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NOTES ON THE OPEN FILE REPORT
ON THE BONAPARTE RIVER MAP AREA
BRITISH COLUMBIA

FEBRUARY 1969

R. B. CAMPBELL
H. W. TIPPER

92 P

26 February, 1969

Notes on the open file report on the Bonaparte River Map Area, (92P), British Columbia, by R.B. Campbell and H.W. Tipper.

The Bonaparte River map area is bounded by longitudes 120° and 122° West and by latitudes 51° and 52° North. The present report is based on field work carried out from 1963 to 1965. The information in this report was obtained in part from air photo interpretation and aerial reconnaissance by helicopter, but mostly from ground traverses. The information in the S.W. quarter is derived mainly from Trettin's report of 1961.

PHYSIOGRAPHY

Bonaparte River map area is part of the interior plateau and is sub-divided into several plateaux and highland regions. The sub-divisions are as follows:

1. Fraser Plateau which comprises about three-quarters of the map area, mainly the western part. It is essentially a flat or gently rolling region lying between 4,000 and 5,000 ft. elevation. In the south-west quarter the Marble Range rises abruptly to 7,500 ft.

   The flattest part of the plateau, in the west half, is underlain by flat lying Pliocene and/or Miocene lavas.

2. The Thompson Plateau.

   This is distinguished from the Fraser Plateau by slightly greater relief and the absence of extensive flat lava areas. The Eastern boundary of Thompson plateau is approximately the North Thompson Valley.

   Thompson plateau is underlain by folded and block faulted late Palaeozoic, Mesozoic and early Tertiary volcanic sedimentary and grantiic rocks.

3. Quesnel and Shushwap Highlands.

   These two sub-divisions abutt the Fraser and Thompson plateaux on the east along the line from the South East corner on the map area, along the North Thompson River valley to Little Fort and south westerly to the east end of Cannim Lake. The region is characterised by broad rounded mountains up to 7,000 ft. separated by deep valleys.

   This area is underlain mainly by folded and metamorphosed Palaeozoic rocks with lesser amounts of Mesozoic rocks. Igneous intrusions of Cretaceous age commonly form the prominent ridges of the mountains.

4. Glaciation.

   The entire map area was glaciated. Evidence indicates that a dividing line between northward and southward flowing ice was situated in the map area. Glacial deposits, although widespread, are not deep. Over the plateau in the west half of the area drift is generally one to five feet deep except where filling preglacial gullies and valleys.

   Except for the area west of Marble Range, the last glacial ice to cover the area issued from the Cariboo Mountains. Available information suggests that ice advanced from east to west along the north boundary of the area from where it fanned out northward and southward. The southward flowing ice moved south-westerly and southerly in the western part of the area but near the central and southern parts it flowed southerly and south easterly.

5. General Geology.

The map area straddles the Quesnel trough, a basin of early Mesozoic eugeosynclinal deposition situated between the Omineca geanticline in the Columbia Mountains to the East and the Pinchi geanticline to the West.

Late Precambrian and/or early Palaezoic strata are widely exposed in the Omineca geanticline. These, together with late Palaezoic rocks, lie along the eastern edge of the map area and mark the western extremity of the eastern fold belt of which the Shushwap Metamorphic Complex is an integral part. Late Palaezoic rocks of the Pinchi geanticline are restricted to the western part of the map area. Between the geanticlines is a great thickness of late Triassic and early Jurassic primarily volcanic clastic rocks intruded by large granitic batholiths.

LAYERED ROCKS

Shushwap Metamorphic Complex (Map Unit A)

Rocks assigned to this complex underlie a small area along the eastern boundary of the map area in Clearwater River Valley. The rocks are dominantly quartzo feldspathic biotite gneiss and schist, containing garnet and sillimanite, and minor ampnibolite, quartzite, marble and 15-25% pegmatite. They are intensely and complexly deformed, their age is not definitely known and Campbell has some evidence that Kaza group and probably younger strata are involved.

Kaza or Cariboo group. Map Unit 1.

Lithology

Map Unit 1 comprises quartz mica schist and micaceous quartzite with minor amounts of black phyllite, quartz-hornblende mica schist and marble.

Chlorite schist and greenstone are restricted to a small area on the north end of Green Mountain.

INTRUSIVE ROCKS

Serpentinite was noted in two small bodies south-west and south of Little Fort. The remainder of the known intrusive rocks are granitoid and can be divided into two groups depending on age. In general hornblende-biotite quartz diorite, and grano-diorite with minor diorite, syenodiorite, and syenite are late Triassic or early Jurassic (Rhaetian or Hettangian) and biotite granodiorite and quartz monzonite are Cretaceous.

Serpentinite (Map Unit 9) was found in sufficiently large masses to be mapped separately in only two places, one south and the other southwest of Little Fort on the margin of the Thuya batholith. The serpentinite is very fine grained and commonly dark grey or black with green scaly serpentine on shear surfaces. Between Thuya batholith and the more northerly of the serpentinite bodies near Little Fort is a zone of brown weathering serpentinite, locally with veinlets of magnetite, and of foliated mafic phases of the batholith with sparse iron sulphide. The age of the ultramafic rocks is not known. The unit has been designated as Permian and/or Triassic.

Rhaetian or Hettangian granitic rocks - (Map Units 13 and 14)

Map Unit 13 - Syenite and Monzonite.

North and West of Friendly Lake several intrusions range from narrow dykes to elongate masses two miles long by half a mile wide. Rocks contain pink and less commonly creamy white phenocryst set in a grey to creamy fine grained matrix. Small quantities of very fine amphibole are the only apparent mafic constituent.

A body of syenite (Map Unit 13b) about six miles long and up to one and a half miles wide is associated with Thuya batholith type granitic rocks in a small area about five miles immediately west of the town of Barriere.

Rocks of Map Unit 13 are known to intrude only strata of the Nicola and Cache Creek groups upon which they seem to have had little or no contact metamorphic effect. Fragments of rocks similar to those near Friendly Lake were noted in early Jurassic conglomerate on Windy Mountain, hence the age designation of Rhaetian or Hettangian in common with the Thuya and Takomkane batholiths. The syenite west of Barriere evidently intrudes Cache Creek group strata, hence is Permian or younger. Its age has not been more closely determined.

Thuya and Takomkane Batholiths and Related Intrusions - (Map Units 14, 14a, 14b)

Thuya batholith rocks are reasonably well exposed near Thuya Creek which flows easterly to join the Thompson River just south of Little Fort.

Thuya batholith in the east central part of the map area is at least 40 miles long east-west and 25 miles wide north-south. Contacts of the western part are covered with Tertiary volcanic deposits. The batholith extends westerly from North Thompson River to Rayfield River, a branch of Bonaparte River, and northerly from seven to possibly fourteen miles south of Bonaparte Lake to about four miles beyond Icken Creek. Much smaller masses of similar and apparently related rocks were found four to six miles west of Barriere near the south boundary of the map area about ten miles west of McClure.

Takomkane batholith is named for Takomkane Mountain in Quesnel Lake map area where the rocks are particularly well exposed. Boss Mountain molybdenum deposit is on the eastern slopes of Takomkane Mountain. Takomkane batholith straddles the centre of the Northern boundary of the map area. The crudely circular pluton roughly thirty miles across extends from near the village of Forest Grove west of Cannim Lake to the north boundary and from Spout Lake on the west to near Hendrix Creek on the east. The bulk of the rocks of the Thuya and Takomkane batholiths and related intrusions are hornblende biotite granodiorite and quartz diorite. Major variants are diorite and syenodiorite of Takomkane Batholith (Map Unit 14a) and leucogranodiorite and quartz monzonite of Thuya Batholith (Map Unit 14b.)

Map Unit 14.

The main parts of the two batholiths are medium grained rocks with scattered coarse physocrysts of pinkish inclusion-rich potash feldspar. Neither the abundance nor the prominence of the phenocrysts is such that the rocks generally would be termed porphyritic. The rocks are prominently speckled medium grey to brownish grey but locally have a greenish cast as a result of epidotic alteration. Mafic minerals vary from less than 5% to more than 20% and show little preferred orientation. In general, composition of the main phases of the batholiths averaged from 24 modal analyses is approximately 50% plagioclase, 15% potash feldspar, 20% quartz, 7% hornblende, 3% biotite and 5% accessory and alteration minerals. All the rocks have been altered to some degree; hornblende and particularly biotite may be changed to chlorite and epidote, plagioclase is almost invariably altered to epidote, sericite, clay minerals and carbonate, and potash feldspar shows a dusting of clay minerals.

Of the variations from the normal type, the most striking is medium to coarse hornblendite found along the eastern side of Thuya batholith near Thompson River.

Map Unit 14a.

A strip along the western edge of Takomkane batholith consists of diorite and syenodiorite (note C.J.R. Woodcock for information.)

Nine miles west of Barriere a small intrusive body associated with the Fennell formation consists of fine and medium grained augite-hornblende diorite. Epidote is a common and locally abundant alteration mineral.

Map Unit 14b.

Leucogranodiorite and quartz monzonite form the western phase of Thuya batholith. The rocks are similar to those of the eastern part of the batholith but contain much less mafics.

Structural Relations.

The contacts of the Thuya and Takomkane batholiths and related intrusions are very poorly exposed and in places are covered by extensive deposits of Tertiary rocks. On a broad scale the contacts are discordant with the layering of the invaded rocks but locally they are concordant.

Contacts with the Nicola group are not sharply defined. The transition zone, up to a mile wide, contains rocks that are typical of the granitic batholiths, others typical of the Nicola group or its metamorphic equivalents and others that are rather hybrid looking diorites that could belong to one side or the other of the contact.

The age relations of the various phases of the batholiths are not known.

Thuya and Takomkane batholiths cut Upper Triassic and older rocks are not known to cut younger sequences. The plutons are overlain by Eocene and Miocene or Pliocene volcanics; in some cases they are faulted against the former as well as against lower Jurassic rocks.

Age and Correlation.

The age of the Thuya batholith is inferred to be Rhaetian or Hettangian, that is very late Triassic or very early Jurassic. The compositional similarity of the Takomkane batholith and other minor intrusions to the Thuya batholith indicates that they are contemporaneous, Potassium-argon age determinations were made on two samples of Thuya batholith and one of Takomkane batholith. The latter is 187 million years for biotite. One of the former from the eastern or 'normal' phase of the batholith is 194 plus or minus 10 million years for biotite and 198 plus or minus 28 million years for hornblende; the other from the western leucocratic phase is 166 plus or minus 11 million years for biotite. Three of the four ages are in excellent agreement and corroborate the geologically inferred age.

The younger age is probably a result of argon loss from the biotite or it could represent the true age of the younger phase.

Cretaceous Granitic Rocks - (Map Unit 20, 20a, 20b)

Raft and Baldy batholiths and related intrusions, (Map Unit 20).

Raft batholith is 40 miles long in a west, north-westerly direction and a maximum of 10 miles wide. From its western end near the eastern end of Cannim Lake it extends easterly to Clearwater River and beyond. North of Mahood Lake two oval shaped bodies three to four miles across are texturely and compositionally similar to Raft batholith as is a small intrusion near the head of Cannim Lake on the eastern shore and another just east of Hendrix Creek on the north boundary.

