of flow-breccias, containing glassy, flow-banded, aphyric and porphyritic blocks, as much as 2 m in size in a red, yellow or cream-weathering matrix. The flow-breccias are intercalated with discontinuous lobes of coherent dacite, exhibiting flow-banding and flow-folding. These are interpreted as non-brecciated flow-lobes within the breccia; their chemical composition is nearly identical to that of unaltered blocks.

eg. Chisbako ?

Areas underlain by the flow-breccias are of moderate topography and are poor in outcrop, usually near contacts with the more resistant overlying units. The flow breccia sequence is at least 100 m in total thickness; the breccias include blocks with glassy aphanitic groundmasses, plagioclase and plagioclase-augite phyric blocks and blocks exhibiting well-developed flow-banding and flow-folding.

The flow-breccias pass laterally into and are overlain by black glassy flows very similar in lithology to blocks included in the flow-breccias. These flows are mainly of dacitic composition, aphyric or with plagioclase±augite phenocrysts and are interpreted as proximal, nonbrecciated equivalents of the flow-breccias.

The lava flows are usually structureless but locally exhibit flow-banding and flow-folding. This lithology is resistant to erosion and forms rare cliff exposures with spectacular colonnades as much as 30 m high. The total thickness of this part of the succession could not be measured, due to lack of continuous outcrop; it probably varies greatly throughout the area. Significant exposures of the colonnade-forming lavas occur at Little Mountain, Clisbako Canyon, Clusko Canyon and 8 km west of Mount Dent, at Column Hill (Fig. 2).

The colonnades are overlain by a series of intermediate (mainly dacitic) lava flows. Several of the ridges, particularly near the periphery of the Eocene outcrop area, are cored or capped by this assemblage. These lavas are also mainly of dacitic composition, although their distribution in the field suggests a more fluid and mafic composition (Metcalfe and Hickson, 1994). The rocks are poorly vesicular; the vesicles are usually less than 2 mm and are irregular in shape. Flow-banding is rare and the flows are typically cut by a penetrative fabric subparallel to their flow bases, which is deformed in some exposures in a manner similar to flow-folding. The fabric is interpreted as a flow lamination caused by the streaking out of vesicles. The flow-laminated flows may therefore be lateral equivalents of the colonnade-forming flows but appear to overlie the latter in all parts of the area. Alternatively, flow laminated exposures may represent the upper portions of thick (>100 m) dacite flows, while the colonnades represent portions of the flow centre. A contact between the lithologies was found in Clusko Canyon (Fig. 2), but was not accessible. The top of a flow-laminated unit was not observed.

Biotite-bearing assemblage

Canyon Mountain, in the south-central portion of the area (Fig. 2, 3), is underlain by a flow-dome complex consisting of biotite-porphyritic rhyolite flows and flow-breccias intercalated with pyroclastic and epiclastic fragmental units of similar composition. Similar fragmental units occur

11 km to the northeast of Canyon Mountain and in that location exhibit well-developed reverse grading, interpreted as the result of a pyroclastic flow. Both here and at Canyon Mountain, the fragmental units include blocks of plagioclase+augite phyric dacite.

The biotite-bearing assemblage is poorly exposed, but occurs in one other significant exposure on Tzazati Mountain, in the extreme southeast of the area (Fig. 2). The outcrop is separated from those in the central portion of the area by a topographic low, filled with basalts of the younger Chilcotin Group (Fig. 2). It is probable that the topographic low formed by erosion of the less resistant fragmental rocks. The topography and the distribution of the fragmental rocks may indicate collapse of the volcano to the southeast, followed by eruption of a small resurgent dome at Canyon Mountain.

The relative ages of biotite-bearing and plagioclase+augite-bearing assemblages are not known. Blocks of the latter assemblage occur in the biotite-bearing fragmental rocks. However, northeast of Canyon Mountain, near the Junction of the Michelle-Canyon and Michelle-Baezaeko forest service roads, felsic pyroclastic rocks underlie at least one unit of the black felsic flow breccias. In the roadside exposure to the east of Canyon Mountain, the strata appear to dip moderately to the east, beneath a hill capped by a dacite colonnade. The fragmental rocks may be filling paleovalleys, but it is also possible that eruption of plagioclase+augite bearing-lavas persisted after eruption of the less commonly occurring biotite-bearing assemblage.

