TERTIARY STRATIGRAPHY & INDUSTRIAL MINERALS, CACHE CREEK (921/14), BRITISH COLUMBIA

QUATERNARY
PLEISTOCENE AND RECENT

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

TERTIARY
MIOCENE
CHILCOTIN GROUP

Mvb — Vesicular and amygdaloidal basalt flows

MIDDLE EOCENE
KAMLOOPS GROUP

Evd — Light to dark grey, aphanitic andesite flows

Evdm — Light grey porphyritic (hornblende) andesite flows

Evdf — Medium to dark grey porphyritic (plagioclase) andesite breccia; minor flows

Evdx — Light to dark grey aphanitic andesite breccia

Evb — Dark grey vesicular and amygdaloidal, aphanitic basalt flows and breccia

Ebx — Cream-weathering rhyodacite breccia, brown-weathering andesite breccia; minor intercalated lithic tuff

Eptf — Cream weathering shale, siltstone, carbonaceous shale; zeolitized, bedded rhyolite tuff and tuffaceous sandstone lenses

Ecg — Volcanic pebble to boulder conglomerate; minor layered lithic grit

Evrtf — Cream-weathering rhyolite tuff and volcanic breccia composed of aphanitic andesite clasts

Etf — Layered buff to cream lithic-crystal tuff and tuffaceous sandstone

Ef — Aphanitic rhyolite intrusions; at Cache Creek, white-weathering, aphanitic to porphyritic (biotite, quartz, feldspar) rhyolite breccia and flows or intrusions

Evr — White-weathering, aphanitic to porphyritic (biotite, quartz, feldspar) rhyolite

CRETACEOUS
UPPER CRETACEOUS

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

JURASSIC
LOWER AND MIDDLE JURASSIC
Ashcroft Formation

lmJA — Dark grey shale, argillite, siltstone; minor greywacke; rare argillaceous limestone

lmJcg — Pebble to cobble conglomerate

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

ℓJdi — Diorite; minor granodiorite

ℓdi — Metadiorite and metagabbro

TRIASSIC
UPPER TRIASSIC
NICOLA GROUP:

uTnv — Grey and grey-green massive tuff and flows

uTnc — Light grey massive to medium grey bedded limestone

uTns — Greywacke, siltstone, argillite; minor conglomerate

PENNSYLVANIAN TO TRIASSIC
CACHE CREEK COMPLEX

PTspx — Melange: blocks of chert, limestone, greenstone, ultramafite in a grey siliceous phyllite and ribbon chert matrix

PTsv — Massive greenstone, green phyllite; rare pillow metabasalt

PTsc — Light to medium grey, massive limestone and local dolomite

us — Serpentinite; minor metadiorite, metagabbro

Geological boundary — (defined / approximate / assumed)

(defined, with slickensides / approximate / assumed)

Fault — (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, beneath bedrock units; anticline or antiform; upright (phase determined); inclined (phase undetermined); upright (phase undetermined); inclined (phase determined))

Radiometric date

location and rock type: ● igneous ◇ sedimentary

material or mineral: a amphibole, b biotite, p plagioclase, s sanidine

method: K potassium-argon

46 age in millions of years

Geology: Geotex Consultants Limited, P.B. Read, 1986 & 1987.

TERTIARY STRATIGRAPHY AND INDUSTRIAL MINERALS, CACHE CREEK MAP AREA (92I/14), SOUTHWESTERN BRITISH COLUMBIA*

P.B. Read

INTRODUCTION

Cache Creek map area spans an open, northwesterly trending syncline occupied by the mid-Eocene Kamloops Group. Deadman River Fault cuts across the northeastern limb, and Bonaparte Fault may truncate the southwestern limb. Beyond these faults only erosional outliers remain lying on a faulted basement of Cache Creek Complex, Nicola Group, Guichon batholith, and Ashcroft Formation. The basal Eocene unconformity is very irregular and at the southwest end of the Arrowstone Hills, has a paleorelief of nearly 600 metres. Along the eastern edge of the map area, remnants of olivine basalt flows of the Chilcotin Group outline the western side of a Miocene valley centered approximately along the present course of Deadman River.