Baldy batholith is named for Baldy Mountain on the Eastern boundary of the map area east of Little Fort. The great bulk of the pluton is in the Adam's Lake map area, only its western end extends into Bonaparte River map area. This batholith is about 25 miles long and reaches a maximum width of 15 miles - like Raft batholith it is elongate in an east-west direction just north of Baldy Mountain.

Lithology.

Most of the rocks of the Raft and Baldy batholiths are granodiorite or quartz monzonite, hence are appreciably more potassic than those of Thuya and Takomkane batholiths. They differ from the latter also in having less mafic mineral and a preponderence of biotite over hornblende.

Though Raft and Baldy batholiths have compositions significantly different from Thuya and Takomkane batholiths they differ little in texture except that the former are more distinctly porphyritic with pinkish, somewhat rectangular potash feldspar phenocrysts up to one centimetre long that are prominent and common though not ubiquitous.

The compositions of the two batholiths seem to be fairly uniform but local variants were noted. There are narrow zones of hornblende diorite near the north contact of Raft batholith just west of Clearwater River. The body just east of Hendrix Creek on the north boundary is hornblendic and possibly should not be grouped with Raft and Baldy batholiths. It appears to intrude lower Jurassic rocks.

Structural Relations.

The contacts of Raft and Baldy batholiths are not well exposed and the few places where they are seen they appear to be steep and discordant with respect to the layering or foliation of the surrounding rocks and this is consistent with the cross cutting relationships as seen on the scale of the map. The surrounding rocks are apparently only locally deformed by the emplacement of the plutons although they are metamorphosed commonly for only a few hundred yards but in some places up to several miles from the nearest granitic contact. Pyroxene rich rock from Map Unit 16 on the northern contact of Raft batholith may be the result of re-crystallization in the contact zone.

Raft batholith cuts rocks as young as early Jurassic and is overlain by plateau lavas (Map Unit 25) and younger Tertiary volcanic deposits.

Age and Correlation.

From geological relationships the rocks of Map Unit 20 can be dated only as early Jurassic or later and pre-late Miocene although it seems almost certain that they were emplaced prior to the deposition of the Chua Chua beds and hence are pre-Eocene.

Potassium-argon age determinations on biotite were made from two samples from Raft batholith and two from Baldy batholith. The latter both from the Adams Lake map area gave ages of 96 ± 5 million years and 80 ± 6 million years whereas the former gave 105 ± 9 million years and 140 ± 9 million years. This encompasses the interval from Late Jurassic to mid-late Cretaceous. No explanation is apparent for the wide range in ages. It is interesting to note, however, that the oldest dates are from Raft batholith which is apparently less potassic, more calcic and richer in mafics than Baldy batholith and this may be intermediate in both composition and age between the latter and the older Thuya and Takomkane batholiths.

Granitic Rocks near Fraser River (Map Unit 20a)

In the valley of Leon Creek south west of Fraser River is a small area underlain by granitic rocks. These are described by Trettin (1961) as follows:

> "the intrusions are composed of diorite, quartz diorite, granodiorite, and dacite. Quartz diorite is the commonest rock type. The plutonic rocks have a hypidiomorphic equigranular texture and are mostly even grained. Many of the rocks are porphyritic.
>
> that the quartz diorite has been emplaced by intrusion and not by process of granitization is suggested by the cross cutting relations of the granitic rocks and the very low grade of regional metamorphism of the country rocks suggesting shallow depth of emplacement"

Trettin, for various reasons, considers these intrusions to be "early Lower Cretaceous or older". In Taseko Lakes map area to the west, Tipper in 1963 found that the Coast Intrusions are Cretaceous or early Tertiary age. Also, less than 20 miles to the west, small granitic stocks intrude the Jackass Mountain Group of early Cretaceous age. Furthermore it has been established (Jeletzky and Tipper 1968) that uninterrupted sedimentation in that area continued throughout late Jurassic and most of early Cretaceous time.

For these reasons a late Cretaceous or Tertiary age for these intrusions is probable. However, the possibility of some relation to the older granitic rocks of Map Unit 14 cannot be ruled out.

Granitic Intrusion Tintlahtan Lake - Map Unit 20b.

Just north-east of Tintlahtan Lake a small group of leuco-quartz Monzonite cuts the fragmental volcanic rocks (Map Unit 16). The intrusive rock is light to medium grey and medium grained. Scattered veinlets of smoky grey carry molybdenite.

The age of this intrusion is not known other than that it cuts Lower Jurassic rocks. It may be of the same age as Raft batholith or it may be younger, equivalent,perhaps to the compositionally similar intrusive 50 miles to the south east in Adams Lake map area for which a potassium-argon age on biotite is 46 ± 5 million years.

Structural Geology

Three main elements of the structure are:

1.) Major faulting in the North Thompson River, Louis Creek and Lemieux Valleys.

2.) Block faulting in the Eakin Creek Region.

3.) Deformation in the Marble Range.

Faulting along North Thompson River Valley.

A major north north-west trending fault extends from the south-east corner of the map area down Louis Creek Valley into North Thompson River Valley and then into Lemieux Creek Valley where it seems to splay into several branches. The general zone of faulting however may extend to Mahood Lake and beyond.

The southern part of the fault appears to be a single break or narrow zone from near Lemieux Creek and divided into several north westerly trending branches. The principle branch is inferred to bring the Fennell Formation against the Cache Creek Group and Map Unit 10. If this is so, then the fault which is evidently steep from Mann Creek south, apparently flattens and becomes a reverse or thrust fault near Mahood Lake. Compelling evidence of faulting between the Fennell Formation and Map Unit 10 is lacking however.

Jones (1959) showed several faults in and near Louis Creek Valley to the south-east in Vernon map area. One or all of these may be extensions of the fault discussed here. To the north in Quesnel Lake map area, the trace of the fault cannot be identified at present but this should be possible with further work. It may in some way continue into the fault that passes along Spanish Lake and valley and thence north-westwards to near the north west corner of the Quesnel Lake map area.

The latter fault is thought to be a principle southward extension of the Pinchi fault.

Block faulting in the Eakin Creek Region.

Conspicuous on air photographs of the Eakin Creek Region are the multitude of closely spaced topographic linears which, although some may be glacial, are largely a reflection of block faulting, the main structural feature of this part of the map area. These linear features are concentrated in an area between Bonaparte Lake and North Thompson River and north-westward through Cannim Lake to Mount Timothy and Lac Lattache. The greatest concentration is apparently north and south of Eakin Creek but this may be accounted for by thinner drift cover which permits a sharper topographic topographic definition of the features. Elsewhere, as to the south-east around Mount Hagan where drift and forest cover are thicker, the features are less prominent, the subduing of the features there may also be attributable to different rock types.

These features apparently are confined to areas south-west and west of North Thompson fault and to the west they end abruptly at the margin of the plateau lavas, Map Unit 25.

The distribution and orientation of these lineaments is illustrated in Fig. 5. In the Eakin Creek area, the preferred trend is north west although North, north-east or east trends are noted. Around Cannin Lake north-east trends are predominant and near Lac Lattache north west trends are more common. In these areas the features with predominant north-west trends are the longest uninterrupted and most deeply incised of all the lineaments. In Fig. 5 only the obvious and largest lineaments are illustrated.

Unquestionably some joint systems when examined in outcrop are parallel with the major lineaments with no movement of the joints indicated. However, the major lineaments are oriented in so many directions it would be difficult to conceive of the joints that were not parallel or sub-parallel with some of these. This is particularly true of Thuya batholith (Map Unit 14) which appears to be shattered by thousands of closely spaced joints, fractures, and/or faults. The writers believe these features are a result of erosion along the system of closely spaced faults to which the joint systems of the area may or may not be related. Admittedly some of these lineaments may result from erosion along prominent joints but these are few. The reasons for believing block faulting is responsible for this topographic effect are as follows:

1.) In many places the lineaments mark abrupt changes in lithology within one map unit.

2.) Rocks of different ages are in contact along these lineaments in several places.

3.) In several places blocks of older or younger rocks are introduced into areas of younger or older rocks respectively and this can be explained most readily by block faulting.

4.) Where the rocks along these lineaments are exposed a narrow zone of brecciation, shearing and slickensiding is present.

Most of these faults appear to be near vertical. The amount of displacement on these faults is not thought to be great. Mapping clearly shows that Jurassic and Triassic rocks are more thoroughly fractured by the faulting than the early Tertiary rocks which are cut by relatively few widely spaced faults. The cretaceous Raft batholith does not exhibit closely spaced fractures characteristic of the older Thuya and Takomkane batholiths.

This block faulting is the main or only deformation that has disrupted the late Triassic and early Jurassic rocks of Units 10, 11, 15 and 16. Nowhere do these rocks give evidence of a widespread systematic deformation by folding. They consist of numerous distinct blocks, apparently with a single, consistent attitude within a single block but completely disorientated with respect to one another.

The age of the block faulting can be established with reasonable assurance. The Dead Man River Formation (Map Unit 24) and Map Unit 25 are not cut by any of these faults, so the faulting can be no younger than late Miocene. The Eocene and Oligocene Skull Hill formation is cut by the faults so that block faulting must have occurred between-Miocene and Late Miocene times.

However, the Skull Hill formation is much less fractured than the early Jurassic and late Triassic rocks suggesting that least two episodes of faulting took place, one prior to the eruption of Skull Hill formation and one later, possibly a result of further movement on some of these faults. In this way the difference in the amount of fracturing in older and younger rocks can be explained.

When the earlier episode of block faulting occurred is not definitely known. Unquestionably it is in part early Jurassic (Sinemurian) although it could have occurred repeatedly over a long period. Significantly Raft batholiths does not show intense fracturing characteristic of Thuya and Takomkane batholiths. Possibly block faulting in the Raft batholith related to the same Cretaceous orogeny.

Deformation in the Marble Range.

The south-west part of the map area is dominated by the Marble Range which includes the Edge Hills and other small ridges and hills. This structurally disturbed area is isolated from deformed rocks of the eastern part of the area by the great expanse of flat lying lavas (Map Unit 25) in the central plateau. Within the Marble Range and the surrounding hills the strata reveal an episode of folding and crossing, thrusting and an episode of normal faulting. This interpretation has a bearing on the structural history of the area and of the cordillera as a whole.

Several pronounced lineaments (See Fig. 6) trend to north-westerly parallel sub-parallel to the trend of Marble Range in an area bounded on the north-east by the basaltic plateau lavas (Map Unit 25) and on the south-west by the Fraser River fault. These lineaments are believed to be normal faults related to the episode of block faulting in the eastern part of the area; beneath the lava cover, the two areas of faulting are thought to emerge and be indistinguishable.

The fault between Edge Hills and Marble Range that apparently truncates the structure on the Edge Hills is a zone of intense shearing and brecciation. The faults cutting the Marble Range where exposed also exhibit shearing. Between Tsilsalt Ridge and Hart Ridge, two Jurassic units (Map Units 17 and 18) have been downfaulted forming a graben in the Cache Creek Group (Map Unit 4). Near the west end of Loon Lake, the Cache Creek Group is in fault contact with the Skull Hill formation (Map Unit 22) as evidenced by a zone of shearing, brecciation and alterations.