Quartz porphyry

To the south of Clisbako Lake (Fig. 2) are small exposures of a white to buff-weathering felsic rock whose contacts were obscured at all localities examined. The unit may be intrusive or extrusive in origin. The unaltered rock contains 5-10% subhedral biotite phenocrysts (1-2 mm) and 20-25% euhedral to subhedral quartz phenocrysts (2-5 mm) in an extremely fine-grained groundmass or matrix. Quartz phenocrysts enclose relict mica. Minor hornblende phenocrysts are also present.

The quartz porphyry was not observed elsewhere in the area, although smaller amounts of quartz occur in the biotite-bearing assemblage. The occurrence of relict mica phenocrysts suggests that this lithology is part of the biotite-bearing assemblage, but the abundance of modal quartz is unusual.

Amygdaloidal lava

To the south of Thunder Mountain, to the east of Clisbako Canyon and in several other parts of the study area are minor exposures of amygdaloidal lava. This lithology has not yet been examined in detail. The lithology is green in colour, as a result of pervasive chlorite-epidote alteration and contains as much as 10% amygdules, 0.5-3 cm in size. The amygdules contain fine-grained silica and, rarely, carbonate. The flows appear to overlie the other Eocene lithologies in the Clisbako area and probably represent the latest stages of volcanic activity in this period.

Chilcotin Group basaltic rocks

Relatively well-exposed basaltic lava flows occur in most of the valleys in the study area. These lavas are distinctively fresh in appearance and commonly show well-developed colonnades and flow tops. They were assigned by Tipper (1959, 1969) to the Miocene Chilcotin Group and were also described by Mathews (1989). Tipper noted the presence of a number of small cinder cones in the valleys and on ridge crests, which are probable source vents for the lavas. It is possible that these cones are more abundant than suggested by Tipper's mapping.

One such cone (Cleft Hill) lies to the southwest of the Eocene outcrop area (Fig. 2) and was examined during the course of 1994 mapping. The cone has a central crater which is open to the north. Rocks exposed on the crater wall comprise interlayered agglutinate and vesicular basalt blocks. The cone appears to have a very low proportion of scoriaceous material, compared to the 7200 Ka Nazko cone (Souther et al., 1987), in the northeast of the area.

SUMMARY

The study area contains three volcanic assemblages, the oldest being a deformed volcanic basement of presumed Jurassic age and the youngest being valley-filling basaltic flows of unknown age, identified as Chilcotin Group. The oldest undeformed units in the area are felsic to intermediate volcanic flows and fragmental deposits of Eocene age, which host hydrothermal alteration and mineralization.

The Eocene volcanic rocks are subdivided into two minor and two major lithologic types, on the basis of fieldwork, chemical analysis and petrographic examination. The most commonly exposed assemblage is a sequence of flat-lying to moderately inclined flows and related flow-breccias, most commonly dacites, but ranging to rhyolitic and andesitic compositions. Lithologies include flow-breccias near the base, passing upsection to colonnade-forming and flow-laminated lava flows. Phenocrysts are rare and comprise plagioclase and augite, both phases showing oscillatory zoning. Plagioclase is the first-formed phenocryst, in all cases observed.

The second assemblage is characterized by the presence of biotite as a phenocryst phase. Biotite rhyolite flow-domes and associated pyroclastic rocks are exposed in the centre of the area and fragmental rocks are exposed at the southeastern edge. Quartz porphyry occurrences in the centre of the area may be related to this assemblage. Rare occurrences of pervasively altered intermediate flows near the periphery of the Eocene outcrop area are interpreted as the latest products of Eocene volcanism.

The outcrop area of the felsic volcanic rocks and the overlying mafic assemblage forms an approximately circular highland area with a diameter of approximately 50 km (Fig. 4). The area is eroded to the north, exposing the basement and the central part of the area is a topographic low, partially filled by younger basaltic lavas of the Chilcotin Group. It is possible that the area described was the site of a large composite volcano which underwent caldera formation and subsequent erosion, prior to the eruption of the Chilcotin Group basalts. Implicit in this are the possibilities that the (presently) subeconomic mineralization of the Clisbako area is related to caldera formation and that exploration targets in the area may be masked by the present cover of Chilcotin Group lavas.

ACKNOWLEDGMENTS

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nothing said or given ??

and thorough critical review.