In addition to Monger and McMillan (1982), who revised the earlier regional work of Duffell and McTaggart (1952), Travers (1978), Shannon (1981), and Freebold and Tipper (1969) studied pre-Cenozoic rocks; McMillan (1977) investigated Cenozoic and older rocks south of the Thompson River and Ewing (1981) mapped the Eocene volcanic and sedimentary succession north of McAbee.

TERTIARY STRATIGRAPHY

In the map area, volcanic rocks dominate the Kamloops Group to such an extent that volcaniclastic sediments are developed only as local lenses up to 30 metres thick on the basal unconformity, and as two 100-metre-thick lenses up to 3 kilometres long within the lower few hundred metres of the group north of McAbee. Rhyolite and rhyodacite are products of the oldest volcanism which probably erupted from centres such as the lava dome in the Trachyte Hills (Church, 1977), and near the town of Cache Creek. West of Cache Creek, rhyolite flows (Ef) cut the Ashcroft Formation and possibly some of the lowest volcanics of the Kamloops Group. In Cache Creek, rhyolite breccia, tuff and quartz-feldspar-biotite porphyry (Ef) are either extrusive or high-level subvolcanic and comprise an eruptive centre. Lenses of waterlain lithic and crystal-vitric tuff (Etf) developed along the base of the group, but only east of Cache Creek is there a sufficient vitric component for the development of zeolites. South of and within Scottie Creek, rhyolite and rhyodacite tuff and breccia lenses (Evrtf) up to 100 metres in thickness and up to 3 kilometres in length apparently lie at or near the base of the group. These lenses have been mapped previously as part of the Miocene Chilcotin Group (Monger and McMillan, 1982), but until radiometrically dated have been placed tentatively in the Kamloops Group.

The bulk of the Kamloops Group is aphanitic, medium grey, nonvesicular to locally highly vesicular dacite and andesite flows (Evd) and volcanic breccia (Evdx). Although the flow unit has minor thin interflow breccias, and the breccia unit includes some flows, the two rock units are easily separated in the field. Millimetre mapping along their trend, suggests that they do not occupy unique stratigraphic positions but instead interfinger. The widespread flow and breccia succession contains rare, areally restricted units such as porphyritic hornblende andesite flows (Evdm) on the southern base of Cache Creek Hills, and porphyritic plagioclase andesite and basalt flows and breccias (Evdf) exposed locally along the southern side of Cache Creek Hills and in the bluffs along the west side of Deadman River.

Within a few hundred metres of the base of the group, two distinctive, cream-weathering lenses of tuffaceous sediments (Eptf) and volcanic conglomerate (Ecg) outcrop near the base of the bluffs on the south side of Cache Creek Hills. The western area contains a very thin basal pebble conglomerate overlain by cream-weathering tuffaceous and carbonaceous shale with local cristobalite-bearing layers, and towards the top of the lens, sandstone up to 10 metres in thickness with a crystal and zeolitized ash component. Both flows and pillowed flows are intercalated here and there, and all rock types are extremely lenticular. The eastern and thicker lens, contains a thick pebble to boulder conglomerate and volcanic lithic grit forming the lower two-thirds of the lens. In the upper third, cream-weathering shale and carbonaceous shale host a few tuffaceous sandstone lenses which are zeolitized. A thick, crudely layered breccia to conglomerate, composed of volcanic clasts lying in a lithic-volcanic grit and tuff matrix (Ebx), forms part of the bluffs along the western valley wall of Deadman River where it forms a 9-kilometre-long lens that exceeds 200 metres in thickness. This lens along Deadman valley may represent the proximal portion of a fan-delta that has its distal segment preserved as two sedimentary lenses on the southern slopes of Cache Creek Hills.