The sense of movement on these faults is not indicated by the fault zones themselves. The faults are near vertical and possess a similar pattern to that in the Eakin Creek region. In the Marble Range vertical displacement does not appear to be great for none of the faults seem to disrupt greatly the fold pattern of the range, as shown by Trettin (1966, page 101) in his section across Mount Soues. The sense of movement is thus not known, but is probably normal, and related in time to the faulting in the Eakin Creek Region.

The faulting is later than the folding of the Pavillion and Cache Creek Group. Trettin, who recognised the folding in the Marble Range, described the structure as follows (Trettin, 1966, Pages 98 - 99).

> "The overall structure of the range is a north-westerly plunging anticlinorium en echelon with a synclinorium. The structure of the synclinorium is complicated, and has not been studied in detail. In the central parts of the anticlinorium, folds formed in member A are relatively simple and shallow. On the flanks of the anticlinorium, they show complex drag folding. In the western parts of the range, folds formed in member C change, in south-westward direction from open and upright to isoclinal and overturned. These changes in structural style can partly be attributed to changes in the thickness of the limestones, and partly to structural disturbances on the south-west (Fraser River Fault Zone) ".

From a study of the Mount Kerr map section, Tipper concluded that the synclinorium is made up of the lower part of Marble Canyon formation with map unit 5 at the base and that these rocks have been thrust south-westerly onto the upper part of Marble Canyon formation.

The Pavillion Group has also been folded and Trettin commented as follows : (Trettin 1961, Page 23).

> "In most localities the strata of division 1 (map units 7 and 8) strike north-westerly and dip steeply. Marker beds are scarce and stratigraphic tops could be determined only at a few localities. Judging from the well stratified and plastic nature of the rocks they are tightly folded".

From the foregoing it is apparent that the Cache Creek Group in the western part of the area and the Pavillion Group, were folded, possibly at the same time. As the Pavillion Group is involved, the time of folding is not likely older than middle or early Triassic. Presumably the Cache Creek Group in the eastern part of the map area was folded at the same time. In the discussion of block faulting in the Eakin Creek Region, it was pointed out that the late Triassic rocks (map units 10 and 11) were not folded. If this lack of folding in late Triassic and the younger rocks is true also for the whole area then the folding of the Cache Creek and Pavillion Groups is no younger than late Triassic and no older than early or middle Triassic.

A mid-Triassic orogeny has been recognised in northern British Columbia (Souther and Armstrong, 1966, pages 173-174). Possibly the mid-Triassic folding in Bonaparte River map area is a reflection of that orogeny.

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   The flattest part of the plateau in the west half is underlain by flat lying Pliocene and/or Miocene lavas.

2. <u>The Thompson Plateau</u>. This is distinguished from the Fraser plateau by slightly greater relief and the absence of extensive flat lava areas. The Eastern boundary of Thompson plateau is approximately the North Thompson Valley.

   Thompson plateau is underlain by folded and block faulted late Palaezoic, Mesozoic and early Tertiary volcanic sedimentary and granitic rocks.

3. <u>Quesnel and Shushwap Highlands</u>. These two sub-divisions above the Fraser and Thompson plateaux on the East along the line from the South East corner on the map area, along the North Thompson River valley to Little Fort and south-westerly to the east end of Cannim Lake. The region is characterised by broad rounded mountains up to 7,000 ft. separated by deep valleys.

   This area is underlain mainly by folded and metamorphosed Palaezoic rocks with lesser amounts of Mesozoic rocks. Igneous intrusions of Cretaceous age commonly form the prominent ridges of the mountains.

<u>Glaciation</u>.

The entire map area was glaciated. Evidence indicates that a dividing line between northward and southward flowing ice was situated in the map area. Glacial deposits, although widespread, are not deep. Over the plateau in the west half of the area drift is generally one to five feet deep except where filling preglacial gullies and valleys.

Except for the area west of Marble Range, the last glacial ice to cover the area issued from the Cariboo Mountains. Available information suggests that ice advanced from east to west along the north boundary of the area from where it fanned out northward and southward. The southward flowing ice moved south-westerly and southerly in the western part of the area but near the central and southern parts it flowed southerly and south-easterly.

<u>General Geology</u>.

The map area straddles the Quesnel trough, a basin of early Mesozoic eugeosynclinal deposition situated between the Omineca geanticline in the Columbia Mountains to the east and the Pinchi geanticline to the west.

Late Precambrian and/or early Palaezoic strata are widely exposed in the Omineca geanticline. These, together with late Palaeozoic rocks, lie along the eastern edge of the map area and mark the western extremity of the eastern fold belt of which the Shushwap Metamorphic Complex is an integral part. Late palaeozoic rocks of the Pinchi geanticline are restricted to the western part of the map area. Between the geanticlines is a great thickness of late Triassic and early Jurassic primarily volcanic clastic rocks intruded by large granitic batholiths.

LAYERED ROCKS

Shushwap Metamorphic Complex. (Map Unit A)

Rocks assigned to this complex underlie a small area along the eastern boundary of the map area in Clearwater River Valley. The rocks are dominantly quartzo feldspathic biotite gneiss and schist, containing garnet and sillimonite, and minor amphibolite, quartzite, marble and 15-25% pegmatite. They are intensely and complexly deformed, their age is not definitely known and Campbell has some evidence that Kaza group and probably younger strata are involved.

Kaza or Cariboo Group. (Map Unit 1.

Lithology.

Map Unit 1 comprises quartz mica schist and micaceous quartzite with minor amounts of black phyllite, quartz-hornblende mica schist and marble. Chlorite schist and greenstone are restricted to a small area on the north end of Green Mountain.

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Serpentinite (Map Unit 9 was found in sufficiently large masses to be mapped separately in only two places, one south and the other south-west of Little Fort on the margin of the Thuya batholith. The Serpentinite is very fine grained and commonly dark grey or black with green scaly serpentine on shear surfaces. Between Thuya batholith and the more northerly of the Serpentinite bodies near Little Fort is a zone of brown weathering serpentinite, locally with veinlets of magnetite, and of foliated mafic phases of the batholith with sparse iron sulphide. The age of the ultramafic rocks is not known. The unit has been designated as Permian and/or Triassic.

Rhaetian or Hettangian granitic rocks (Map Units 13 and 14)

Map Unit 13 - Sienite and Monzonite.

North and West of Friendly Lake several small intrusions range from narrow dykes to elongate masses two miles long by half a mile wide. Rocks contain pink and less commonly creamy white phenocryst set in a grey to creamy fine grained matrix. Small quantities of very hard fine amphibole are the only apparent mafic constituent.

A body of syenite (Map Unit 13b) about six miles long and up to one and a half miles wide is associated with Thuya batholith type granitic rocks in a small area about five miles immediately West of the town of Barriere.

Rocks of Map Unit 13 are known to intrude only strata of the Nicola and Cache Creek groups upon which they seem to have had little or no contact metamorphic effect. Fragments of rocks similar to those near Frenzie Lake were noted in early Jurassic conglomerate on Windy Mountain, hence the age designation of Rhaetian or Hettangian in common with the Thuya and Takomkane batholiths. The syenite west of Barriere evidently intrudes Cache Creek group strata, hence is Permian or younger. Its has has not been more closely determined.

Thuya and Takomkane Batholiths and Related Intrusions - (Map Units 14, 14a, 14b)

Thuya batholith rocks are reasonably well exposed near Thuya Creek which flows easterly to join the Thompson River just south of Little Fort.

Thuya batholith in the east central part of the map area is at least 40 miles long east-west and 25 miles wide north-south. Contacts of the western part are covered with Tertiary volcanic deposits. The batholith extends westerly from North Thompson River to Rayfield River, a branch of Bonaparte River, and northerly from seven to possibly fourteen miles south of Bonaparte Lake to about four miles beyond Icken Creek. Much smaller masses of similar and apparently related rocks were found four to six miles west of Barriere near the south boundary of the map area about ten miles west of McClure.

Takomkane batholith is named for Takomkane Mountain in Quesnel Lake map area where the rocks are particularly well exposed. Boss Mountain molybdenum deposit is on the eastern slopes of Takomkane Mountain. Takomkane batholith straddles the centre of the northern boundary of the map area. The crudely circular pluton roughly thirty miles across extends from near the village of Forest Grove west of Cannim Lake to the north boundary and from Spout Lake on the west to near Hendrix Creek on the east. The bulk of the rocks of the Thuya and Takomkane batholiths and related intrusions are hornblende-biotite granodiorite and quartz diorite. Major variants are diorite and syenodiorite of Takomkane Batholith (Map Unit 14a) and leucogranodiorite and quartz monzonite of Thuya Batholith (Map Unit 14b).

Map Unit 14.

The main parts of the two batholiths are medium grained rocks with scattered coarse phynocrysts of pinkish inclusion-rich potash feldspar. Neither the abundance nor the prominence of the phynocrysts is such that the rocks generally would be termed porphyritic. The rocks are prominently speckled medium grey to brownish grey but locally have a greenish cast as a result of epidotic alteration. Mafic minerals vary from less than 5% to more than 20% and show little preferred orientation. In general, composition of the main phases of the batholiths averaged from 24 modal analyses is approximately 50% plagioclase 15% potash feldspar, 20% quartz, 7% hornblende, 3% biotite and 5% accessory and alteration minerals. All the rocks have been altered to some degree; hornblende and particularly biotite may be changed to chlorite and epidote, plagioclase is almost invariably altered to epidote, sericite, clay minerals and carbonate, and potash feldspar shows a dusting of clay minerals.

Of the variations from the normal type, the most striking is medium to coarse hornblendite found along the eastern side of Thuya batholith near Thompson River.

Map Unit 14a.

A strip along the western age of Takomkane batholith consists of diorite and syenodiorite (note C.J.R. Woodcock for information).

Nine miles west of Barriere a small intrusive body associated with the Fennell formation consists of fine and medium grained augite-hornblende diorite. Epidote is a common and locally abundant alteration mineral.

Map Unit 14b.

Leucograno diorite and quartz monzonite form the western phase of Thuya batholith. The rocks are similar to those of the eastern part of the batholith but contain much less mafics.

Structural Relations.

The contacts of the Thuya and Takomkane batholiths and related intrusions are very poorly exposed and in places are covered by extensive deposits of Tertiary rocks. On a broad scale the contacts are discordant with the layering of the invaded rocks but locally they are concordant.

Contacts with the Nicola group are not sharply defined. The transitions zone, up to a mile wide, contains rocks that are typical of the granitic batholiths, others typical of the Nicola group or its metamorphic equivalents and others that are rather hybrid looking diorites that could belong to one side or the other of the contact.

The age relations of the various phases of the various phases of the batholiths are not known.

Thuya and Takomkane batholiths cut Upper Triassic and older rocks are not known to cut younger sequences. The plutons are overlain by Eocene and Miocene or Pliocene volcanics; in some cases they are faulted against the former as well as against Lower Jurassic rocks.

