# TERTIARY STRATIGRAPHY & INDUSTRIAL MINERALS, BONAPARTE TO DEADMAN RIVERS (92P/2 & 92P/3), BRITISH COLUMBIA

**TERTIARY STRATIGRAPHY AND INDUSTRIAL MINERALS, BONAPARTE TO DEADMAN RIVERS, SOUTHWESTERN BRITISH COLUMBIA (92P/2 & 92P/3)**

P.B. Read

INTRODUCTION

The map area straddles part of the southern edge of thousands of square kilometres of Miocene basalt flows which extend from the Thompson and North Thompson rivers on the south and east respectively to the western edge of the Interior Plateau, and northwestward into the Chilcotin-Nechako basin. The map area includes the northwesterly extension of a broad syncline that lies between Bonaparte and Deadman rivers (Read, 1988) and contains Eocene volcanic rocks of the Kamloops Group. The Tertiary rocks lie on a faulted basement composed of the Cache Creek Complex along the west edge, and the Nicola Group, Ashcroft Formation and Thuya Batholith to the east.

The area was selected to study the setting of the Red Lake diatomaceous earth deposit and assess the potential for similar deposits. Except for the distribution of the Miocene and Eocene, this detailed mapping differs little from the regional geology of Campbell and Tipper (1971).

TERTIARY STRATIGRAPHY

In the map area, the mid-Eocene volcanic rocks of the Kamloops Group underlie the Miocene between Gorge Creek in the south and Bonaparte River in the north. With the exception of a few lenses, the Kamloops Group consists of aphanitic, medium grey, nonvesicular to locally highly vesicular dacite and andesite breccia (Evdx) and flows (Evd). Breccia forms the basal unit and attains a thickness of 200 to 300 metres in Loon valley on the west side of the area. On both sides of Loon Lake, flows interfinger with and overlie the breccia. Between Loon and Hihium lakes, platy-jointed and flow-layered flows reach a thickness of at least 600 metres. A few lenses, up to 25-metres in thickness, of bedded rhyolite tephra (Etf) lie near the breccia-flow boundary. These outcrop on the north side of Loon Lake and on the north side of Bonaparte River east of Chasm Creek where andesite and dacite clasts occur in a bedded rhyolite matrix. Unlike the nearly horizontal bedding of the Miocene rhyolite tephra, the Eocene tephra dips up to 40 degrees.

Within the map area, the Miocene succession consists of up to 350 metres of fluviatile rhyolite ash and fine clastic sediments underlying a minimum thickness of 500 metres of olivine basalt flows. The core from two drill holes east of Chartrand Lake (DDH88-1 and DDH88-2) indicates that the basalt flows and sediments are intercalated over a thickness of 150 metres. All of these rocks belong to the Chilcotin Group, which Mathews (in press) defined as consisting of Neogene basalts, and intercalated sedimentary and pyroclastic strata in south-central British Columbia. The rhyolite ash and fluviatile and lacustrine sediments, up to the first appearance of basalt, belong to the Deadman River Formation (Mvr) of Campbell and Tipper (1971), and the overlying olivine basalt flows and intercalated rhyolite ash and sediments belong to the newly proposed Chasm Formation (Mvb).

The Deadman River Formation outcrops in a few roadcuts, slide scarps and stream bottoms on the western side of the map area, along sections of Bonaparte River, and Loon and Scottie creeks. On the east side of the map area, it underlies parts of the valley walls of Deadman River and the north-trending valley containing Young Lake. White to buff-weathering, unbedded rhyolite ash dominates, and white, locally diatomaceous, sandstone, siltstone and shale occur near the top of the sequence. Although there are only a few exposures of carbonaceous shale and siltstone near the top, the two drill holes near Chartrand Lake show layers up to few metres in thickness are scattered throughout the formation. In the Deadman River valley, Campbell and Tipper (1971) suggested that diatomaceous layers up to 4 metres in thickness occur near the bottom of the succession, but in Loon Creek, diatomaceous earth outcrops near the base and at the top. In Loon Creek, pebble conglomerate and sandstone form a minor part of the formation.