INDUSTRIAL MINERALS

In the Cenozoic rocks, only some of the sedimentary lenses at the base of the Kamloops Group and the two sedimentary lenses in the lower part of the group contain industrial minerals. The McAbee aggregate quarry, in an outlier of the Guichon batholith, is an intermittent producer of railway ballast.

Zeolites

East of Cache Creek, the basal tuffaceous lenses of the Kamloops Group are commonly zeolitized with heulandite-clinoptilolite replacing original vitric material. North of Cache Creek and near the west end of the Cache Creek Hills at Z1 (FM0621700mE, FM5632025mN), exchangeable cation analyses of two samples taken from a 6-metre-thick section of bedded vitric-crystal (biotite, hornblende, quartz, feldspar) rhyolite tuff indicate a Na > K-rich intermediate clinoptilolite (Table 2). Neither the top nor bottom of this zeolitized tuff outcrops and within a 100 metres along strike it passes under drift. At East Battle (Z3), (FM0633770mE, FM5629330mN), a minimum thickness of 6 metres of bedded vitric-crystal (biotite, hornblende, quartz, feldspar) tuff overlies a sedimentary breccia composed of angular fragments derived from the underlying Guichon outlier. An exchangeable cation analysis (C86-422F3) indicates an intermediate clinoptilolite (Table 2).

Within a few hundred metres above the base of the volcanic-rich Eocene section, tuffaceous sediments of the two lenses north of McAbee are commonly zeolitized. Shale, claystone and siltstone, containing zeolitized vitric-crystal tuffs, comprise the upper 10 to 70 metres of the lenses. Bedded tuffaceous sandstone and ash lenses range in thickness from less than a metre to 10 metres and in rock type from heulandite to clinoptilolite-bearing vitric-crystal (biotite, hornblende, quartz, feldspar) tuffs to finely laminated vitric tuffs. In the latter, mineral assemblages range from dominantly tridymite-cristobalite through mixtures containing some of heulandite-clinoptilolite, kaolinite, montmorillonite, feldspar and quartz, to essentially pure heulandite. Each lens has been sampled every metre, where possible, along a cross-section. Of the two lenses described north of McAbee (Read 1987, p. 253), a section through the 89-metre-thick western one (Z4 at FM0626860mE, FM5628930mN) has been sampled every metre in its exposed portions. Waterlain, zeolitized acid tephra locally underlies the upper 4 metres of the lens, and forms a 10-metre-thick bed near the middle of the lens. Thermal stability investigations of the zeolitized samples suggest that heulandite and heulandite-rich intermediate compositions predominate (samples MR770 39' and MR 770 36'), and that clinoptilolite occurs only in sample MR770 15' taken near the margin of the lens, but exchangeable cation analyses indicate that all are intermediate clinoptilolite (Table 2). A zeolite-rich sample from 10-metre-thick tuffaceous sandstone at West Battle (Z2) (FM0631105mE, FM5629430mN) has an exchangeable cation analysis (BC 20') typical of intermediate clinoptilolite (Table 2).

The McAbee Quarry (A1) at FM0632960mE, FM5628000mN lies adjacent to a siding of the Canadian National Railways at McAbee. The intermittently operated quarry has provided about 1.5 x 10^6 tonnes of crushed Guichon diorite for railway ballast throughout western Canada. The quarry has estimated reserves which approximately equal the production to date.

All zeolite localities lie within 11 kilometres of the Canadian National Railways at McAbee or Ashcroft, and are within 3 kilometres of the Trans-Canada Highway.