Age and Correlation.

The age of the Thuya batholith is inferred to be Rhaetian or Hettangian, that is very late Triassic or very early Jurassic. The compositional similarity of the Takomkane batholith and other minor intrusion to the Thuya batholith indicates that they are contemporaneous. Potassium-argon age determinations were made on two samples of Thuya batholith and one of Takomkane batholith. The latter is 187 million years for biotite. One of the former from the eastern or 'normal' phase of the batholith is 194 ± 10 million years for biotite and 198 ± 28 million years for hornblende; the other from the western leucocratic phase is 166 ± 11 million years for biotite. Three of the four ages are in excellent agreement and corroborate the geologically inferred age. The younger age is probably a result of argon loss from the biotite or it could represent the true age of the younger intrusive phase.

Cretaceous Granitic Rocks (Map Unit 20, 20a, 20b)

Raft and Baldy batholiths and related intrusions, (Map Unit 20).

Raft batholith is 40 miles long in a west, northwesterly direction and a maximum of 10 miles wide. From its western end near the eastern end of Cannim Lake it extends easterly to Clearwater River and beyond. North of Mahood Lake, two oval shaped bodies three to four miles across are texturely and compositionally similar to raft batholith as is a small intrusion near the head of Cannim Lake on the eastern shore and another just east of Hendrix Creek on the north boundary.

Baldy batholith is named for Baldy Mountain on the Eastern boundary of the map area east of Little Fort. The great bulk of the pluton is in the Adam's Lake map area. This batholith is about 25 miles long and reaches a maximum width of 15 miles - like Raft batholith it is elongate in an east-west direction just north of Baldy Mountain.

Lithology.

Most of the rocks of the Raft and Baldy batholiths are granodiorite or quartz monzonite, hence are appreciably more potassic than those of Thuya and Takomkane batholiths. They differ from the latter also in having less mafic mineral and a preponderence of biotite over hornblende.

Though Raft and Baldy batholiths have compositions significantly different from Thuya and Takomkane batholiths, they differ little in texture except that the former are more distinctly porphyritic with pin kish, somewhat rectangular potash feldspar phenocrysts up to one centimetre long that are prominent and common though not ubiquitous.

The compositions of the two batholiths seems to be fairly uniform but local variants were noted. There are narrow zones of hornblende diorite near the north contact of Raft batholith just west of Clearwater River. The body just east of Hendrix Creek on the north boundary is hornblendic and possibly should not be grouped with Raft and Baldy batholiths. It appears to intrude lower Jurassic rocks.

Structural Relations.

The contacts of Raft and Baldy batholiths are not well exposed and the few places where they are seen they appear to be steep and discordant with respect to the layering or foliation of the surrounding rocks and this is consistent with the cross cutting relationships as seen on the scale of the map. The surrounding rocks are apparently only locally deformed by the emplacement of the plutons although they are metamorphosed commonly for only a few hundred yards but in some places up to several miles from the nearest granitic contact. Pyroxene rich rock from Map Unit 16 on the northern contact of Raft batholith may be the result of recrystallization in the contact zone.

Raft batholith cuts rocks as young as early Jurassic and is overlain by plateau lavas (Map Unit 25) and younger,Tertiary volcanic deposits.

Age and Correlation

From geological relationships the rocks of map unit 20 can be dated only as early Jurassic or later and pre-late Miocene although it seems almost certain that they were emplaced prior to the deposition of the Chua Chua beds and hence are pre-Eocene.

Potassium-argon age determinations on biotite were made from two samples from Raft batholith and two from Baldy batholith.

LEGEND

WEST HALF

:ECENT
:lt. alluvium, (few if any bedrock

PLIOCENE
:e basalt, basalt andesite, related
:s; basaltic arenite; 25a, olivine

FORMATION: shale, sandstone,
lomerate, breccia

lsite; related tuff and breccia;
minor lignite and conglomerate

LIGOCENE
P (21 and 22)
MATION: dacite, trachyte, basalt,
elated breccias

EAST HALF

QUATERNARY

RECENT

29 Blocky basalt flows

PLEISTOCENE AND RECENT

28 Till, gravel, clay, silt, alluvium (few if any bedrock exposures)

PLEISTOCENE OR RECENT

27 Basaltic cinder cone (incorporates cobbles of older rocks)

TERTIARY OR QUATERNARY

PLIOCENE OR PLEISTOCENE

26 26a, basaltic arenite, conglomerate, breccia, rubble; basaltic flows, locally pillowed; 26b, extinct basaltic volcanoes, basaltic flows and cinder deposits

TERTIARY

MIOCENE AND/OR PLIOCENE

25 Plateau lava; olivine basalt, basalt, andesite, related ash and breccia; basaltic arenite; minor plugs

MIOCENE

24 DEADMAN RIVER FORMATION: shale, sandstone, tuff, diatomite, conglomerate, breccia

EOCENE AND (?) OLIGOCENE

KAMLOOPS GROUP (21 and 22)

22 SKULL HILL FORMATION: dacite, trachyte, basalt, andesite, rhyolite, related breccias

EOCENE

21 CHU CHUA FORMATION: conglomerate, sandy shale, arkose, coal

MESOZOIC

CRETACEOUS

20 20a, quartz diorite, diorite, granodiorite (may include some older rocks)

APTIAN AND/OR ALBIAN

JACKASS MOUNTAIN GROUP

19 Greywacke, shale, siltstone; minor arkose and lenses of pebble conglomerate

JURASSIC (?)

18 Shale, grit

17 Chert-pebble conglomerate, greywacke

TRIASSIC OR JURASSIC

RHAETIAN OR HETTANGIAN

14 THUYA AND TAKOMKANE BATHOLITHS AND SIMILAR GRANITIC ROCKS: hornblende-biotite quartz diorite and granodiorite, minor hornblende diorite, monzonite, gabbro, hornblendite; 14a, diorite and syenodiorite; 14b, leuco-quartz monzonite and granodiorite

TRIASSIC

KARNIAN AND NORIAN

11 NICOLA GROUP

Augite andesite flows and breccia, tuff, argillite, greywacke, grey limestone

CRETACEOUS

20 RAFT AND BALDY BATHOLITHS AND SIMILAR GRANITIC ROCKS: biotite quartz monzonite and granodiorite; minor pegmatite, aplite, biotite-hornblende quartz monzonite; 20b, aplite, leuco-quartz monzonite and granite

JURASSIC

SINEMURIAN TO (?) MIDDLE JURASSIC

16 Porphyritic augite andesite breccia and conglomerate; minor andesite arenite, tuff, argillite, and flows (may include some 11); 16a, isolated areas of hornblende andesite (may be all or partly intrusive)

15 Andesitic arenite, siltstone, grit, breccia and tuff; local granite bearing conglomerate, greywacke; minor argillite and flows (may include some 11)

TRIASSIC OR JURASSIC

RHAETIAN OR HETTANGIAN

14 THUYA AND TAKOMKANE BATHOLITHS AND SIMILAR GRANITIC ROCKS: hornblende-biotite quartz diorite and granodiorite, minor hornblende diorite, monzonite, gabbro, hornblendite; 14a, diorite and syenodiorite; 14b, leuco-quartz monzonite and granodiorite

13 13a, fine- to medium-grained, pink to brown and grey syenite and monzonite; 13b, medium-grained, creamy-buff, locally coarsely porphyritic (K-feldspar) syenite and monzonite

TRIASSIC ?

KARNIAN AND NORIAN

11 NICOLA GROUP

Augite andesite flows and breccia, tuff, argillite, greywacke, grey limestone; 11a, includes minor 3 and 10

10 Black shale, argillite, phyllite, siltstone, black limestone

PERMIAN AND/OR TRIASSIC

LATE PERMIAN (?) EARLY AND/OR MIDDLE TRIASSIC
PAVILION GROUP (7, 8)

8 Tuff, chert, argillite, limestone, greywacke, andesitic and basaltic flows

7 Chert, argillite, siltstone; minor tuff and limestone

PERMIAN
GUADALUPIAN

6 CACHE CREEK GROUP (4 to 6)
MARBLE CANYON FORMATION: massive limestone, limestone breccia and chert; minor argillite, tuff, andesitic and basaltic flows

WOLFCAMPIAN TO GUADALUPIAN

5 Argillite, basaltic flows, tuff, chert, limestone

4 Basic volcanic flows, tuff, ribbon chert, limestone, argillite

PALEOZOIC

PROTEROZOIC (?)

PERMIAN AND/OR TRIASSIC

9 Serpentinite and serpentinized peridotite

12 12a, quartzite, quartz-phyllite, quartz-granule conglomerate, argillite, phyllite, calcareous phyllite, marble, greenschist, greenstone; 12b, dark grey and black argillite, siltstone, phyllite, minor limestone

PENNSYLVANIAN AND PERMIAN
MORROWAN TO GUADALUPIAN

3 CACHE CREEK GROUP
Volcanic arenite, greenstone, argillite, phyllite; minor quartz-mica schist, limestone, basaltic and andesitic flows, amphibolite, conglomerate and breccia; includes small bodies of 16a

MISSISSIPPIAN AND/OR LATER
SLIDE MOUNTAIN GROUP

2 FENNELL FORMATION: pillow lava flows, greenstone, foliated greenstone, greenschist, argillite, chert, minor amphibolite, limestone, breccia

WINDERMERE OR CAMBRIAN AND LATER
KAZA OR CARIBOO GROUP (1)

1 Feldspathic quartz-mica schist, locally garnetiferous, micaceous quartzite, black siliceous phyllite, quartz-hornblende-mica schist, marble, chlorite schist, greenstone, amphibolite

SHUSWAP METAMORPHIC COMPLEX

SHUSWAP METAMORPHIC COMPLEX

A Micaceous quartzo-feldspathic gneiss, quartz-mica schist, amphibolite, micaceous quartzite, pegmatite

Geological boundary (approximate) . . . .

Bedding, tops not indicated (inclined, vertical) . . . .

Schistosity and cleavage (inclined, vertical) . . . .

Fault (approximate, assumed) . . . .

Thrust fault (approximate, assumed) . . . .

Anticline (defined, approximate) . . . .

Syncline (defined, approximate) . . . .