Most of the sediments are fluviatile and partly fill deeply incised, steep-walled valleys very similar to the present valleys of Deadman and Bonaparte rivers and Chasm Creek. Local debris-flows from the steep valley walls form some of the fill. The northwest side of Loon valley, near Wohlleben Creek, has a few exposures of the Deadman River Formation that define the cross-section of the Miocene Bonaparte channel (Mio-Bonaparte channel), which is 5 kilometres wide and more than 400 metres deep, with a fill of more than 365 metres of rhyolite ash, conglomerate and diatomaceous earth (Fig. 1). The Mio-Bonaparte channel is more than 2 kilometres wide along the bottom of Loon Creek which indicates that the channel depth not only exceeds 400 metres but could easily approach 500 metres. The Miocene interfluves were probably similar to the present rolling hills in the map area.

The Chasm Formation typically forms a chain of cliffs up to 50 metres in height at the top of the present valley sides. The postglacial channel of Chasm Creek, ringed by cliffs of 100 metres or more, exposes up to a dozen olivine basalt flows ranging in thickness from 1 to 15 metres. Only near the margins are the flows vesicular or amygdaloidal with zeolites as the common filling. Away from the margins, most of the flows are medium to dark grey with prominent olivine and plagioclase. The outcrops are blocky to columnar jointed, and lack platy jointing or flow layering. These outcrop characteristics distinguish the Miocene olivine basalt flows from the typically grey, aphanitic and platy jointed flows of the Eocene Kamloops Group. In addition, Miocene volcanic breccias are very locallized in contrast to the widespread distribution of breccias in the Eocene. Near the base of the formation, some Miocene basalt flows have a weak platy jointing and contain ultramafic nodules such as those near the mouth of Fly Creek, or olivine xenocrysts as in basal flows near Moose Creek. Drill holes east of Chartrand Lake show that the lower 150 metres of the formation consists of olivine basalt flows with intercalations of rhyolite ash, siltstone, shale and carbonaceous sediments ranging from 2 to 9 metres in thickness. The base of the Chasm Formation is set at the first appearance of olivine basalt and thus the formation includes the overlying silicic tephra and sediment layers among the olivine basalt flows.

Within the map area, the succession of flat-lying olivine basalt flows is close to 500 metres thick as exposed in the valleys of Bonaparte River, Loon Creek, and Deadman River. Such a thickness probably contains dozens of flows and is many times the average thickness of 67 metres for the Chilcotin Group. The thickest section of 141 metres was measured by Bevier (1983) 3 kilometers south of the map area. Because the flows form a third or less of the Miocene channel fills, most spread out over a rolling topography that had more than 800 metres of relief but which lacked the deeply incised valleys filled by the Deadman River Formation.

MIOCENE DRAINAGE

At four locations within cliffs of conglomerate in the Mio-Bonaparte channel on the south side of Loon Creek, pebble imbrication indicates northerly flow. Because massive rhyolite ash dominates the Deadman River Formation, current indicators are extremely rare. Uncooperative landowners will not allow access to the only other area near the mouth of Chasm Creek with potential current indicators.