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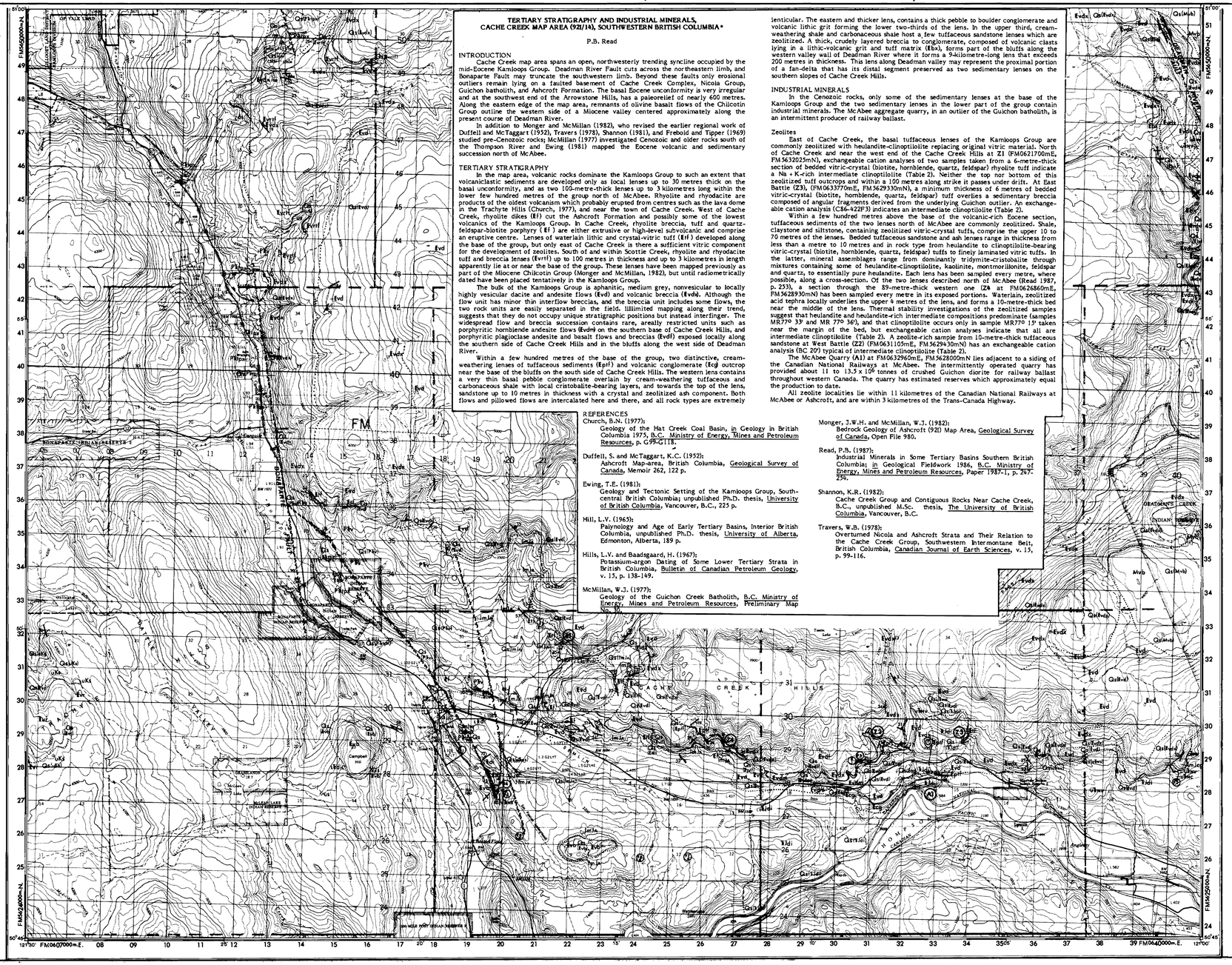

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SCALE 1:50,000

Miles 0 1 2 3

Metres 1000 0 1000 2000 3000 4000

TABLE 1
INDUSTRIAL MINERALS NEAR CACHE CREEK

Loc #	Property	Commodity	Status	Location Easting	Location Northing	Cert	Minfile Number
A1	McAbee Quarry	Aggregate (RR ballast)	Producer	FM0632960	FM5628000	1	092INW092
Z1	Cache Creek	Zeolite	Showing	FM0621700	FM5632025	1	092INW096
Z2	West Battle	Zeolite	Showing	FM0631105	FM5629430	1	092INW094
Z3	East Battle	Zeolite	Showing	FM0633770	FM5629330	1	092INW093
Z4	McAbee	Zeolite	Showing	FM0626860	FM5628930	1	092INW095