Lineation (undifferentiated) 25

Small outcrop . . . . ×

Fossil locality . . . . Ⓕ

Mineral occurrence . . . . ×Au

MINERALS

Coal	Coal	Molybdenum	Mo
Copper	Cu	Silver	Ag
Diatomite	diat	Volcanic ash	ash
Gold	Au	Zinc	Zn
Lead	Pb		

Geology by R. B. Campbell and H. W. Tipper, 1964, 1965

PERMIAN AND/OR TRIASSIC

LATE PERMIAN (?) EARLY AND/OR MIDDLE TRIASSIC
PAVILION GROUP (7, 8)
8 Tuff, chert, argillite, limestone, greywacke, andesitic and basaltic flows

7 Chert, argillite, siltstone; minor tuff and limestone

PERMIAN
GUADALUPIAN
6 CACHE CREEK GROUP (4 to 6)
MARBLE CANYON FORMATION: massive limestone, limestone breccia and chert; minor argillite, tuff, andesitic and basaltic flows

WOLFCAMPIAN TO GUADALUPIAN
5 Argillite, basaltic flows, tuff, chert, limestone

4 Basic volcanic flows, tuff, ribbon chert, limestone, argillite

PERMIAN AND/OR TRIASSIC
9 Serpentinite and serpentinized peridotite

12 12a, quartzite, quartz-phyllite, quartz-granule conglomerate, argillite, phyllite, calcareous phyllite, marble, greenschist, greenstone; 12b, dark grey and black argillite, siltstone, phyllite, minor limestone

PENNSYLVANIAN AND PERMIAN
MORROWAN TO GUADALUPIAN
3 CACHE CREEK GROUP
Volcanic arenite, greenstone, argillite, phyllite; minor quartz-mica schist, limestone, basaltic and andesitic flows, amphibolite, conglomerate and breccia; includes small bodies of 16a

MISSISSIPPIAN AND/OR LATER
SLIDE MOUNTAIN GROUP
2 FENNELL FORMATION: pillow lava flows, greenstone, foliated greenstone, greenschist, argillite, chert, minor amphibolite, limestone, breccia

WINDERMERE OR CAMBRIAN AND LATER
KAZA OR CARIBOO GROUP (1)
1 Feldspathic quartz-mica schist, locally garnetiferous, micaceous quartzite, black siliceous phyllite, quartz-hornblende-mica schist, marble, chlorite schist, greenstone, amphibolite

SHUSWAP METAMORPHIC COMPLEX

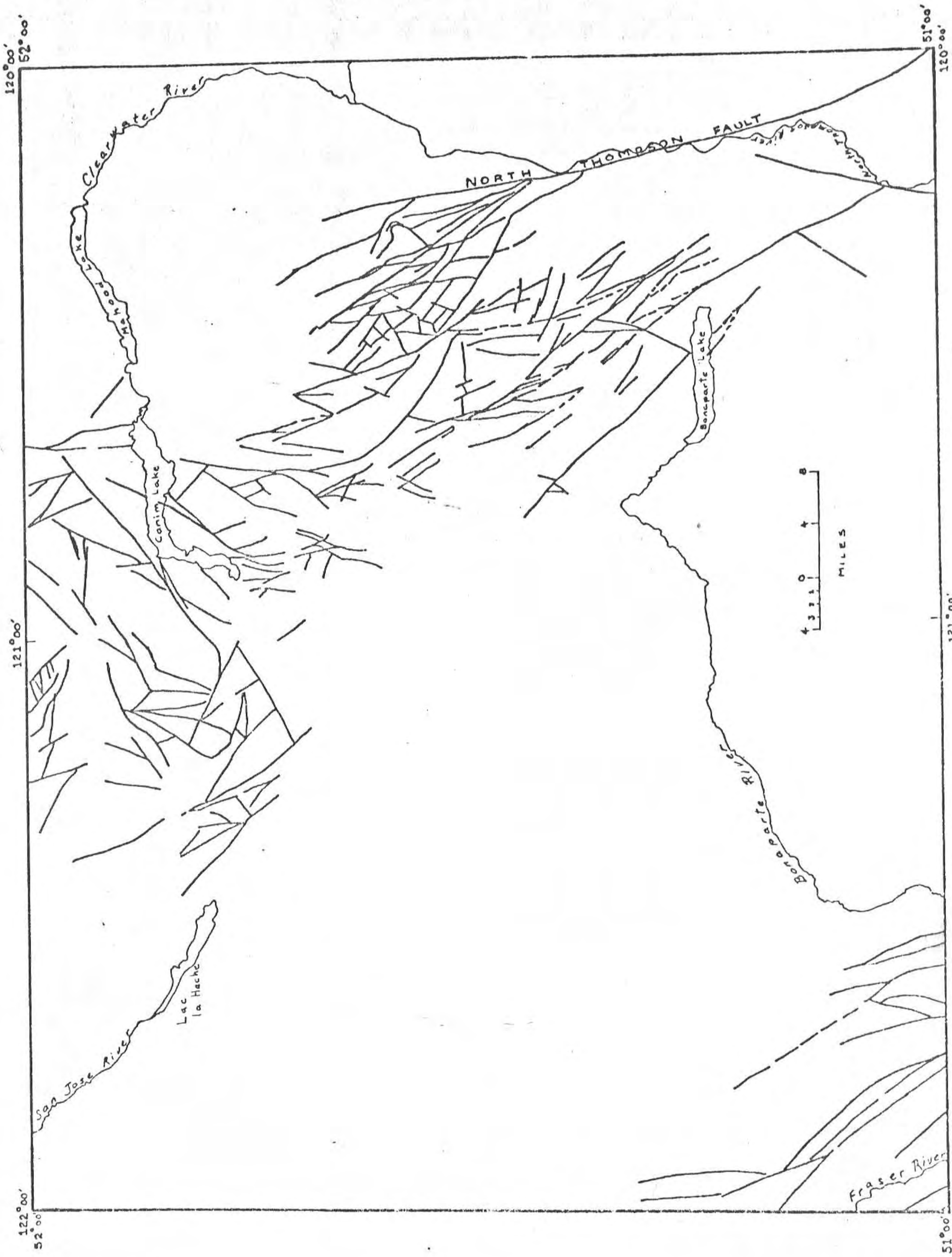

Figure 5. Pattern of block faulting in Eakin Creek region (northeast part) and normal faults in Marble Range (southwest part).

CHAPTER V

ECONOMIC GEOLOGY

Some parts of the Bonaparte River map-area are believed to have considerable potential for mineral exploration. This applies particularly to the region underlain by Triassic and Jurassic volcanic and sedimentary assemblages intruded by plutonic rocks having a variety of ages. The main geological features of the Princeton-Merritt-Kamloops copper producing area seem to be duplicated in Bonaparte River map-area, including somewhat similar fracture patterns expressed by topographic lineaments (M. Schau, personal communication; (see discussion in preceding chapter). To the northwest the same general belt contains the Boss Mountain molybdenum mine and several significant copper properties. Known mineral occurrences, of which many are listed in the succeeding section, provide ample evidence that deposits of economic interest are to be found within the map-area.

In the writer's opinion both the plutonic and the intruded rocks merit careful search. The widespread though not necessarily thick cover of glacial and recent deposits suggest that geophysical and geochemical prospecting techniques should be useful.

Description of Properties

The location of properties is shown on the index map (Fig. 6). The number of brackets following the name of each property corresponds to the number marking the location of the property on the index map.

Placer Deposits

Eakin or Three Mile Creek (1)

References: Uglow, W.L.: Geology of the North Thompson Valley Map-area, B.C.; Geol. Surv., Can., Sum. Rept., 1921, pp. 101A-102A (1922). Ann. Rept., Minister of Mines, B.C., 1931, p. A108 (1932).

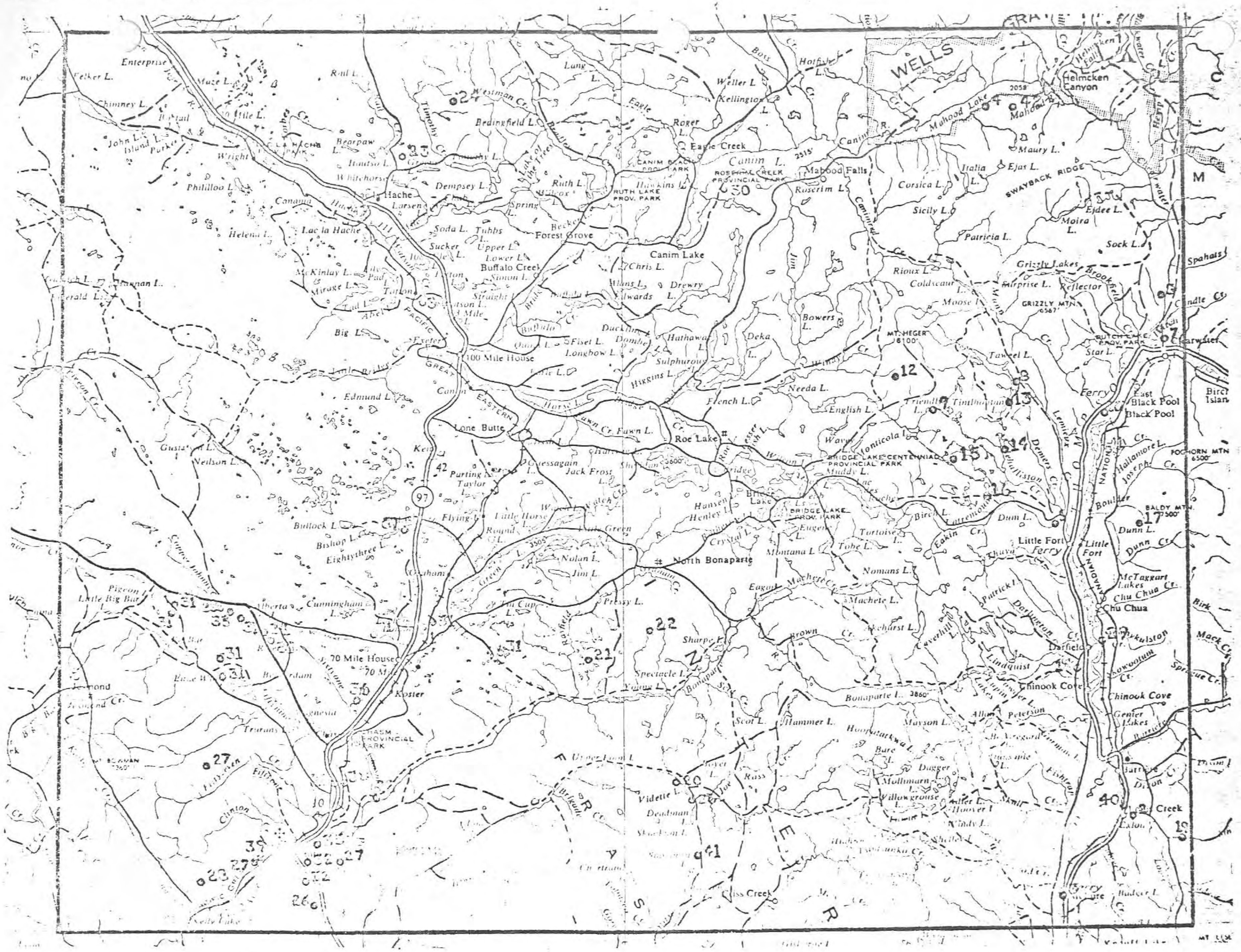

Figure 6. Index map of properties in Bonaparte River map-area.

Eakin Creek flows into Lemieux Creek, west of Mount Clie, on the North Thompson River. Recorded attempts to recover gold, present in gravels of this creek, took place in the early 1920s and 1930s and a small amount of coarse gold was obtained. This gold was derived, according to Uglow, from a boulder conglomerate of the Chu Chua Formation, which is located just upstream from the gold-bearing gravels.

