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INDUSTRIAL MINERALS IN TERTIARY ROCKS, LYTTON TO GANG RANCH, SOUTHERN BRITISH COLUMBIA* (92I/05, 12, 13; 92O/01, 08; 92P/04)

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INTRODUCTION

This report summarizes results of 44 days of fieldwork investigating the occurrence of industrial minerals, and those aspects of the structure and Tertiary and Cretaceous stratigraphy which control their development in an area along the Fraser River from the Stein River to China Gulch. In this area, the industrial minerals of major interest are bentonite, perlite and zeolites in Eocene rocks. In addition to the regional geology of Monger (1982) for Ashcroft map area (92I), Tipper (1978) for Taseko Lakes map area (92O), and Campbell and Tipper (1971) for Bonaparte Lake map area (92P), Trettin (1961) and Mathews and Rouse (1984) have done detailed geological studies in the southern and northern parts of the area respectively. In the Ashcroft map area, investigation was restricted to those rocks considered by Monger to be of Eocene age. The only industrial mineral deposit, the perlite mine of Aurun Mines Ltd., lies beyond the northwest corner of the mapped area. In 1988, K. Green intends to carry this investigation northward. Laboratory investigations of samples are in progress, but tests of materials relative to ASTM specifications, and the radiometric and palynological dating of samples have not started.

CRETACEOUS AND TERTIARY STRATIGRAPHY AND STRUCTURE

North of the Stein River, over 1000 metres of mainly pebble to cobble conglomerate, some greywacke and rare siltstone occupy a northerly trending syncline truncated by the Fraser fault on the east (Monger's Fountain fault) and the Lillooet fault on the west. X-ray diffraction shows that the greywacke contains appreciable laumontite, a zeolite that occurs in the Cretaceous rocks of the Ashcroft area (Duffell and McTaggart, 1952, page 43; Read, 1974, page 20) but is absent in Eocene rocks. The succession is devoid of suitable host rocks for Cenozoic industrial minerals and may even be of mid-Cretaceous rather than Eocene age.

From Fountain to Watson Bar creeks, Slok Creek and Fraser faults bound a wedge of volcanic rocks mapped mainly as the Lower Cretaceous Spences Bridge Group by Trettin and mostly as Eocene by Monger. Both Lower Cretaceous and Eocene are present as Trettin proved the former based on palynology, and Mathews (unpublished date) and Monger the latter on radiometric dating; only their distribution is in contention. The distribution shown in Figure 3-8-1, closely adheres to that of Trettin, except that his Fountain Valley assemblage is considered to be Eocene as is an area of radiometrically dated rocks northwest of Glen Fraser. In contrast to Monger's Eocene designation, most of the remainder of the rocks to as far north as Watson Bar Creek are probably Spences Bridge Group, and are devoid of industrial mineral occurrences. Several samples have been collected for radiometric dating to resolve the age of these unfossiliferous rocks.

On the west side of the Fraser River, north of its junction with Pavilion Creek, the trace of Fraser fault separates rocks of the Spences Bridge Group to the southwest from a partly preserved, southwesterly dipping wedge of probable Eocene rocks to the northeast. They lie unconformably on the Pavilion Group. Trettin had placed fault "e" (Fraser fault) along this surface, but good exposure at EM0579000mE, EM5638800mN shows the unfaulted and unconformable nature of this contact. Northward, the Fraser fault outcrops on the right wall of High Bar Canyon where it dips 65 degrees southwest and shows strike-slip slickensides in a 15-metre-wide zone of crushed rocks.

Slok Creek fault forms the southwestern side of the fault wedge and juxtaposes it against the Lower Cretaceous Jackass Mountain Group to as far north as Watson Bar Creek. The fault outcrops at river level on the left bank of the Fraser at EM0581400mE, EM5622600mN where it dips 77 degrees northeast and has strike-slip slickensides.

North of Watson Bar Creek, the fault wedge widens and contains mainly Eocene stratified rocks and minor volcanics of the Spences Bridge Group. Some of the palynologic and radiometric age determinations of Mathews and Rouse come from rocks within this area, and support the stratigraphic distribution shown (Figure 3-8-1). At Watson Bar Creek, dull maroon and grey-brown-weathering volcanic rocks of the Spences Bridge Group give way northward to varicoloured creams, pink, grey, brown and maroon-weathering stratified rocks of Eocene age. The change is abrupt and along a zone of no exposure which is an assumed extension of Hungry Valley fault rather than an unconformity. The fault apparently truncates the Slok Creek fault, but terminates southeastward against the Fraser fault. The Eocene succession of varicoloured volcanics with intercalated volcanogenic sediments underlying sandstone, shale, bentonite and volcanic conglomerate compares closely to that outlined by Mathews and Rouse to the north in Churn Creek (Figure 3-8-2). Flow