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Geological Survey of Canada Project 930025

Assessment Reports — Omission

eg. a) Metal

b) Eighty - Eight Res.

c) Rio Algom

FIGURES

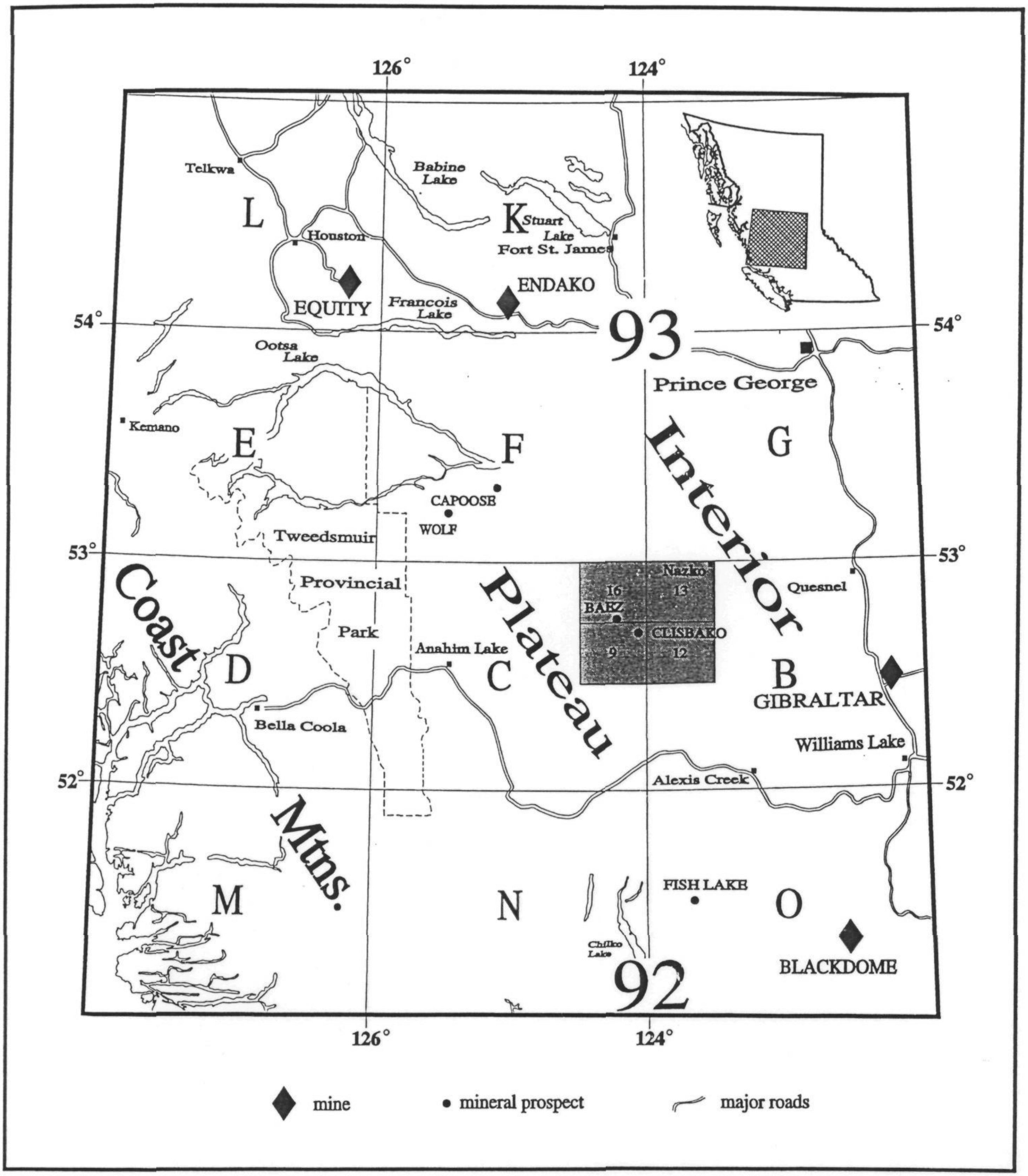
Figure 1. Location of the study area.

Figure 2. Approximate area underlain by the Eocene and Miocene volcanic rocks (this study, Tipper, 1959, 1969). The area was glaciated and outcrop is not abundant in lowland areas. Eocene volcanic rocks rest upon a deformed basement of presumed Jurassic age. The eroded remnants of the Eocene volcanic rocks are partially covered by valley-filling Chilcotin Group basalts.

