BRITISH COLUMBIA
Ministry of Energy and Mines
Energy and Minerals Division
Geological Survey Branch

Geology and Industrial Minerals of the Tertiary Basins, South-Central British Columbia

By Peter B. Read
Geotex Consultants Ltd.

GeoFile 2000-3

PREFACE

This publication provides the first comprehensive description of the Eocene stratigraphy of the Tertiary basins in south-central British Columbia and documents the numerous, related mineral occurrences. These basins are highly prospective for a variety of industrial minerals, including diatomite, zeolite, perlite, bentonite and kaolin.

The field work on which this publication is based was conducted from 1986 to 1989. Progress reports were published in seven Open File maps and led to the discovery of a number of new occurrences, including an economic zeolite deposit. This compendium was written in 1991 and does not describe any of the recent industrial mineral discoveries in these basins. The reader is referred to the provincial MINFILE records for detailed descriptions of these new occurrences. This publication will be of benefit to those interested in industrial mineral opportunities within the province.

W.R. Smyth
Director, Geological Survey
B.C. Ministry of Energy and Mines

TABLE OF INDUSTRIAL MINERAL DISCOVERIES DURING THE 1990s

MINFILE #	Name	Commodity	NTS Map	Location	
082LSW158	Will	kaolinite	082L05E	50°27′39″	119°40′59″
082LSW159	Pinaus	diatomite	082L05E	50°23′41″	119°36′45″
092HSE160	Tulameen Bentonite	bentonite	092H07E	49°26′33″	120°34′5″
092HSE162	Similkameen Bentonite	bentonite	092H07E	49°23′55″	120°32′21″
092HSE163	Ashnola Bentonite	bentonite	092H07E	49°22′49″	120°32′27″
092HSE166	Bromley Vale Zeolite	zeolite	092H07E	49°25′18″	120°35′42″
092HSE167	Tailings Tephra	zeolite	092H07E	49°25′7″	120°31′17″
092HSE243	Bromley Creek Zeolite	zeolite	092H07E	49°25′25″	120°33′50″
092INW095	Ranchlands	zeolite	092I14W	50°49′44″	121°16′24″
092O 081	Churn Creek Bentonite	bentonite	092O09W	51°31′30″	122°18′35″
092O 098	Crow's Bar	bentonite	092O08E	51°18′12″	122°11′38″
092O 100	Lot 3155	zeolite	092O08E	51°19′11″	122°13′35″
092O104	Mooney's Ranch	volcanic glass	092O01E	51°8′30″	122°6′13″
092O 107	North Mooney's	zeolite	092O01E	51°9′18″	122°5′21″
092O 108	South Mooney's	zeolite	092O01E	51°7′51″	122°5′12″
092O 117	Churn Creek Zeolite	zeolite	092O09W	51°31′17″	122°19′55″
092O 118	2700 Road	zeolite	092O09W	51°30′2″	122°18′30″
092O 119	Central Empire Valley Rd.	zeolite	092O08W	51°29′7″	122°17′45″
092O 120	Grinder Creek Zeolite	zeolite	092O08E	51°23′55″	122°14′35″
092P 096	Deadman River	diatomite	092P02W	51°3′39″	120°52′46″
092P 097	North Snohoosh	diatomite	092P02W	51°5′54″	120°52′4″

SUMMARY

This geological investigation concentrated on areas of sediment-dominated successions of Eocene age with occurrences of industrial minerals. Most of the areas lie close to major transportation routes and to nearby markets.

The Princeton and Tulameen basins share a common Eocene stratigraphy in which Eocene sediments of the Allenby Formation overlie Eocene volcanic rocks of the Cedar Formation. Widespread waterlain rhyolite tephra and a distinctive conglomerate permit a stratigraphic subdivision of the more than 2000-metre thickness of sediments into 12 informal members. The detailed stratigraphic subdivision spans a 12-kilometre outcrop gap to the Tulameen basin but does not span an 8.5-kilometre gap to the southern outlier of the Princeton basin near Sunday Creek. The detailed stratigraphy yields a correlation scheme for coal seams of the Princeton basin which, although largely similar to others, differs in correlating the Bethlehem and Bethlehem lower seams with the Golden Glow and Bromley Vale #1 seams respectively. The most extensive clinoptilolite-rich zeolite occurrences (eight showings) and the only bentonite past producer in the province (one past producer and seven showings) are in the Princeton basin.