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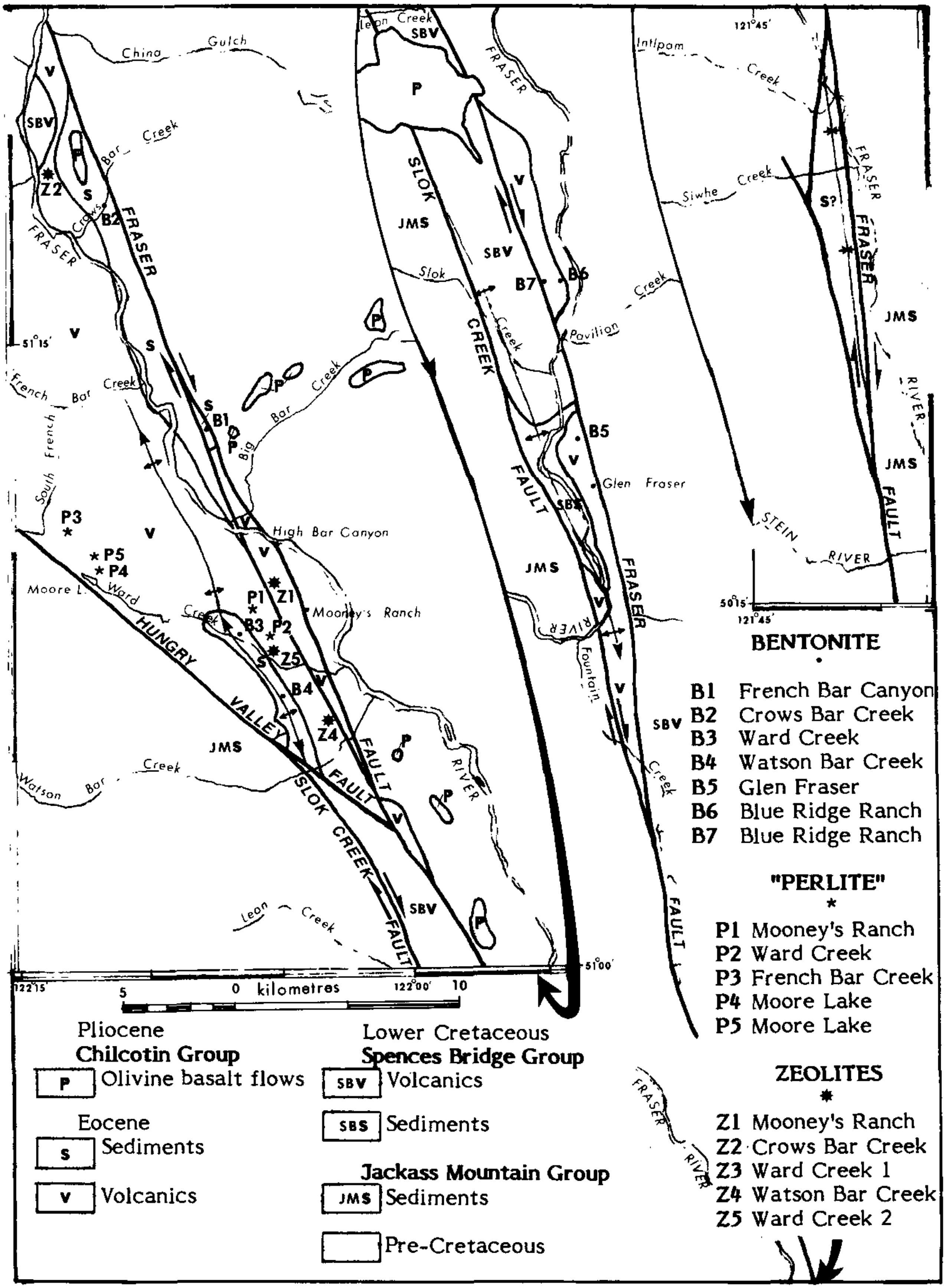
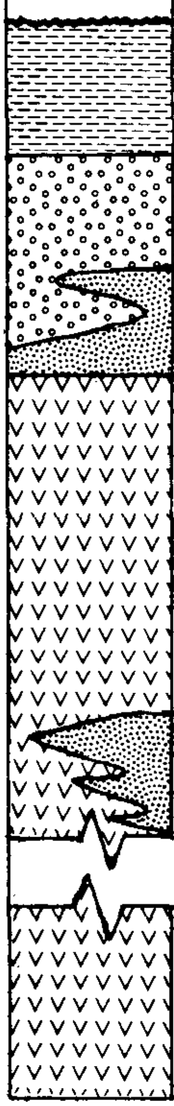


Figure 3-8-1. Simplified geological map along the Fraser River from Stein River to China Gulch showing industrial mineral occurrences.

layering and scattered bedding attitudes outline a north-northwesterly trending, sharp monoclinal flexure with a steep northeastern limb and a subhorizontal to gently dipping southwestern limb. Hungry Valley fault truncates the flexure to the south, and to the north the flexure opens as the fault wedge widens and passes into an easterly dipping homocline near Churn Creek. All the industrial mineral occurrences of the mapped area lie within the Eocene.