Figure 3. Stratigraphic relationships of Eocene volcanic assemblages present in the study area. The biotite-bearing assemblage overlies at least some of the plagioclase+augite bearing assemblage, but eruption of the latter may have continued after the biotite-bearing eruptions.

Figure 4. Topography of the study area. The ridges cored by Eocene rocks form a circular pattern, interpreted as the remnant of an Eocene volcano. The lowland areas are filled with younger Chilcotin Group basalts.

Figure 1



126°
124°
Telkwa
Babine Lake
L
K
Stuart Lake
Houston
Fort St. James
EQUITY
ENDAKO
Francois Lake
54°
93
Ootsa Lake
Prince George
Kemano
E
F
G
Interior
CAPOOSE
WOLF
Tweedsmuir
53°
Provincial
Park
Coast
Plateau
Nazko
16
13
BAEZ
CLISBAKO
9
12
Quesnel
Anahim Lake
D
C
B
GIBRALTAR
Bella Coola
Williams Lake
52°
Alexis Creek
Mtns.
FISH LAKE
M
N
O
Chilko Lake
92
BLACKDOME
mine
mineral prospect
major roads

Figure 2.

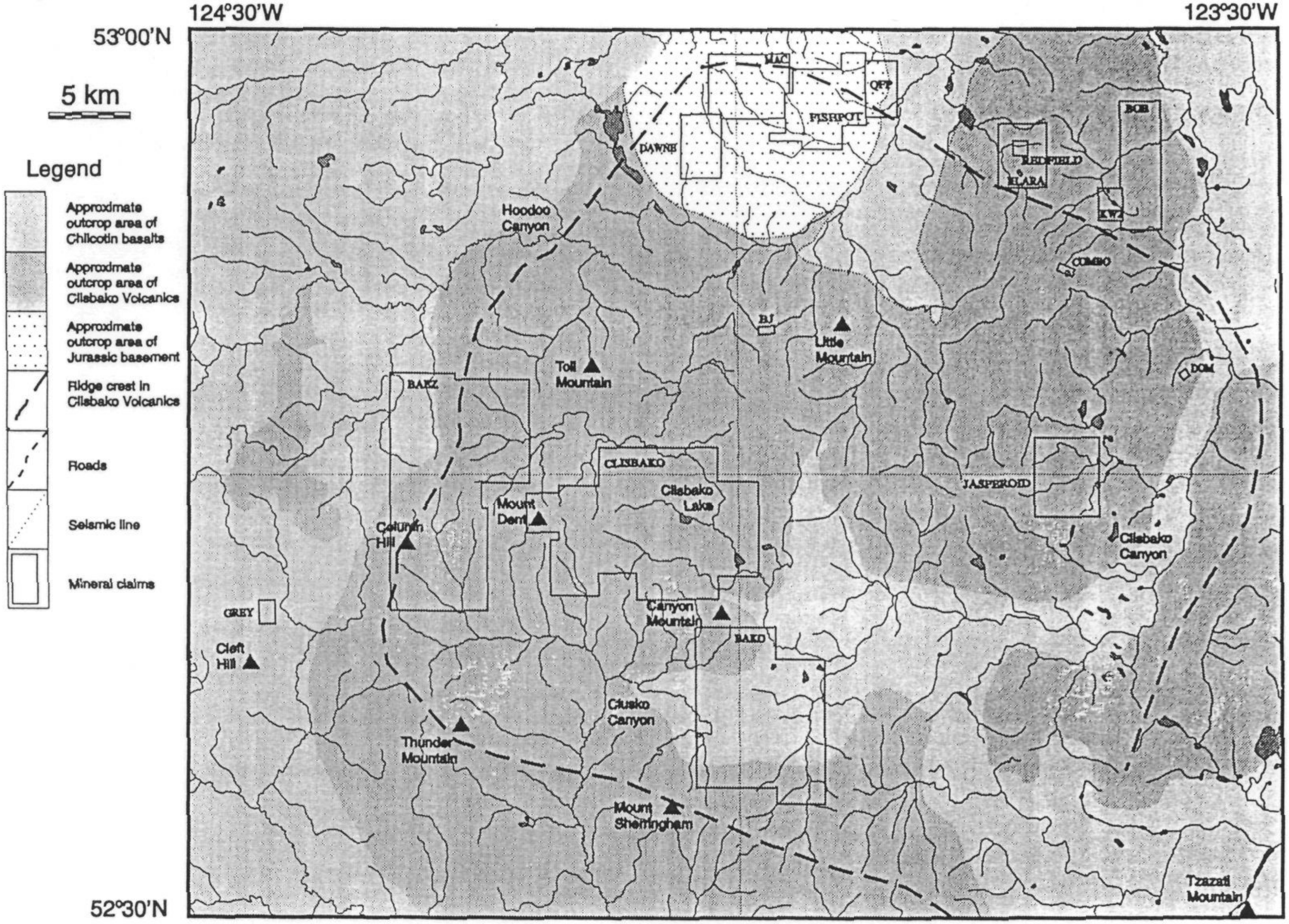
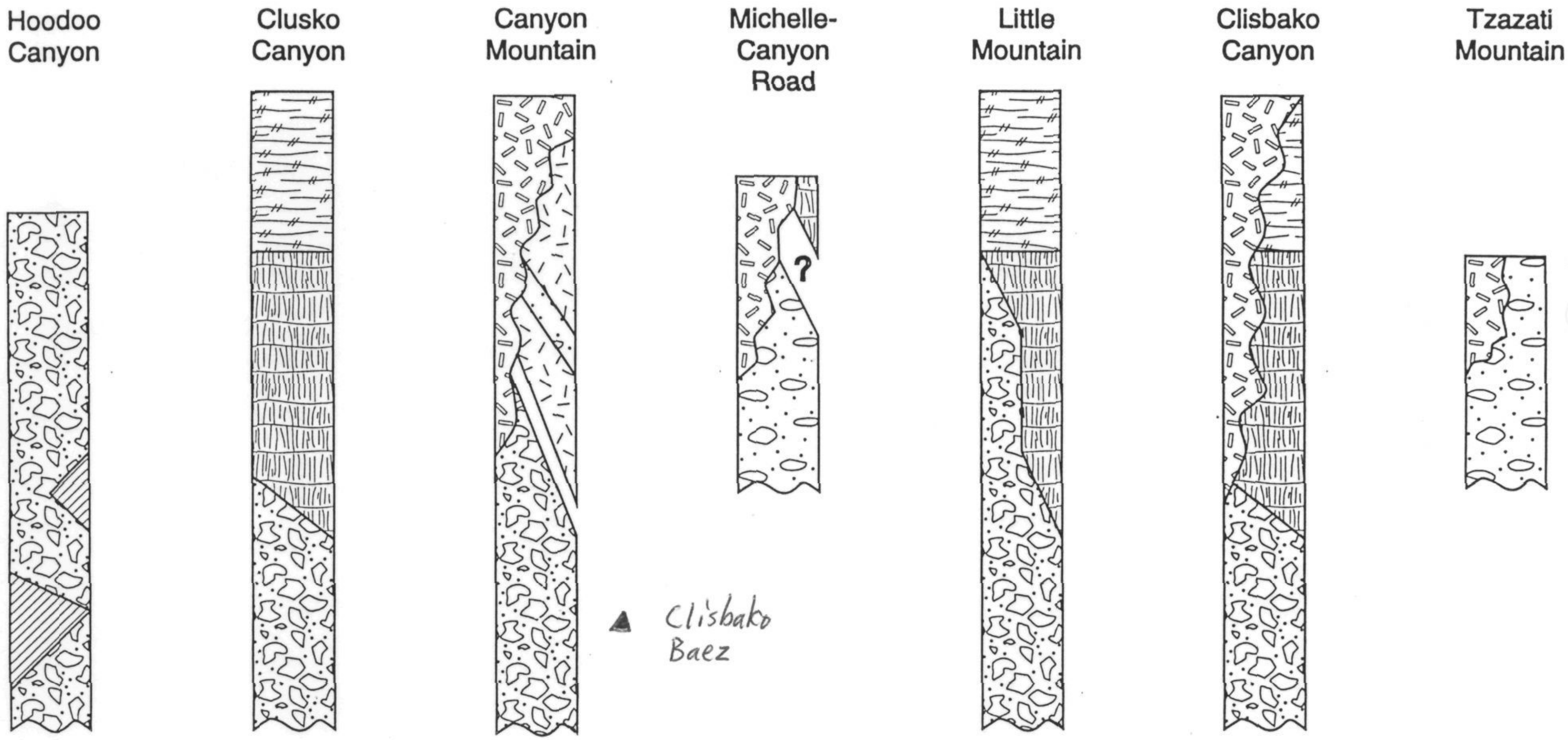

