# TERTIARY STRATIGRAPHY & INDUSTRIAL MINERALS, MERRITT BASIN, BRITISH COLUMBIA

OPEN FILE 88-15

## TERTIARY STRATIGRAPHY AND INDUSTRIAL MINERALS, MERRITT BASIN, SOUTHERN BRITISH COLUMBIA (92I/1 & 92I/2)

P.B. Read

INTRODUCTION:

Merritt basin is one of three areas of extensive Eocene sediments preserved well to the west of the Omineca Belt in southern British Columbia. Of the others, Hat Creek has been described by Church (1977), and Princeton-Tulameen, by McMechan (1983), Church et al. (1983) and Read (1987b). Merritt, Tulameen-Princeton, and an unnamed fault sliver between the two (Thorkelson, 1986) share a common stratigraphy and may be remnants of a former, more than 1000-metre-thick, northerly elongate sheet extending from the International Boundary to north of Merritt and possibly to as far north as the North Thompson and Clearwater rivers where remnants of the arkose-rich Chu Chua Formation outcrop (Campbell and Tipper, 1971).

Geological data from Ells (1905), White (1947), Preto (1979), McMillan (1978; 1981), Monger and McMillan (1982), Read (1987a) and numerous assessment reports have been used extensively in the preparation of this map.

STRATIGRAPHY AND STRUCTURE:

Merritt basin contains a wedge of Eocene volcanic rocks that underlies a cover of sandstone, pebble conglomerate, shale and minor coal comprising the Eocene Coldwater Formation (Fig. 1). Northerly trending, normal(?) faults segment the basin into three parts: (a) a western part underlying the lower end of Guichon valley to Lower Nicola and beyond to the south, (b) a central portion around and east of Merritt, and (c) an eastern segment underlying the lower part of Quilchena valley. In the western part, a gentle northeasterly dipping sequence of sandstone and shale with rare coal and bentonite seams, possibly totalling 1200 metres in thickness, apparently overlies felsic to intermediate flows and volcanic breccias that Monger and McMillan (1982) considered to be Eocene. The central portion contains folded sandstone and shale with minor, but formerly productive coal seams. As Ells (1905), White (1947) and Cockfield (1948) observed, the sediments form southeasterly trending, open to tight, upright folds south of Merritt. The southwesternmost sediments occupy the core of a northeasterly overturned syncline, and the Eocene volcanic rocks, to the southwest of the sediments, are a lower rather than a higher stratigraphic unit. Near Normandale mine, the presence of eastward dipping sediments requires a fault to form the boundary between the Coldwater Formation and the Nicola Group to the east. In Hamilton Creek, bore hole X#1 penetrated 387 metres of gently dipping Eocene sediments, which east of Merritt, lie on a Mesozoic basement with no intervening Eocene volcanic rocks. To the east in Quilchena valley, sandstone and pebble conglomerate, minor shale and rare coal and bentonite seams form a gentle easterly dipping wedge of Eocene sediments. They may reach a thickness of 1200 metres before truncation on the east by an unnamed fault.

Fresh, vesicular olivine basalt flows of Pleistocene age form remnants along the Nicola and Quilchena valleys. Elevations of the bases of the remnants decline from 1070 metres (3500 feet) north of Courtney Lake to 640 metres (2100 feet) in Nicola valley northeast of Hamilton Creek. The flows probably originated north of Courtney Lake and flowed down Quilchena valley into the Nicola valley.

STRATIGRAPHIC CORRELATIONS:

Based on similarities in the lithology of the volcanic and overlying sedimentary rocks of the Merritt basin with the stratified rocks in the Princeton basin, the volcanic rocks have been correlated with the Lower Volcanics or Cedar Formation of the Princeton Group, and the sediments of the Coldwater Formation with those of the Allenby Formation. As Hills (1965, p. 28) noted, the sandstones at Princeton, Merritt, Nicola-Mamit (Guichon Creek) and Quilchena are arkosic, and at all locations, except Coalmont, the arkoses are very pure with more than 90 per cent of the detritus being of granitic origin. Furthermore, Hills concluded (p. 37) that the sediments of the Coldwater Formation in Merritt basin belong to the uppermost and possibly the uppermost part of the middle of three palynological zones present in the Princeton and Tulameen basins, whereas the sediments of the Tranquille Formation belong to only the lowermost zone which is not represented in Merritt basin. Correlation of the Eocene rocks of the Merritt basin with those of the Princeton Group is strongly supported by lithology and palynology; Ewing's (1981) suggested correlation with the Kamloops Group is not.