Northward from the south side of Leon Creek to at least Dog Creek, Pliocene olivine basalt flows, up to 125 metres in thickness, form erosional remnants of the Chilcotin Group that lie in a 10-kilometre-wide belt centred along the present course of the Fraser River. As noted by Mathews and Rouse, the elevations of the base of the remnants decrease northwards from nearly 1280 metres (4200 feet) south of Leon Creek to 1030 metres (3375 feet) north of Big Bar Creek, but the Pliocene erosion surface has at least 100 metres of relief under some remnants. Although Monger and Mathews and Rouse showed Pliocene sediments beneath the flows, usually a 100-metre-thick zone of no outcrop intervenes between the lowest flow and the highest basement outcrops. Even south of Leon Creek, fluviatile sediments mapped as Pliocene (Monger, 1982) could as easily be Pleistocene or Recent and plastered against the flows, as Pliocene and underlying them. Bevier (1983) noted that although the bulk of the Chilcotin Group lies in a 6-10 Ma range, an earlier pulse lies in a 19-25 Ma range and a later pulse in the 2-3 Ma interval. In contrast to the Miocene portion of the Chilcotin Group (Read, 1988), the Pliocene part is apparently devoid of industrial mineral occurrences.



Lithology and Thickness	Loc #	Industrial Mineral	Age	Map Unit / Previous Unit
Fraser Fault Shale, siltstone, sandstone, bentonite, rare coal (±200 m)			Eocene	S Eocene[1]
Volcanic conglomerate (150-400 m)			Eocene	S Eocene[1]
Tuffaceous sandstone, siltstone, bentonite (0-200 m)	B1 B2	bentonite bentonite	Eocene	S Eocene[1]
Grey, brown, maroon andesite-dacite breccia, local bentonite, minor flows; intercalated rhyolite-rhyodacite flows and tephra, locally waterlain (500-1000 m)	P1 P2 P3 P4 P5 Z1 Z2 Z3 Z4 Z5	"perlite" "perlite" "perlite" "perlite" "perlite" zeolites zeolites zeolites zeolites zeolites	Eocene	V Eocene[1] Ward Creek[2] Fountain Valley[2]
Lenticular sandstone, siltstone, fine bentonitic breccia (0-100 m)	B3 B4	bentonite bentonite	Eocene	S Ward Creek[2] Spences Bridge[3]
unknown thickness of volcanic rocks				
Grey, brown, maroon andesite-dacite breccia, local bentonite, local rhyolite (100-200 m) (may be basal portion of overlying thick volcanic unit)	B5 B6 B7	bentonite bentonite bentonite	Eocene	V Eocene[4] Spences Bridge[2]

[1] Mathews and Rouse (1984)
[2] Trettin (1961)
[3] Tipper (1978)
[4] Monger (1982)

Figure 3-8-2. Generalized stratigraphic column for the Eocene rocks showing the approximate stratigraphic positions of the industrial mineral occurrences.

INDUSTRIAL MINERAL OCCURRENCES IN EOCENE ROCKS

"PERLITE"

Volcanic glass having the hand specimen and thin section characteristics of perlite, and here designated as "perlite", outcrops at five localities on the north side of Ward Creek. On a unused portion of the farm road descending to Mooney's Ranch, a small roadcut exposes medium to dark grey perlite (P1, Figure 3-8-1) at EM0562800mE, EM5665750mN and 1080 metres (3550 feet) elevation. At 1.4 kilometres to the southeast, on the ridge crest on the north side of Ward Creek (EM0563700mE, EM5664700mN), a subvertical perlite (P2) of unknown thickness outcrops for 45 metres along strike before passing northwestward beneath overburden. These two perlite localities may connect in subcrop to yield a steeply dipping body of 1500 metres strike length but unknown thickness.