124°30'W
123°30'W
53°00'N
52°30'N
5 km
Legend
Approximate outcrop area of Chilcotin basalts
Approximate outcrop area of Clisbako Volcanics
Approximate outcrop area of Jurassic basement
Ridge crest in Clisbako Volcanics
Roads
Seismic line
Mineral claims
MAC
QFP
FISHPOT
DAWNB
BOB
REDFIELD
ELARA
KW2
COMBO
Hoodoo Canyon
BJ
Little Mountain
Toil Mountain
DOM
BAEZ
CLISBAKO
Clisbako Lake
JASPEROID
Mount Dent
Column Hill
Clisbako Canyon
GREY
Canyon Mountain
BAKO
Cleft Hill
Clusko Canyon
Thunder Mountain
Mount Sherringham
Tzazati Mountain

Figure 3.



CLISBAKO VOLCANICS (EOCENE)

Plagioclase+augite-bearing assemblage

Flow-laminated plagioclase + augite phyric dacite. Thickness unknown; top not observed.

Weakly to moderately plagioclase phyric dacite flows with collonnades. Grades laterally and down section to flow breccias. Variable thickness, up to 100 m.

Flow-breccias incorporating plagioclase +augite phyric dacite boulders. Rare flow lobes of coherent lava. Thickness unknown; base not observed.

Biotite-bearing assemblage

Biotite, quartz and feldspar phyric rhyolite flow domes, intercalated with and grading laterally into flow breccias.

Biotite-bearing pyroclastic and epiclastic rocks containing blocks of biotite rhyolite and accidental blocks of plagioclase+augite phyric dacite.

CHILCOTIN GROUP (MIOCENE)

Valley-filling plagioclase + olivine phyric basalts, overlying Eocene assemblages with erosional unconformity.

no such name!

MOUNT CLISBAKO, CENTRAL B.C.: STRATIGRAPHY, PETROLOGY AND ECONOMIC SIGNIFICANCE OF ASSEMBLAGES IN A BURIED EOCENE VOLCANO

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Volcanic rocks exposed in the Clisbako River area of central British Columbia host epithermal alteration and potentially economic mineralization. The study area contains evidence for three periods of volcanic activity: 1. A deformed volcanic assemblage of presumed Jurassic age; 2. Eocene felsic to intermediate volcanic flows and fragmental deposits which host the epithermal mineralization; 3. Neogene valley-filling basaltic flows correlated with the Chilcotin Group.

On the basis of fieldwork, chemical analysis and petrographic examination, the Eocene volcanic rocks are subdivided into two major and two minor lithologic types. The most commonly exposed assemblage is a sequence of flat-lying to moderately inclined flows and related flow-breccias, ranging between rhyolite and andesite, but mainly dacite. Mapped units include flow-breccias near the base, passing upsection to colonnade-forming and flow-laminated lava flows. Plagioclase and augite phenocrysts are rare, both with oscillatory zoning.

The second assemblage is identified by euhedral biotite phenocrysts and comprises rhyolite flow-domes and associated pyroclastic units which contain accidental blocks of augite phyric dacite. The pyroclastic units weather recessively and are rarely exposed. Flow-domes and pyroclastic rocks are exposed in the centre of the area and pyroclastic rocks at the southeastern edge. Quartz porphyry occurrences in the central area, near a flow-dome, may be part of this assemblage.

Both biotite- and augite-bearing assemblages in the Eocene volcanics are calc-alkaline and potassic, but the two assemblages can be distinguished on the basis of incompatible element content. Chemical variations in unaltered lithologies of both assemblages are consistent with feldspar fractionation.

The area underlain by Eocene volcanic rocks forms a circular highland area, 50 km in diameter. It is eroded to the north, exposing deformed volcanic rocks of the Jurassic basement. The central part of the area is a topographic low, partially filled by younger basaltic lavas of the Chilcotin Group. Biotite-phyric pyroclastic rocks occurring in the centre and southeast are interpreted as the products of a large pyroclastic eruption, possibly a caldera-forming event. The biotite-bearing flow-domes are interpreted as the latest products of this phase of volcanism. The biotite-bearing assemblage occurs near to the (presently) subeconomic mineralization of the Clisbako area and may have been the heat source for an epithermal system. The region is interpreted to be the erosional remnant of a large Eocene volcano, possibly a caldera, partially filled with basaltic lavas of the Chilcotin Group. These later lavas may mask significant exploration targets.