The Merritt basin contains four widely separated, sediment-dominated sequences of the Eocene Coldwater Formation which locally overlie small erosional remnants of Eocene volcanic rocks of the Cedar Formation. Bentonite (two showings) is the only industrial mineral known in the basin.

Along the southern edge of the Cache Creek and Arrowstone hills area, from the village of Cache Creek to Battle Creek, tuffaceous sediments and rhyolite tephra form several sedimentary lenses up to 100 metres thick that underlie a dacite-andesite ± basalt flow and tephra sequence up to 2000 metres thick. The basal sedimentary lenses contain four heulandite-clinoptilolite showings, and where the intermediate tephra is waterlain near the base, it is bentonite-rich (two showings). In the Arrowstone Hills, the Chilcotin Group consists of up to 500 metres of olivine basalt flows of the Chasm Formation overlying up to 400 metres of rhyolite tuff and ash, and tuffaceous, fluviatile and locally lacustrine sediments composing the Deadman River Formation. The sediments and rhyolite tephra fill mainly northwestward-flowing Miocene drainage channels up to 450 metres deep and 5 kilometres wide, which were mapped for over 45 kilometres from southeast of Deadman River to northwest of Bonaparte River, but probably extend much farther. Diatomite-bearing sediments are restricted to the channel fillings and intercalations among the immediately superjacent basalt flows (one producer and 23 showings).

At Hat Creek, over 1600 metres of Eocene and(?) Oligocene sediments overlie up to a few hundred metres of Eocene volcanics and as many as 400 metres of mid- Cretaceous sediments. With the exception of the Eocene volcanic rocks, this stratigraphy subcrops beneath 100 metres or less of overburden that mantles most of the valley floor. The Eocene and Cretaceous rocks form two northerly trending synclines separated by a locally faulted anticline. Northerly oriented strike-slip faults with minor dip-slip components have offset the folds by as much as 5000 metres. The Cretaceous and Tertiary rocks, including Miocene basalt flows, compose bedrock slide blocks of Quaternary age that are up to 4000 metres long. They have moved up to 2500 metres from either valley wall towards the present valley axis along extensive bentonitic horizons (one bentonite showing).

Along the Fraser River from north of Lillooet to Gang Ranch, the Fraser fault slices through Eocene and older rocks. A 200-metre-thick panel of easterly dipping Eocene volcanic rocks and waterlain ash lies between Slok Creek and Fraser faults for at least 12 kilometres between the mouths of Fountain and Slok creeks (one bentonite showing). A few kilometres to the north, a thin, westerly dipping panel of Eocene volcanic rocks and ash underlies a 10-kilometre-long wedge east of the fault (two bentonite showings). Mapping and radiometric dating indicate a 10-kilometre gap in Eocene rocks straddles Leon Creek near the fault. Extending for over 65 kilometres northward from the junction of the Fraser and Hungry Valley faults, Eocene volcanic and overlying sedimentary rocks form a panel 1600 metres thick, which dips gently eastward and terminates against the Fraser fault. Most of the industrial mineral occurrences are in waterlain rhyolite (nine heulandite-clinoptilolite showings) and intermediate tephra (eight bentonite showings) in the upper part of the Eocene volcanic succession. Volcanic glass (three showings) and perlite (two showings and one past producer) form in rhyolite flows and hypabyssal intrusions. The Cretaceous rocks are devoid of industrial minerals.