Within the map area, the angle of intersection of Miocene channels and the differences in elevations along their bases indicate most of the Miocene channels drained to the north and west, in contrast to the present south to southwest drainage system (Fig. 1). In the Mio-Bonaparte channel, pebble imbrication, and a northward decrease in the elevation of the channel prove north-northwestward flow in a channel that is subparallel to, but about 4 kilometres east of Bonaparte River. Deadman valley contains exposures of parts of four Miocene channels which from south to north are Mio-Deadman, Mio-Snohoosh, Mio-Hamilton and Mio-Coal Creek. Of these, the southward decrease in the elevation of the base of the channel of Mio-Coal Creek and its angle of intersection with Mio-Hamilton Creek require a southward flow in both channels. The elevation of the base of Mio-Hamilton Creek, at less than 930 metres (3050 feet) in Hamilton Creek where the Miocene channel is 0.5 kilometre wide in the creek bottom, implies that Mio-Deadman and Mio-Snohoosh cannot be part of a south flowing Mio-Hamilton channel because Mio-Deadman and Mio-Snohoosh bases are not less than 915 metres (3000 feet) and 925 metres (3025 feet) respectively. If Mio-Deadman and Mio-Snohoosh are not part of a southward flowing system, then the channels must be northward flowing and probably join with Mio-Hamilton beneath a thick cover of basalt flows under the mid-course of Brigade Creek. The low elevation of the base of olivine basalt flows in Loon Creek is less than 915 metres (3000 feet) and in Bonaparte River less than 715 metres (2350 feet) and provides evidence of a west-northwestward flowing Miocene channel which joins the four Miocene channels exposed in Deadman valley with the Mio-Bonaparte near the mid-course of Chasm Creek. The regional distribution of Miocene rocks and the elevations of the underlying basement preclude an eastward drainage of any significant Miocene channel towards the North Thompson River.

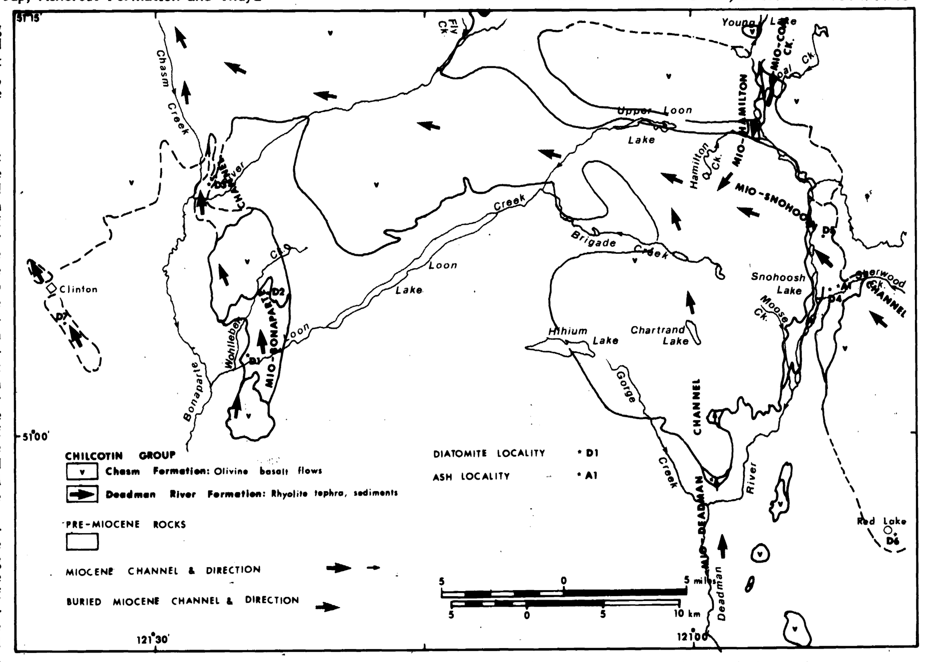



Figure 1: Simplified geological map showing the distribution and flow directions of Miocene drainage channels.

INDUSTRIAL MINERALS IN THE CHILCOTIN GROUP

Industrial minerals in the Chilcotin Group are restricted to diatomaceous earth and volcanic ash which are found only in the Deadman River Formation. Because much less than 1 per cent of the area underlain by the formation contain outcrops, it cannot be adequately prospected for industrial minerals without trenching or drilling.