INDUSTRIAL MINERALS OF THE MERRITT BASIN

Bentonite

Bentonite-rich zones up to 8 metres in thickness occur near coal seams in Quilchena and Guichon valleys. In Quilchena valley, a caved adit exposes a minimum thickness of 2.7 metres of bentonite between coaly shale (Ries and Keele, 1913) and nearby outcrops expose an 8 to 10-metre-thick bentonite-rich zone (**B4**). About 300 metres along strike to the northeast, an old bulldozer cut exposes a 5-metre-thick bentonite zone overlying carbonaceous shale (**B3**). Cation exchange analyses indicate that the major exchangeable cations are divalent and corroborate the calcium-rich analyses obtained by Thompson and Sadler (1923, p. 74). Water absorption and suspension tests indicate that the Quilchena bentonite is inferior to that from Wyoming (p. 76-77). North of Coutlee in Guichon valley, slumped trenches and roadcuts expose three bentonite-bearing shale-rich zones. The stratigraphically lowest contains a 3 to 5-metre-thick bentonitic shale and siltstone layer (**B1**), and the intermediate, a 7 to 9-metre-thick bentonite-bearing shale (**B2**). Cation exchange analyses indicate that both contain mainly divalent exchangeable cations.

Zeolites

Because waterlain acid tephra is apparently absent from Merritt basin, zeolitized ash has not been discovered. However, outcrop is very sparse, and zeolitized tephra, which is difficult to recognize, may have been missed during the logging of drill holes.

TABLE 1
EXCHANGEABLE Ca, Na, K, AND Mg ANALYSES AND CATION EXCHANGE CAPACITY (CEC)[1]

| Unit/ Sample | Loc. #* | Exchangeable Cation Analysis (mequiv./100g) Mg | Ca | K | Na | Total | CEC (mequiv./100g) |
|---|---|---|---|---|---|---|---|
| GUICHON CREEK: | | | | | | | |
| **Coldwater Formation** | | | | | | | |
| C86-410A | **B1** | 9.4 | 19.4 | 2.1 | 15.0 | 45.9 | 47.6 |
| C86-410E | **B2** | 9.2 | 12.5 | 1.8 | 9.7 | 33.2 | 32.1 |
| QUILCHENA CREEK: | | | | | | | |
| **Coldwater Formation** | | | | | | | |
| C86-409G | **B3** | 8.1 | 28.8 | 0.56 | 8.3 | 45.8 | 38.1 |
| C86-409E | **B4** | 4.2 | 26.1 | 1.9 | 17.8 | 50.0 | 45.2 |

* **B** = Bentonite

[1] Analyzed samples weigh 10-15 gms and are crushed to -120 mesh.

TABLE 2
INDUSTRIAL MINERALS IN MERRITT BASIN

| Loc # | Property | Commodity | Status | Location Easting | Northing | Cert | Minfile Number |
|---|---|---|---|---|---|---|---|
| GUICHON CREEK: | | | | | | | |
| B1 | Coutlee | Bentonite | Showing | FL0653150 | FL5562300 | 1 | 092ISE203 |
| B2 | Coutlee | Bentonite | Showing | FL0653900 | FL5562300 | 1 | 092ISE203 |
| QUILCHENA CREEK: | | | | | | | |
| B3 | Quilchena Creek | Bentonite | Showing | FL0679250 | FL5556725 | 1 | 092ISE138 |
| B4 | Quilchena Creek | Bentonite | Showing | FL0679100 | FL5556540 | 1 | 092ISE138 |

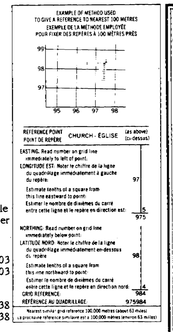








Figure 1: Simplified geological map of Merritt basin


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Province of British Columbia — Ministry of Energy, Mines and Petroleum Resources