This investigation concentrated on the occurrences of zeolites, bentonite, kaolinite, perlite and volcanic glass, and diatomites in Cenozoic rocks. The geological setting of the previously known occurrences, combined with the known or inferred chemical and physical conditions of the 63 occurrences discovered during this study, lead to the following conclusions:

Of the areas investigated, industrial zeolite occurrences are restricted to the Princeton and Tulameen basins, basal sedimentary lenses near McAbee, and waterlain rhyolite tephra along the Fraser River. In the Princeton basin, zeolitized tephra horizons are up to 3.5 kilometres long and 30 metres thick. Some samples have cation exchange ca-

pacities (CEC) similar to those of the products from operating mines in the western United States. Along the Fraser River, a few intermediate CEC values suggest an industrial zeolite potential.

Bentonite is widespread in sedimentary and adjacent volcanic rocks of Eocene age. Although few of the areas have been explored, drilling at Hat Creek has outlined significant thicknesses. From a few exchangeable cation analyses, divalent cations dominate except for showings in the south end of the Princeton basin and a showing in the Deadman River valley.

Known kaolinite occurrences in British Columbia are the result of subtropical weathering of granitic or compositionally equivalent volcanic rocks on unconformities ranging in age from Early Cretaceous to Late Eocene. Kaolinite occurrences are in sediments overlying such an unconformity developed on granitic rocks, but sediments are absent within the area investigated. They occur to the southwest in the Georgia Basin and may have developed to the northwest in the Chilcotin-Nechako region.

Perlite develops in glassy rhyolite which is a part of the little-altered Eocene volcanic sequence along the Fraser River. Similar rocks may occur farther north along and west of the river.

Diatomaceous earth occurs in Miocene and younger rocks in the sedimentary fill of the deep drainage channels buried beneath the widespread basalt flows of the Chilcotin Group. All of the showings in the Arrowstone Hills are in the sediments of this northwestward-flowing drainage system, and those north of Gang Ranch are in sediments in a north-draining channel. This Miocene drainage system subparallels the Fraser and undoubtedly has tributaries to the west, in the Chilcotin-Nechako area.

Although not a subject of this investigation, the discovery of a major northwesterly to northerly flowing Miocene drainage system opens the possibility of Miocene placer gold and provides a framework to guide the prospecting for such occurrences.

Uninvestigated areas of greatest potential for industrial minerals in Cenozoic rocks are near Kamloops, parts of the Queen Charlotte Islands, and those parts of the Chilcotin-Nechako area close to transportation.

TABLE OF CONTENTS

PUBLISHED MAPS PREPARED DURING THE COURSE OF FIELDWORK FOR THIS STUDY:

Open File

1987-19: Tertiary Stratigraphy and Industrial Minerals, Princeton and Tulameen Basins, British Columbia (92H/2, 7, 8 9, 10) by P.B. Read (1:25 000), 1 sheet.

1988-15: Tertiary Stratigraphy and Industrial Minerals, Merritt Basin, Southern British Columbia (92I/1, 2) by P.B. Read (1:25 000), 1 sheet.

1988-29: Tertiary Stratigraphy and Industrial Minerals: Fraser River, Lytton to Gang Ranch, British Columbia (92I/5, 12, 13; 92J/16; 92O/1, 8; 92P/4), by P.B. Read (1:50 000), 1 sheet.

1988-30: Tertiary Stratigraphy and Industrial Minerals, Cache Creek Map Area, Southwestern British Columbia (92I/14, by P.B. Read (1:50 000), 1 sheet.

1989-21: Tertiary Stratigraphy and Industrial Minerals, Bonaparte to Deadman Rivers (92P/2, 3),by P.B. Read (1:50 000), 1 sheet.

1989-27: Geology and Industrial Minerals in the Gang Rach Area (92O/8W, 9W), by K. Green (1:50 000), 1 sheet.

1990-23: Cretaceous and Tertiary Stratigraphy and Industrial Minerals, Hat Creek, Southern B.C. (92I/12, 13, 14), by P.B. Read (1:25 000), map with notes.