Northwest of Moore Lake at EM0554550mE, EM5668450mN and 1590 metres (5225 feet) elevation on the ridge, flow-layered perlite (P3) outcrops over a minimum thickness of 10 metres, with top and bottom contacts unexposed. At 2.5 kilometres to the southeast and 1510 metres (4950 feet) elevation on the southwest face of the same ridge (P4) (EM0556000mE, EM5667550mN) and 1.8 kilometres to the southeast (EM0555800mE, EM5668400mN) and 1650 metres (5400 feet) elevation on the same ridge crest (P5), are medium to dark grey flow-layered perlite outcrops. The attitudes of the flow layering suggest that the three localities may expose the same perlite layer which would outline a northwesterly trending and horizontally plunging, upright syncline with a preserved hinge line 2500 metres long. The perlite near Moore Lake probably lies at a stratigraphically deeper level than that near Mooney's Ranch. Samples from all localities await whole-rock analyses and testing relative to ASTM specifications.

BENTONITE

Bentonite-rich rocks subcrop at several localities within the fault wedge, and in the southwest-dipping succession of probable Eocene rocks to the northeast of Fraser fault. Most bentonite probably developed as lenses within fine, locally waterlain, andesite breccia. Within the fault wedge, the most extensive areas of bentonite lie along the northeastern side of the wedge between Big Bar and Crows Bar creeks. Bentonite subcrops in a northwesterly elongate, 300 by 2500 metre area of rounded hills and landslides (B1) best displayed at EM0560700mE, EM5674000mN and 750 metres (2450 feet) elevation. This area of bentonite has generated landslides which flowed through a breach in the volcanic conglomerate cliffs and dropped nearly 500 metres to the Fraser River. Some cream-weathering rhyolite tephra and brown and maroon-weathering, fine andesite breccia layers and lenses lie within the bentonite. Northwestward, an outcrop gap 8 kilometres long, probably underlain by bentonitic rocks, separates this area from a second northwesterly elongate area (B2) [500 by 1500 metres centred at EM0556300mE, EM5683650mN and 640 metres elevation (2100 feet)] which straddles Crows Bar Creek. The rounded hills expose slumped bentonite with bentonitic shale, siltstone, maroon and brown andesite breccia and rhyolite tephra. These two areas of bentonite lie either immediately above or below the volcanic conglomerate. To the southeast, between Big Bar Ferry and Watson Bar Creek, bentonitic rocks lie lower in the stratigraphy, beneath andesite breccia and acid flows and tephra. In a northwesterly elongate area of about 1 by 5 kilometres straddling Ward Creek, bentonite lenses up to a few metres in thickness are scattered through fine, varicoloured andesite breccia, acid tephra and bedded volcanigenic sediments. Exposures centred at EM0562500mE, EM5664900mN and 1010 metres (3300 feet) (B3), and EM0564400mE, EM5662100mN and 1040 metres (3400 feet) (B4) typify the lenticular and impure nature of the bentonite. The southernmost occurrence of bentonite (B5), northwest of Glen Fraser at EM0580100mE, EM5631100mN and 490 metres (1600 feet), has similar host rocks.

Of the two bentonite localities northeast of Fraser fault, the bentonite slope (B6) at EM0579400mE, EM5638100mN and 460 metres (1500 feet) appears free of intercalated volcanic breccia. The other locality (B7), at EM0578100mE, EM5638350mN and 560 metres (1850 feet), is spatially related to cream-weathering acid tephra, and maroon and brown-weathering andesite breccia.

ZEOLITES

Zeolitized waterlain rhyolite ash occurs in intercalated rhyolite and andesite tephra up to 1000 metres beneath the volcanic conglomerate (Figure 3-8-2). At EM0563800mE, EM5667250mN and 900 metres (2950 feet) 1.7 kilometres northwest of Mooney's Ranch, a poorly exposed bedded tephra layer over 5 metres thick, with neither top nor bottom contact exposed, contains a clinoptilolite-rich intermediate member of the heulandite group. At EM0554000mE, EM5685450mN and 580 metres (1900 feet) 3.2 kilometres north-northwest of the mouth of Crows Bar Creek, samples from the north end of a more than 700-metre-long lens of bedded rhyolite tephra contain intermediate compositions in the heulandite group. Although all seven samples from these localities yield heulandite-clinoptilolite, both localities require detailed sampling. At EM0564000mE, EM5664550mN and 1020 metres (3350 feet) 2.2 kilometres southwest of Mooney's Ranch, a 100-metre-thick rhyolite tephra is variably zeolitized with clinoptilolite (Z3). Other clinoptilolite-bearing tephra occurrences are at EM0666350mE, EM5660900mN and 640 metres (2100 feet) (Z4) and EM0563900mE, EM5664000mN and 890 metres (2925 feet) (Z5). Rare, tuffaceous arenite layers are weakly zeolitized with clinoptilolite up to 100 metres beneath the volcanic conglomerate. X-ray diffraction and thermal stability investigations (Boles, 1972) form the basis for the heulandite to clinoptilolite designations within the heulandite group.

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