Energy, Mines and Resources Canada — Énergie, Mines et Ressources Canada

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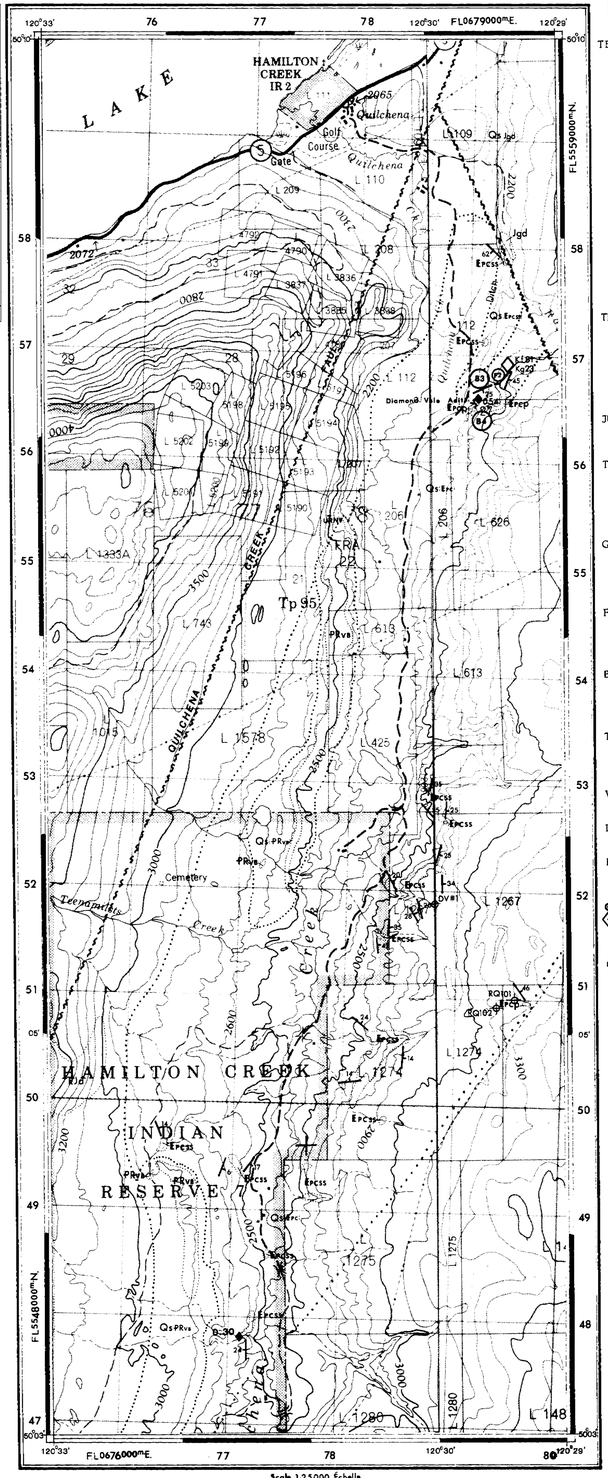
## QUILCHENA VALLEY




Scale 1:25,000 Échelle

QUATERNARY
PLEISTOCENE AND RECENT

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

TERTIARY
PLEISTOCENE
**VALLEY BASALT**

PRvs — Vesicular and amygdaloidal basalt flows

MIDDLE EOCENE
**PRINCETON GROUP**
COLDWATER FORMATION

Epcp — Grey shale, carbonaceous shale; minor coal; rare bentonite

Epcss — White to buff-weathering sandstone, pebble conglomerate; minor siltstone and shale; rare carbonaceous shale and coal

Epc — Undivided: sandstone, pebble conglomerate, siltstone, shale; rare coal

CEDAR FORMATION

Epvr — Cream-weathering porphyritic (feldspar) rhyolite flows and breccia

Epvd — Maroon to grey, vesicular, porphyritic (plagioclase) dacite, andesite and basalt flows, breccia; minor crystal (plagioclase) and lithic tuff

Epv — Undivided: flows, volcanic breccia

TRIASSIC
UPPER TRIASSIC
**NICOLA GROUP**

uTNv — Porphyritic (augite) and aphyric andesite and basalt flows, crystal-lithic tuff; minor volcanic breccia

**INTRUSIONS**

JURASSIC

Jgd — Granodiorite and quartz monzonite

TRIASSIC AND(?) JURASSIC

TrJd — Fine to medium-grained diorite

Geological boundary — (defined / (approximate / (assumed

Fault — (defined / (approximate / (assumed / (dip of fault plane inclined / (normal fault, peg side down

Bedding — (inclined / (vertical

Trace of axial surface — (syncline or synform: (upright (phase determined) / (inclined (phase undetermined) ; (anticline or antiform: (upright (phase undetermined) / (inclined (phase determined)

Vitrinite Reflectance ($R_o$max) ◆0.76

Limit of mapping

Radiometric date:

location and rock type: ⊕ igneous, ◇ sedimentary — material or mineral: g glass, f sanidine, w whole rock — method: K potassium-argon — age in millions of years

Geology by Geotex Consultants Limited: P.B. Read, 1986.

**DRILL HOLES & ADITS**

- B#1 Blair borehole
- DM#6 B.C. Department of Mines drill holes
- DV#3 Diamond Vale drill holes
- E-1 Boring No. 1
- IMP#5 Imperial Metals and Power Ltd. drill holes
- M#-1892 Middlesboro drill holes
- M#4 Middlesboro Collieries adits
- SM#3 Sumicol Consultants Ltd. drill holes
- X#1 Boring No. 1, Indian Reserve