Diatomaceous Earth

The Mio-Bonaparte channel contains diatomaceous earth. A 3-metre-high roadcut on Tomlin Road within 100 metres of its junction with the Loon Lake Road (at 700 metres (2300) feet elevation and UTM coordinates FM0610050E, FM5655900N (D1) exposes diatomaceous earth near the bottom of the channel fill. Roadcuts on an old logging road just east of Wohlleben Creek expose diatomaceous earth between 1030 and 1045 metres (3375 and 3425 feet) at FM0612350E, FM5660250N (D2) which is within 30 metres of the top of the channel fill. Potential for further occurrences of diatomaceous earth in Mio-Bonaparte channel exist near the junction of Chasm Creek and Bonaparte River but uncooperative landowners will not permit access to the area. Near the bottom of Mio-Snohoosh channel, Campbell and Tipper (1971) reported two layers of diatomaceous earth 2 to 3 metres thick on the east side of Snohoosh Lake north of Sherwood Creek close to FM0649200E, FM5661200N (D4). Farther north along the channel, both McCammon (1960) and Campbell and Tipper (1971) noted three diatomaceous layers ranging from 2 to 5 metres in thickness near FM0648700E, FM5664300N (D5). The sparse outcrops of the Mio-Hamilton and Mio-Coal Creek channel fills show diatomaceous siltstone within 5 metres of the overlying basalt flows in an old roadcut on the east valley wall of Deadman valley 0.9 kilometres south of Coal Creek at FM0644850E, FM5673050N (D6). The diatomaceous earth deposit of Western Clay Products Ltd., 7 kilometres south of the southeast corner of the map area near Red Lake at 1235 metres (4000 feet) and FM0653700E, FM5645150N has been an intermittent producer of kitty litter. Drilling has outlined a lacustrine accumulation of diatomaceous earth which is up to 37 metres thick and covers an area of more than 65 hectares.

Volcanic Ash

Massive rhyolite ash of the Deadman River Formation is the dominant rock filling the Miocene channels. To date, prospecting efforts and testing have concentrated on the north side of Sherwood Creek at 915 metres (3000 feet) and FM0649300E, FM5661000N (A1). McCammon (1960) tested this ash for pozzolanic properties. Although it meets ASTM specifications, it has not been used as a pozzolan nor has it found use as a cream glaze on ceramic-ware (McCammon, 1960), or as an abrasive (Eardley-Wilmot, 1924 and 1927). Similar appearing but untested ash is widespread and localities in the Mio-Bonaparte channel, such as the south side of Loon Creek, might be closer to major transportation routes.

REFERENCES


Bevier, M.L. (1983): Regional Stratigraphy and Age of Chilcotin Group Basalts, South-central B.C., Canadian Journal of Earth Sciences, volume 20, pages 515-524.

Campbell, R.B. and Tipper, H.W. (1971): Geology of Bonaparte Lake Map-area, B.C., Geological Survey of Canada, Memoir 363, 100 pages.

Eardley-Wilmot, V.L. (1924): Natural Abrasive Materials in Canada, in Investigations of Mineral Resources and the Mining Industry, 1923, Mines Branch, Canada Department of Mines, Publication Number 616, pages 14-15.

Eardley-Wilmot, V.L. (1927): Abrasives, Part I, Siliceous Abrasives, Mines Branch, Canada Department of Mines, Publication Number 673, pages 85-89.

Hora, Z.D. (1986): New Developments in Industrial Minerals, B.C. Ministry of Energy, Mines and Petroleum Resources, Geological Fieldwork 1985, Paper 1986-1, pages 239-240.

Mathews, W.H. (in press): Neogene Chilcotin Basalts in South-central British Columbia: Geology, Ages and Geomorphic History, Canadian Journal of Earth Sciences.

McCammon, J.W. (1960): Pozzolan, B.C. Minister of Mines, Annual Report 1959, pages 178-184.

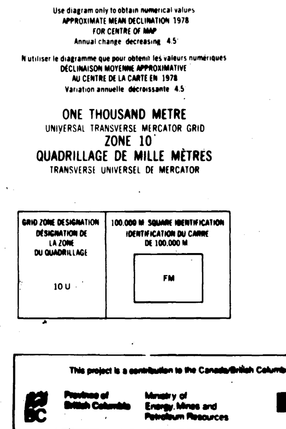
Read, P.B. (1988): Tertiary Stratigraphy and Industrial Minerals, Cache Creek, (92I/14), British Columbia, B.C. Ministry of Energy, Mines and Petroleum Resources, Open File 1988-30.