Louis Creek Placer (2)

References: Ann. Rept., Minister of Mines, B.C., 1913, p. K207 (1914); 1931, p. 109A (1932). Uglow, W.L.: Geology of the North Thompson Valley Map-area, B.C.; Geol. Surv., Can., Sum. Rept., 1921, pp. 101A-102A (1922).

Louis Creek flows into the North Thompson River about 37 miles north of Kamloops. Gold is present in the creek gravels and placer mining was carried out at this locality as early as 1861, and continued sporadically until about 1932. Small amounts of placer gold were recovered. Uglow considers that the gold was probably derived originally from quartz veinlets in schists of the Shuswap region.

McLure Mines (3)

References: Ann. Rept., Minister of Mines, B.C., 1931, p. A109 (1932).

Placer mining leases were obtained to exploit bench-ground at McLure on the North Thompson River, 28 miles north of Kamloops. Expected values did not materialize.

Gold, Silver, Copper, Molybdenum, Lead and Zinc Properties

Mahood Lake (4)

Reference: Ann. Rept., Minister of Mines, B.C., 1924, p. B153 (1925)

A sample of possible gold-silver ore from the south side of Mahood Lake was recorded in 1924.

Clearwater (5)

Reference: Robinson, W.C.: Ann. Rept., Minister of Mines, B.C., 1964, p. 99 (1965).

Molybdenum showings occur on the west side of the Clearwater River 6 miles north of Clearwater is granitic rocks of Raft Batholith. Claims are held by Southwest Potash Corporation, Vancouver. Molybdenum mineralization is present mainly in a set of narrow, widely spaced quartz veinlets. In 1964, 2 holes totalling 1,414 feet were drilled.

Sands Creek (6)

Reference: Walker, J.F.: Clearwater River and Foghorn Creek Map-area, Kamloops District, British Columbia; Geol. Surv., Can., Sum. Rept., 1930, p. 153A (1931). Stevenson, J.S.: Molybdenum Deposits of British Columbia, B.C. Dept. Mines, Bull. 9, pp. 33-34 (1940). McCammon, J.W.: Ann. Rept., Minister of Mines B.C., 1961, pp. 51-53 (1962).

Molybdenite has been reported since 1930 from Sands Creek, a small stream flowing into Clearwater River about 2 miles north of Clearwater Station on the Canadian National Railways.

Claims were located during 1959-1960 and exploration carried out in 1960-61 by the Calder Molybdenum Company Limited but no development has taken place.

Molybdenite is present both in quartz veins and pegmatitic dykes cutting granodiorite and also disseminated through the granodiorite.

Empire and Bluebird (7)

Reference: Ann. Rept., Minister of Mines, B.C., 1934, p. D26 (1935).

The properties were located 1 mile north of Clearwater Station on the Canadian National Railways. Pyrite, galena and sphalerite are in quartz veins in schists.

Lemieux Creek (8)

References: Ann. Rept., Minister of Mines, B.C., 1924, p. B152 (1925).

Silver-lead ore was reported in 1924 from a locality near the head of Lemieux Creek which enters the North Thompson River at Mount Olie.

Friendly Lake (9)

References: Robinson, W.C.: Ann. Rept. Minister of Mines, B.C., 1965, p. 159 (1966). Waterland, T.M.: Ann. Rept., Minister of Mines, B.C., 1966, p. 143 (1967).

Claims held by Anaconda American Brass, Limited, at Friendly Lake about 20 miles by road northeast of Bridge Lake consist of sulphides, including pyrite, galena, molybdenite, chalcopyrite and bornite disseminated and as seams and blebs in fractures in andesite and tuff.

Mann Creek (10)

References: Uglow, W.L.: Geology of the North Thompson Valley Map-area, B.C.; Geol. Surv., Can., Sum. Rept., 1921, p. 105A (1922).

This prospect is situated $1\frac{1}{2}$ miles from the mouth of Mann Creek which enters the North Thompson River south of Black Pool.

Black graphitic schist associated with the Fennell Greenstone is stained with azurite and malachite at this locality.

Queen Bess (11)

References: Ann. Rept., Minister of Mines, B.C., 1895, p. 665 (1896) 1918, pp. K234-236 (1919); 1951, pp. A125-A128 (1952). Uglow, W.L.: Geology of the North Thompson Valley Map-area, B.C.; Geol. Surv., Can., Sum. Rept., 1921, pp. 102A-103A (1922). Walker, J.F.: Clearwater River and Foghorn Creek Map-area, Kamloops District, British Columbia; Geol. Surv., Can., Sum. Rept., 1930, pp. 140A-143A (1931).

The Queen Bess property is located on the east side of North Thompson River valley, 1,000 feet above the valley bottom and 3 miles south of the Canadian National Railways station at Black Pool.

Crown grants were issued for the Ironclad and Lone Prospector claims in 1895. Exploitation of this property by the Queen Bess Mines Company took place between 1917 and 1920, when underground work was carried out, a mill constructed, and a small amount of concentrates produced. Last reported work on the property was in 1927. In 1951, the Lone Prospector and Ironclad claims, covering most of the showings, were owned by G.F. McGregor of the Spar-Mac Ranch at Black Pool.

Erratic mineralization occurs mainly in three narrow fissures, the two main ones being known as the Cameron and Bigelow veins. These fissures are in greenstones of the Fennell Formation (map-unit 2).

Mineralization consists of sphalerite, galena and minor tetrahedrite, with disseminated sulphides in quartz and quartz dolomite gangue in leaner parts of the veins.

The first width run of 720 tons gave 27 tons of lead concentrates assaying 40 to 50 per cent lead, 12 per cent zinc and 48 ounces of silver per ton, and 78 tons of zinc concentrates assaying 48 per cent zinc, 7 to 8 per cent lead and 14 ounces of silver per ton.

Underground workings of this property have been examined and described in some detail by Uglow, Walker and McCammon (Ann. Rept., Minister of Mines, B.C. 1951, pp. A125-A128 (1952)).

Silver Lake (12)

References: Ann. Rept., Minister of Mines, B.C., 1926, p. A187 (1927); 1927, p. C192 (1928); 1930, p. A192 (1931).

This property is 20 miles northwest of Mount Olie, on the North Thompson River, exploration work was reported in 1926, 1927 and 1930.

Zinc, with some lead and silver are reported to occur in a mineralized shear zone in black argillite.

Tintlhohtan Lake (13)

References: Stevenson, J.S.: Molybdenum Deposits of British Columbia; B.C. Dept. Mines, Bull. 9, pp. 20-28 (1940). McCammon, J.W.: Ann. Rept., Minister of Mines, B.C., 1961, pp. 49-51 (1962). Robinson, W.C.: Ann. Rept., Minister of Mines, B.C., 1965, p. 160 (1966).

Molybdenite claims were staked both in 1938-1939 and in 1960-1961 northeast of Tintlhohtan Lake, 12 miles northwest of Little Fort in North Thompson River valley.

Investigation both in 1938-1939, when the ground was known as the Anticlimax property, and in 1960-1961 by the Calder Molybdenum Company Limited has not resulted in development. Molybdenite occurs in pegmatite and quartz veins and lenses in an alkali-granite stock.

The property is described in some detail by Stevenson and McCammon.

Nehalliston Creek (14)

Reference: Waterland, T.M.: Ann. Rept., Minister of Mines, B.C., 1966, p. 144 (1967).

Near the head of Nehalliston Creek on the southwest side of Silver (Deer) Lake copper-lead-zinc claims are held by the United Copper Corporation, Limited.

Little Fort (15)

Reference: Waterland, T.M.: Ann. Rept., Minister of Mines, B.C., 1966, p. 143 (1967).

Ten miles northwest of Little Fort on claims held by Anaconda American Brass, Limited, pyrite, magnetite, pyrrhotite, and chalcopyrite occur in fracture fillings in dioritic and volcanic rocks.

Lakeview (16)

References: Ann. Rept., Minister of Mines, B.C., 1930, pp. A191-192 (1931); 1931, p. A108 (1932). B.C. Dept. Mines, Bull. 1, pp. 68-69 (1932).

This property, situated 9 miles west of Mount Olie on the North Thompson River, was discovered in 1930. It was acquired by the Premier Gold Mining Company who carried out exploration during 1930-1931, but abandoned the property in 1931.

Gold is associated with arsenopyrite, in a massive pyrrhotite and magnetite replacement body in limestone.

Windpass - Gold Hill properties (17)

References: Ann. Rept., Minister of Mines, B.C., 1916, p. K266 (1917); 1917, pp. F219-221 (1918); pt. A, 1925, pp. A167-A170 (1926); 1934, pp. D26-D27 (1935); 1961, p. 49 (1962). Uglow, W.L.: Geology of the North Thompson Valley Map-area, B.C.; Geol. Surv., Can., Sum. Rept., pt. A, 1921, pp. 99A-100A (1922). B.C. Dept. Mines, Bull. 1, pp. 68-69 (1932).

This group of properties is west of Baldy Mountain, east of Dunn Lake, and about 8 miles north-northeast of Chu Chua.

Gold-bearing quartz was discovered in 1916 and a car-load sample was shipped from Windpass No. 1 claim. Additional claims, the Sweet Home, Gold Hill, Keystone and Red Top, were located nearby. Development work proceeded sporadically before and during early 1920s but ceased in 1925. The Windpass and Sweek Home properties were further developed by Windpass Gold Mining Company Limited in 1933 and subsequent years when a mill was constructed and concentrates produced. The mines were closed in 1939. Fort Reliance Minerals Limited now hold mineral leases covering the former Windpass properties.

On the Windpass property, the mineralization is in a quartz vein cutting a pyroxenite sill. Free gold, gold tellurides, bismuth chalcopyrite and magnetite are associated. On the Sweet Home claims a quartz vein, crossing the contact between the pyroxenite sill and banded chert of the Fennell Formation (map-unit 2) contains gold, chalcopyrite, pyrite and bismuth. Mineralization is in two shear zones in greenstones of the Fennell Formation on the Gold Hill property. These shear zones are altered to siliceous ferrodolomite, and cut by quartz stringers which contain free gold together with galena, chalcopyrite, pyrite and sphalerite.

Assays from shipments made in 1916 and 1917 are, respectively gold, 2.40 ounces per ton, silver, 0.90 ounces per ton, and copper 1.46 per cent; gold, 2.14 ounces per ton, silver, 1.40 ounces per ton and copper, 0.58 per cent.

Allies (18)

References: Uglow, W.L.: Geology of the North Thompson Valley Map-area, B.C.; Geol. Surv., Can., Sum. Rept., 1921, pp. 100A-101A (1922).

This prospect is on the west side of the North Thompson River, 2 miles north of Chinook Cove.

Quartzites and concordant feldspar porphyry and felsite dykes of the "Badger Creek Formation" (included in the Cache Group in this report) contain quartz veins. Pyrite, galena and chalcopyrite are disseminated through the veins.