TABLE 2
EXCHANGEABLE Ca, Na, K, AND Mg ANALYSES AND CATION EXCHANGE CAPACITY (CEC)*

Sample	Loc. #	Exchangeable Cation Analysis (mequiv./100g) Mg	Ca	K	Na	Total	CEC (mequiv./100g)
C86-430E1	Z1	2.25	23.25	14.50	22.00	62.0	67.0
C86-430E4	Z1	0.65	15.50	7.00	24.50	47.65	50.0
C86-418G5 BC 20'	Z2	9.4	47.2	19.7	38.6	114.9	111.8
	Z2	3.75	17.75	8.75	32.00	62.25	41.5
C86-422F3	Z3	2.75	20.50	12.75	38.25	74.25	78.6
C86-424B	Z4	4.4	9.6	5.6	8.1	27.7	22.3
C86-424B	Z4	4.8	12.5	7.5	12.3	37.1	28.1
MR 10'	Z4	2.29	10.00	4.38	7.75	20.462	22.3
MR 66'White	Z4	6.75	21.75	18.75	18.50	65.75	58.9
MR 66'	Z4	1.28	3.25	1.70	2.00	8.23	13.9
MR 770 15'	Z4	7.00	14.25	7.25	18.00	46.5	46.1
MR 770 33'	Z4	5.25	29.75	13.75	36.25	85.00	63.8
MR 770 36'	Z4	1.75	31.25	12.50	19.38	65.08	56.7

* Z = Heulandite-clinoptilolite

' Analyzed samples weigh 10-15 gms and are crushed to -120 mesh.

TABLE 3A
PALEONTOLOGY, CACHE CREEK

No.*	Easting	Northing	Feet	Unit	
KAMLOOPS GROUP					
F3	FM0630720	FM5628730	2175	Epif	Middle Eocene (Hills, 1965)
F4	FM0619800	FM5627600	1800	Etf	probably Paleocene (Monger & McMillan, 1982)
Ashcroft Formation					
F7	FM0625600	FM5623650	2050	lmJA	Early Jurassic, late Pliensbachian (Monger & McMillan, 1982)
F8	FM0624150	FM5623600	2200	lmJA	Middle Jurassic, early Bajocian (Monger & McMillan, 1982)
NICOLA GROUP					
F2	FM0640200	FM5628400	2625	uTnc	Late Triassic, early Norian (this study)
F5	FM0620050	FM5627550	2100	uTns	probably late Early or Middle Triassic (Monger & McMillan, 1982)
F6	FM0620500	FM5626150	2200	uTns	Late Triassic, early Norian (Travers, 1978)
CACHE CREEK COMPLEX					
F1	FM0618650	FM5628850	1650	PTspx	Triassic, Ladinian or Carnian (Travers, 1978)

TABLE 3B
RADIOMETRIC DATING, CACHE CREEK

Map No.*	UTM Coordinates Easting	Northing	Elev. Feet	Rock Unit	Age & (Reference)
KAMLOOPS GROUP					
R1	FM0630720	FM5628730	2175	Epif	49±3 Ma (Hills & Baadsgaard, 1967)
R1	FM0630720	FM5628730	2175	Epif	51±3 Ma (Hills & Baadsgaard, 1967)
R1	FM0630720	FM5628730	2175	Epif	58±3 Ma (Hills & Baadsgaard, 1967)
R1	FM0630720	FM5628730	2175	Epif	57±3 Ma (Hills & Baadsgaard, 1967)
R1	FM0630720	FM5628730	2175	Epif	69±3 Ma (Hills & Baadsgaard, 1967)
R1	FM0630720	FM5628730	2175	Epif	57±3 Ma (Hills & Baadsgaard, 1967)

*Map Numbers are assigned to fossil and radiometric dating collections in order of increasing number and letter for decreasing UTM northings.