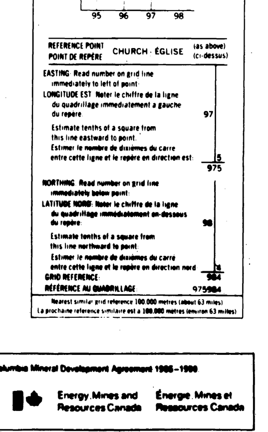

Geology: Geotex Consultants Limited,

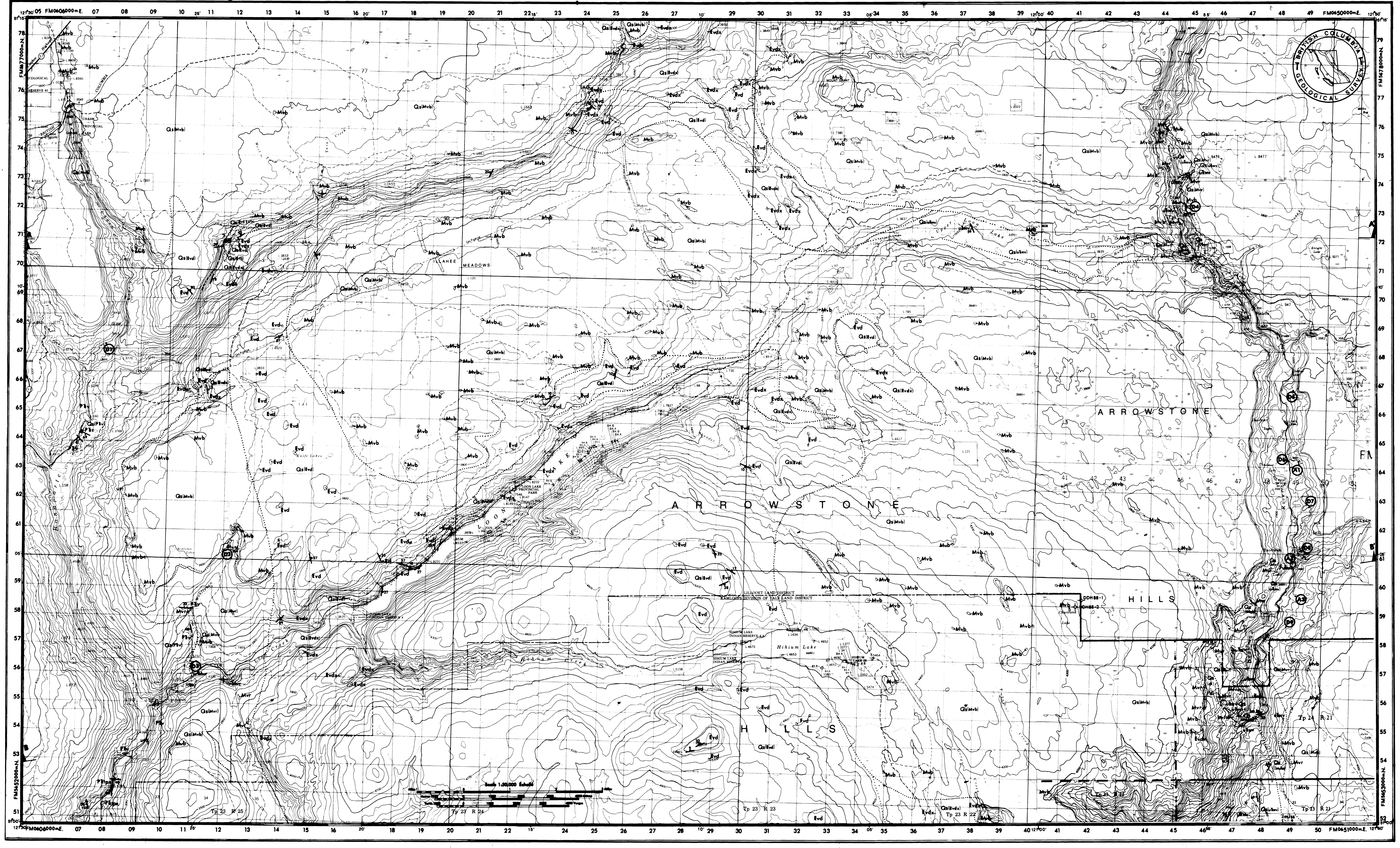
P.B. Read, 1987 & 1988.