Fortuna Group; Skookum Claim (19)

References: Ann. Rept., Minister of Mines, B.C., 1908, p. J123 (1909); 1913, pp. K209-210 (1914); 1918, p. K236 (1919). Uglow, W.L.: Geology of the North Thompson Valley Map-area, B.C.; Geol. Surv., Can., Sum. Rept., 1921, pp. 104A-105A (1922).

The Fortuna Group was located about 8 miles southeast of the Canadian National Railways Station of Louis Creek. The Skookum claim is located about ½ mile north of the Fortuna.

The Fortuna property was worked in 1907-1908 by the Fraser River Copper Mining Company; no subsequent work has been reported.

Pyrite replacing a dolomite bed in argillaceous schists and quartzites of map-unit 12a form the main orebody. Traces of copper mineralization and minor amounts of galena are present. Gold, silver and copper have been reported both from this body, and from quartz stringers in the schists. Platinum was reported in small amounts in the pyrite although Uglow states that analyses of picked samples failed to show any trace of platinum.

The Skookum claim consists of a narrow zone of pyrite and chalcopyrite in quartzites of map-unit 12a.

Vidette Lake Area (20)

<u>References:</u> Stevenson, J.S.: Ann. Rept., Minister of Mines, B.C., 1931-1940 (1931-1941); especially 1936, pp. F36-F43 (1937). B.C. Dept. Mines, Bull. 1, p. 71 (1932).
Cockfield, W.E.: Lode gold deposits of Fairview Camp, Camp McKinney, and Vidette Lake area, and the Dividend-Lakeview property near Osoyoos, B.C.; Geol. Surv., Can., Mem. 179, pp. 26-36 (1935).

Several properties, around the northern half of Vidette Lake on Deadman River, were owned by Vidette Gold Mines Ltd., Hamilton Creek Gold Mines Ltd., and Savona Gold Mines Ltd., the latter company owning the Last Chance - Sylvanite group of claims.

These properties were developed during the thirties, but the only one exploited extensively was owned by Vidette Gold Mines Ltd. This property was located in 1931, was subsequently developed, a mill constructed, and the mine remained in nearly continuous operation until 1940, when it was abandoned.

The ore deposits occur in narrow, fairly continuous quartz veins in greenstone of the Nicola Formation (map-unit 11). Mineralization consists of pyrite, chalcopyrite and reported tellurides, accompanied by gold.

Maximum recorded production for 1 year from the Vidette property was in 1936, when 12,202 tons of ore yielded 8,269 ounces of gold, 13,037 ounces of silver and 27,672 pounds of copper.

The workings have been described in detail by Cockfield and Stevenson.

70-Mile House (21)

Reference: Waterland, T.M.: Ann. Rept., Minister of Mines, B.C., 1966, pp. 135-136 (1967).

Bornite is reported in claims held by Cominco, Limited, 15 miles due east of 70-Mile House. It occurs as fracture fillings and minor disseminations in syenite (map-unit 14).

C-Soo Group (22)

Reference: Waterland, T.M.: Ann. Rept., Minister of Mines, B.C., 1966, pp. 135-136 (1967).

The C-Soo Group of claims east of 70-Mile House, at the head of Campeau Creek, is reported as a copper prospect. Copper Soo Mining Company Limited had geophysical and geochemical surveys conducted in 1966.

Lac la Hache (23)

References: Waterland, T.M.: Ann. Rept., Minister of Mines, B.C., 1966, p. 135 (1967).

Six miles northeast of Lac la Hache on claims owned by Anaconda American Brass Limited, veins carrying galena, chalcopyrite and sphalerite with associated malachite and azurite occur in andesite (map-unit 11).

North of

Lac la Hache (24)

Reference: Waterland, T.M.: Ann. Rept., Minister of Mines, B.C., 1966, p. 135 (1967).

Twelve miles northeast of Lac la Hache, on claims held by Coranex Limited, Vancouver, chalcopyrite occurs as fracture fillings and as disseminations in Nicola volcanic rocks (map-unit 11).

Chromite Occurrence

North of Clinton (25)

References: Ann. Rept., Minister of Mines, B.C., 1932, p. A154 (1933).

On the west side of the Bonaparte River, 7 miles north of Clinton on claims owned by W.N.D. McKay, Clinton, in a serpentinized belt of dunite numerous nodules of high grade float and narrow segregations of speckled chromite in place were reported.

Nickel Deposit

South of Clinton (26)

Reference: Reinecke, L.: Mineral Deposits between Lillooet and Prince George, British Columbia; Geol. Surv., Can., Mem. 118, p. 96 (1920).

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Garnierite was reported about 4½ miles south of Clinton, ½ mile West of Hwy 97. An assay reported 0.11% Nickel

and 0.17 per cent chromium oxide, Cr_2O_3.

Manganese Deposits

Clinton (27)

References: Reinecke, L.: Mineral Deposits between Lillooet and Prince George, British Columbia; Geol. Surv., Can., Mem. 118, p. 95 (1920). Holland, S.S.: Ann. Rept., Minister of Mines, 1948, pp. 91-92 (1949).

Manganese occurs in three locations in the west half of the map-area. Near the base of the Marble Range, about 10 miles northwest of Clinton in argillites and cherts of the Cache Creek Group, a deposit, owned by W. Murray, New Westminster, contains psilomelane, manganite and pyrolusite. Assay results were manganese 7.59 per cent, silica 82.57 per cent, and phosphorus 0.018 per cent.

Just west of the Pacific Great Eastern Railway 3½ miles southwest of Clinton, brick coloured cherty quartzite with thin films of black manganese along fracture surfaces assayed about 0.75 per cent manganese. In an open-cut, rock mineralized with pyrolusite in stringers assayed 15.8 per cent manganese.

On the southeast side of Hart Ridge, 4 miles southeast of Clinton, manganese oxides occur in narrow fractures in white or yellow stained quartzite.

Chrysotile Occurrences

Clinton (28)

References: Dawson, G.M.: Geol. Surv., Can., Ann. Rept. VII B, 1894, p. 345 (1896). Robinson, W.C.: Ann. Rept., Minister of Mines, B.C., 1960, pp. 130-132 (1961).

Across the road from the Maud Ranch, 6 miles by road northeast of Clinton, chrysotile in veinlets generally narrower than 1/16 inch is abundant in a small serpentine mass.

Small veins of chrysotile or serpentine asbestos occur on the south side of Mount soues, southeast of Clinton.

Coal

Chu Chua Coal Mining Syndicate (29)

References: Dawson, G.M.: Report on the area of the Kamloops map-sheet, British Columbia; Geol. Surv., Can., Ann. Rept., (New Series) vol. VII, 1894, p. 228B (1896). Ann. Rept., Minister of Mines, B.C., 1920, p. N168 (1921); 1922, p. N146 (1923). Uglow, W.L.: Geology of the North Thompson Valley Map-area, B.C.; Geol. Surv., Can., Sum. Rept., 1921, pp. 92A-98A (1922).

Coal occurs in the lower part of Newhykulston Creek, south of Chu Chua in the North Thompson River valley, about 50 miles north of Kamloops.

First recorded examination of the deposits was in 1877. Development and exploitation of the property was undertaken by the Chu Chua Coal Mining Syndicate and a small amount of coal produced. The property was shut down in 1923. The coal forms thin seams in shales and sandstones of the Eocene Chu Chua Formation and is classified as low-rank bituminous, or high-rank sub-bituminous.

A detailed report on the property is given by W.L. Uglow.

Canim Lake (30)

References: Ann. Rept., Minister of Mines, B.C., 1923, p. A168 (1924).

Annual Report of the B.C. Minister of Mines for 1923, notes that 'an occurrence of coal is reported in the vicinity of Canim Lake'.

Saline Lakes

Saline lakes have been known in the western half of the map-area for many years and these have been discussed by Reinecke (1920, pp. 51-62) and Cummings (1940, pp. 1-24, 30-32, 40-41, 60-61) and it is from their reports that the following information is taken. For complete information on these lakes and their history, the reader is referred to the reports by Reinecke and Cummings and the additional references mentioned there. So far as is known there has been no interest in these lakes in recent years.

The saline lakes are small and undrained in which the concentration of salts has occurred as a result of evaporation. The important dissolved salts are sodium carbonate, magnesium carbonate, sodium sulphate, and magnesium sulphate. The source of the salts is apparently the underlying rocks from which the material is leached and carried by surface drainage or springs into the lake basins. It has also been suggested that water from volcanic activity has been direct source of the salts.

Soda Lakes (31)

References: Reinecke, L.: Mineral Deposits between Lillooet and Prince George, British Columbia; Geol. Surv., Can., Mem. 118, pp. 57-63 (1920). Cummings, J.M.: Saline and Hydromagnesite Deposits of British Columbia; B.C. Dept. Mines, Bull. 4 pp. 1-24 (1940).

Soda lakes contain brines with mainly dissolved sodium carbonate (Na_2CO_3) or sodium carbonate, magnesium carbonate ($MgCO_3$)

and other salts in small quantities. In this area they are restricted entirely to areas of flat-lying plateau lavas (map-unit 25). The lakes are fed by surface drainage as well as by springs. Soda lakes are concentrated south, southeast and east of Meadow Lake, northwest, northeast and east of 70-Mile House, and near Mount Begbie. From some of these a small commercial production has been caried out.

Epsomite Lakes (32)

References: Reinecke, L.: Mineral Deposits between Lillooet and Prince George, British Columbia; Geol. Surv., Can., Mem. 118, pp. 51-57 (1920). Cummings, J.M.: Saline and Hydromagnesite Deposits of British Columbia; B.C. Dept. of Mines, Bull. 4, pp. 40-41 (1940).

Two small lakes southeast of Clinton contain epsomite (magnesium sulphate). The lakes lie on Cache Creek Group rocks (map-unit 4) of which basic lavas are a major rock type. Presumably surface water and springs percolating through these rocks have leached magnesium sulphate which was concentrated by evaporation in these lakes.

Hydromagnesite Deposits

Deposits of hydromagnesite occur in four areas in the west half of the map-area. These deposits are small and have been described by Reinecke (1920, pp. 20-49) and Cummings (1940, pp. 102-129). Hydromagnesite deposits in this area are a mixture of hydrated magnesium carbonate, calcium carbonate and magnesium sulphate.

Meadow Lake (33)

References: Reinecke, L.: Mineral Deposits between Lillooet and Prince George, British Columbia; Geol. Surv., Can., Mem. 118, pp. 44-46 (1920). Cummings, J.M.: Saline and

Hydromagnesite Deposits of British Columbia, B.C. Dept. of Mines, Bull. 4, pp. 102-108 (1940).

The Meadow Lake deposits comprising about five areas of fairly pure hydromagnesite occur ½ to 2 miles east of Meadow Lake. They underlie an area calculated by Cummings (1940, p. 104) to be 244,000 square yards. Tonnage calculated by Cummings (1940, p. 105) was 114,200 tons.

Watson Lake (34)

References: Reinecke, L.: Mineral Deposits between Lillooet and Prince George, British Columbia; Geol. Surv., Can., Mem. 118, pp. 46-48 (1920). Cummings, J.M.: Saline and Hydromagnesite Deposits of British Columbia; B.C. Dept. of Mines, Bull. 4, pp. 108-110 (1940).

The deposit is situated ¼ mile south of Watson Lake, a small lake about one mile east of Tatton station on the Pacific Great Eastern Railway, southeast of Lac la Hache. Several small areas totalling 26,000 square yards contain an estimated 23,500 tons of hydromagnesite (Cummings, 1940, p. 109).

Clinton (35)

References: Reinecke, L.: Mineral Deposits between Lillooet and Prince George, British Columbia; Geol. Surv., Can., Mem. 118, p. 44 (1920). Cummings, J.M.: Saline and Hydromagnesite Deposits of British Columbia; B.C. Dept. of Mines, Bull. 4, pp. 112-113 (1940).

The Clinton deposits lie in the valley of Clinton Creek, about ½ mile east of Clinton. Three small hydromagnesite deposits have an area of 3,310 square yards and have a tonnage of 2,650 tons.

Sixty-one Mile Creek (36)

Reference: Cumming, J.M.: Saline and Hydromagnesite Deposits of British Columbia; B.C. Dept. of Mines, Bull. 4, pp. 113-114 (1940).

A deposit of hydromagnesite lies about 4 miles north of Chasm Provincial Park. Cummings (1940, p. 113) reported that it covers an area of 13,000 square yards and contains a probable 9,000 to 10,000 tons.

Magnesite Occurrences

Lac la Hache (37)

Reference: Camsell, C.: Note on the occurrences of diatomaceous earth, clay, and magnesite along the route of the Pacific Great Eastern Railway. Geol. Surv., Can., Sum. Rept., Pt. B, 1917, p. 25 (1918).

On the southwest side of Lac la Hache, hard, white, fine-grained magnesite is reported in volcanic rocks as a number of short, narrow veins. Chemical analysis showed the composition to be magnesium carbonate 70 per cent, calcium carbonate 27 per cent, and iron 2 per cent.

Clinton (38)

Reference: Cockfield, W.E., and Walker, J.F.: An occurrence of magnesite near Clinton, British Columbia, Geol. Surv., Can., Sum. Rept., Pt. AII, 1932, pp. 72-72 (1933). Ann. Rept., Minister of Mines, B.C. 1947, p. 220 (1948).

About 6 miles from Clinton and a mile east of the Mond ranch, magnesite occurs in badly altered, basic rock, now consisting largely of serpentine. The magnesite apparently formed from surface alteration of this rock. Complete alteration produces a fine-grained, dense magnesite of good quality.

Travertine Deposit

Clinton (39)

References: Reinecke, L.: Mineral Deposits between Lillooet and Prince George, British Columbia; Geol. Surv., Can., Mem. 118, pp. 49-51 (1920). Merritt, J.E.: Ann. Rept., Minister of Mines, B.C., 1948, p. 188 (1949); 1949, p. 256 (1950); 1953, p. 191 (1954).

A dome-shaped deposit of travertine or calcareous tufa located 3 miles west of Clinton on the Pacific Great Eastern Railway is owned by Clinton Lime Holdings, Limited, Vancouver. The deposit is bedded and consists of firmly compacted rock. From 1947 to 1953 agricultural lime was produced.

Gypsum

Louis Creek Deposit (40)

References: Davis, A.W.: Ann. Rept., Minister of Mines, B.C., 1922, p. N153-N154 (1923).

A small deposit of relatively pure 'gypsite' on the North Thompson River, near Louis Creek, about 40 miles north of Kamloops was judged capable of limited production by Davis but no subsequent development has been recorded.

Volcanic Ash

Deadman River (41)

References: Eardley-Wilmot, V.L.: Siliceous Abrasives; sandstones, quartz, tripoli, pumice, and volcanic dust; Mines Branch, Dept. Mines, Canada, No. 673, pp. 87-89 (1927). Ann. Rept., Minister of Mines, B.C. 1959, pp. 181-185

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Acid volcanic ash of late Tertiary age, which outcrops in the Deadman River valley near Snohoosh Lake, has been considered at different times as a possible source of abrasive material or of pozzolan. The ash isin flat-lying beds of irregular thickness, and large outcrops form steep bluffs on the sides of Deadman River Valley. The commonest type is buff to grey or yellow and medium grained, but may be coarser. It consists mainly of devitrified glass, with quartz and feldspar fragments. Beds of white ash, within the buff ash, are extremely fine grained and uniform and composed of fragments of clear volcanic glass.

Prior to 1927, the white ash bed at Sherwood (Last Chance) Creek, a tributary flowing into Snohoosh Lake, was staked and about 1 ton of material removed. Later, ash staked by T.C. McAlpine as a source of pozzolan, was examined in March, 1959, by C. Riley, for Industrial Minerals Ltd., a privately owned company. Preliminary estimates of the deposits were placed at 15 million tons. Little development work had been done at this time (1959) and no subsequent development has been reported.

Muscovite

Mahood Lake (42)

References: Cummings, J.M.: Ann. Rept., Minister of Mines, B.C., 1947, p. 226 (1948).

Muscovite mica of possible commercial value is present near Mahood Lake, although, according to Cummings, the proportion of mica of marketable grade is too low to be exploited profitably.

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ABSTRACT

Bonaparte River map-area comprises about 6,000 square miles and includes parts of several subsidiary plateau and highland divisions of the Interior Plateau of British Columbia. The region was entirely covered by the last major Pleistocene ice sheet flowing from the Cariboo Mountains to the north and northeast.

The rocks of the map-area range in age from late Precambrian to Recent. Parts of three major tectonic elements are represented; the relatively little deformed thick Mesozoic rocks of the Quesnel Trough are flanked on the east by the metamorphosed and highly deformed late Precambrian to late Paleozoic rocks of the Omineca Geanticline, and on the west by the folded late Paleozoic rocks of the Pinchi Geanticline.

Granitic rocks were emplaced in two major episodes. Hornblende-bearing granodiorite and quartz diorite batholiths are about 190 million years old and non-hornblendic quartz monzonite and granodiorite intrusions are about 100 million years old. Syenitic rocks are evidently related to the older intrusions.

Cenozoic rocks, particularly undeformed Miocene basaltic plateau lavas, cover a large part of the map-area. Middle Eocene volcanic rocks lie unconformably beneath the plateau lavas. Sequences of sedimentary rocks locally underlie each Tertiary volcanic formation. Pleistocene and Recent basaltic volcanic deposits are prominent near the northeast corner.

The Mesozoic rocks of the Quesnel Trough and associated granitic batholiths and minor intrusions reflect many of the relationships that characterize the copper-producing area to the south.

TABLE OF FORMATIONS

ERA	PERIOD	EPOCH	GROUP	FORMATION	MAP UNIT	LITHOLOGY
CENOZOIC	Quaternary	Recent			29	Blocky basalt flows
		Pleistocene and Recent			28	Till, gravel, clay, silt, alluvium
		Pleistocene or Recent			27	Basaltic cinder cone (Pyramid Mt.)
	Tertiary or Quaternary	Pliocene or Pleistocene			26	Basaltic arenite, conglomerate, breccia and rubble, basaltic flows, cinder deposits, cones
			Erosional interval in part			
	Tertiary	Late Miocene and/or Pliocene			25	Olivine basalt, andesite, related ash and breccia, minor plugs
		Late Miocene		Deadman River Formation	24	Shale, sandstone, tuff, diatomite, conglomerate, breccia
			Unconformity			
		Oligocene			23	Andesite, dacite, felsite, related tuff and breccia, greywacke, shale, minor lignite and conglomerate
			Not in contact			
		Eocene and (?) Oligocene	Kamloops Group	Skull Hill Formation	22	Dacite, trachyte, basalt, andesite, rhyolite and related breccia
				Chu Chua Formation	21	Conglomerate, sandy shale, arkose, coal
			Unconformity			
MESOZOIC	Cretaceous		Raft and Baldy batholiths and other granitic rocks		20	Biotite quartz monzonite, granodiorite, hornblende diorite, quartz diorite, aplite, pegmatite, leuco-quartz monzonite
			Not in contact, intrusive into Jurassic and older rocks			
		Aptian and/or Albian	Jackass Mountain Group		19	Greywacke, shale, siltstone, minor arkose and lenses of pebble conglomerate
			Not in contact			
	Jurassic (?)				18	Shale and grit
						Fault contact
					17	Chert pebble conglomerate and greywacke
			Not in contact			
	Jurassic	Sinemurian to (?) middle Jurassic			15,16	Andesitic arenite, siltstone grit, breccia, and tuff; minor argillite and flows (map-unit 15) (all or in part contemporaneous with map-unit 16 / Porphyritic augite andesite breccia and conglomerate minor andesitic arenite, tuff, argillite, and flows (map-unit 16) / Boulder and cobble conglomerate grit, greywacke (base of map-unit 15)
	Triassic or Jurassic	Rhaetian or Hettangian	Thuya and Takomkane batholiths, other granite rocks, and syenite		13,14	Hornblende-biotite quartz diorite and granodiorite, hornblende diorite, monzonite, syenite, syenodiorite, and hornblendite
			Intrusive Contact			
	Triassic	Karnian and Norian	Nicola Group		11	Andesitic flows and breccia, tuff, argillite, greywacke, grey limestone
			Not in contact, in part correlative			
					10	Black shale, argillite, phyllite, siltstone, black limestone
			Relations uncertain			
PALEOZOIC and/or MESOZOIC	Permian and/or Triassic				9	Serpentinite and serpentinized peridotite
			Not in contact			
			Pavilion Group		8	Tuff, chert, argillite, limestone, greywacke and basaltic flows
					7	Chert, argillite, siltstone; minor tuff, and limestone
			Fault contact, relations otherwise uncertain			
PALEOZOIC	Permian	Guadalupian	Cache Creek Group	Marble Canyon Formation	6	Massive limestone, limestone breccia, chert, minor argillite, tuff, and andesitic and basaltic flows
		Wolfcampian to Guadalupian			5	Argillite, basaltic flows, tuff, chert, limestone
					4	Basic volcanic flows, tuff, ribbon chert, limestone, argillite
			Not in contact			
	Pennsylvanian and Permian	Morrowan to Guadalupian	Cache Creek Group		3	Volcanic arenite, greenstone, argillite, phyllite; minor quartz-mica schist, limestone, basaltic and andesitic flows, amphibolite, conglomerate and breccia
			Fault contact, relations otherwise uncertain			
	Mississippian and/or later		Slide Mountain Group	Fennell Formation	2	Pillow lava flows, greenstone, foliated greenstone, greenschist, argillite, chert, minor amphibolite, limestone, and breccia
			Fault contact, relations otherwise uncertain			
PROTEROZOIC or PALEOZOIC	Windermere or Cambrian and later		Kaza or Cariboo Group		1	Feldspathic quartz-mica schist, locally garnetiferous, micaceous quartzite, black siliceous phyllite, quartz-hornblende-mica schist, marble, chlorite schist, greenstone, and amphibolite
			Relations unknown			
UNKNOWN			Shuswap Metamorphic Complex		A	Micaceous quartzo-feldspathic gneiss, quartz-mica schist, amphibolite, micaceous quartzite, and pegmatite