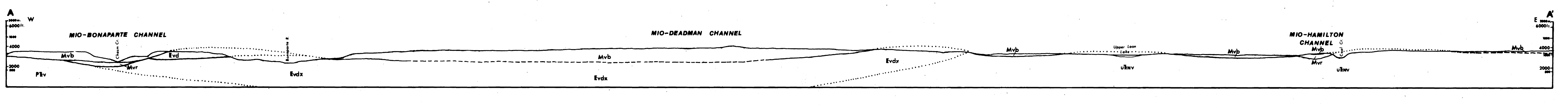
TABLE 1
INDUSTRIAL MINERALS IN BONAPARTE AND DEADMAN RIVERS

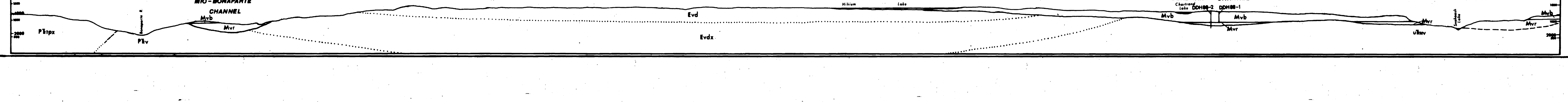
| Loc # | Property | Commodity | Status | Location Easting | Location Northing | Cert | Minfile Number |
|---|---|---|---|---|---|---|---|
| A1 | Skookum Lake | Volcanic Ash | Showing | FM0649000 | FM5664300 | 1 | 092P095 |
| A2 | Sherwood Creek | Volcanic Ash | Showing | FM0649300 | FM5661000 | 1 | 092P093 |
| A3 | Snohoosh Lake | Volcanic Ash | Showing | FM0649000 | FM5659600 | 1 | 092P094 |
| D1 | Chasm Creek | Diatomaceous Earth | Showing | FM0607700 | FM5667300 | 1 | 092P100 |
| D2 | Wohlleben Creek | Diatomaceous Earth | Showing | FM0612350 | FM5660250 | 1 | 092P161 |
| D3 | Loon Creek | Diatomaceous Earth | Showing | FM0611050 | FM5655900 | 1 | 092P099 |
| D4 | Coal Creek | Diatomaceous Earth | Showing | FM0644850 | FM5673070 | 1 | 092P162 |
| D5 | Deadman Lake | Diatomaceous Earth | Showing | FM0648750 | FM5666700 | 1 | 092P098 |
| D6 | Skookum Lake | Diatomaceous Earth | Showing | FM0648700 | FM5664300 | 1 | 092P164 |
| D7 | North Snohoosh | Diatomaceous Earth | Showing | FM0649400 | FM5662700 | 1 | 092P097 |
| D8 | Sherwood Creek | Diatomaceous Earth | Showing | FM0649200 | FM5661200 | 1 | 092P163 |
| D9 | Deadman River | Diatomaceous Earth | Showing | FM0648700 | FM5658500 | 1 | 092P096 |




Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources
OPEN FILE 1989-21

## TERTIARY STRATIGRAPHY AND INDUSTRIAL MINERALS, BONAPARTE TO DEADMAN RIVERS

**NTS 92P/2, 3**

**GEOLOGY BY P. B. READ**

QUATERNARY
PLEISTOCENE AND RECENT

- Qs(Evd) — Unconsolidated sediments: glacial deposits, colluvium and alluvium; few if any outcrops; probable subcrop unit within parentheses

TERTIARY
MIOCENE
**CHILCOTIN GROUP**

- Mvb — **Chasm Formation** Vesicular and amygdaloidal basalt flows; very rare basalt breccia
- Mvr — **Deadman River Formation** Rhyolite ash, white to buff tuffaceous sandstone, siltstone and shale; minor pebble conglomerate, and carbonaceous siltstone and shale; local diatomaceous shale and siltstone

MIDDLE EOCENE
**KAMLOOPS GROUP**

- Evd — Light to dark grey, aphanitic andesite flows
- Light grey porphyritic (hornblende) andesite flows
- Medium to dark grey porphyritic (plagioclase) andesite breccia; minor flows
- Evdx — Light to dark grey aphanitic andesite breccia
- Dark grey vesicular and amygdaloidal, aphanitic basalt flows and breccia
- Cream-weathering rhyodacite breccia, brown-weathering andesite breccia; minor intercalated lithic tuff
- Cream weathering shale, siltstone, carbonaceous shale; zeolitized, bedded rhyolite tuff and tuffaceous sandstone lenses
- Volcanic pebble to boulder conglomerate; minor layered lithic grit
- Cream-weathering rhyolite tuff and volcanic breccia composed of aphanitic andesite clasts
- Etf — Layered buff to cream lithic-crystal tuff and tuffaceous sandstone
- Aphanitic rhyolite intrusions; at Cache Creek, white-weathering, aphanitic to porphyritic (biotite, quartz, feldspar) rhyolite breccia and flows or intrusions
- White-weathering, aphanitic to porphyritic (biotite, quartz, feldspar) rhyolite

CRETACEOUS
LOWER AND UPPER CRETACEOUS

- uKs — Chert-rich conglomerate and sandstone; brownish weathering sandstone; minor shale with coal horizons

JURASSIC
LOWER AND MIDDLE JURASSIC
**Ashcroft Formation**

- Dark grey shale, argillite, siltstone; minor greywacke; rare argillaceous limestone
- lmJss — Feldspathic wacke, pebble conglomerate; minor shale and siltstone, locally red
- Pebble to cobble conglomerate

JURASSIC
EARLY JURASSIC
**THUYA BATHOLITH**

- qm — Leucoquartz monzonite

TRIASSIC AND(?) JURASSIC
LATE TRIASSIC AND(?) EARLY JURASSIC
**GUICHON BATHOLITH**

- Diorite; minor granodiorite
- di — Metadiorite and metagabbro

TRIASSIC
MIDDLE AND UPPER TRIASSIC
**NICOLA GROUP:**

- uTrNv — Grey and grey-green massive tuff and flows
- Light grey massive to medium grey bedded limestone
- Greywacke, siltstone, argillite; minor conglomerate

PENNSYLVANIAN TO TRIASSIC
**CACHE CREEK COMPLEX**

- PTrtpx — Melange: blocks of chert, limestone, greenstone, ultramafite in a grey siliceous phyllite and ribbon chert matrix
- PTrv — Massive greenstone, green phyllite; rare pillow metabasalt
- PTrc — Light to medium grey, massive limestone and local dolomite
- us — Serpentinite; minor metadiorite, metagabbro

Geological boundary (defined (approximate (assumed

Fault (defined, with slickensides (approximate (assumed (dip of fault plane inclined (reverse fault, peg side down (strike-slip fault (beneath bedrock units

Bedding (inclined (vertical

Flow layering (inclined (vertical

Foliation (inclined (vertical

Trace of axial surface (syncline or (synform (upright (phase determined) (inclined (phase undetermined) (beneath bedrock units (anticline or (antiform (upright (phase undetermined) (inclined (phase determined)

Radiometric date

| location and rock type | material or mineral | method | |
|---|---|---|---|
| igneous | a amphibole | K potassium-argon | 46 age in millions of years |
| sedimentary | b biotite | | |
| | p plagioclase | | |
| | s sandine | | |