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CONTINENTAL LIME LTD.

1994, 1995, AND 1997 EXPLORATION OF THE NORTHERN PART OF BRAZEAU RANGE

WEST-CENTRAL ALBERTA

Metallic and Industrial Minerals Permit
9396010038

Geographic Coordinates

52°23' N to 52°33' N
115°53' W to 116°14' W

NTS Sheets 83 B/5, C/8, and C/9

1998 05 15

by

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1. SUMMARY

Along Brazeau Range near Nordegg, Alberta and within metallic and industrial minerals permit 9396010038, the Devonian Palliser Formation, the Upper Devonian to Lower Carboniferous Banff Formation, and the Lower Carboniferous Rundle Assemblage were examined for high-calcium limestone.

During June and July 1994, September 1995, and July and September 1997, Paleozoic limestone units were examined at 34 locations, and 162 samples were collected and analyzed for whole rock constituents and LOI. Samples were collected from a total stratigraphic thickness of about 535 m, while more than 850 m of strata were examined.

More than 600 m of the lower part of the Rundle Assemblage were examined at 30 sections and 142 samples collected from about 466 m normal thickness of strata. Concentrations of CaO vary from 35.22 to 55.30%, with up to 17.29% MgO, and up to 0.75% SiO_2.

The Banff Formation was examined at five sections representing more than 175 m of strata and 11 samples were collected from about 14 m normal thickness of strata. Concentrations of CaO vary from 25.66% to 53.87%, with up to 21.76% MgO, and up to 27.95% SiO_2.

About 70 m of the Palliser Formation were examined at four sections and nine samples collected from about 55 m normal thickness of strata. Concentrations of CaO vary from 31.49% to 51.75%, with up to 21% MgO, and up to 2.16% SiO_2.

Carbonate units examined within the Palliser and Banff Formations are of little economic interest for high-calcium limestone, as they exhibit low concentrations of CaO, and elevated concentrations of MgO, SiO_2, or both. High-calcium limestone units are present within the lower Rundle Assemblage; however, thickness and constituent concentrations exhibit variability along strike.

2. INTRODUCTION

During 1994, 1995, and 1997, Halferdahl & Associates Ltd. on behalf of Continental Lime Ltd. conducted exploration for high-calcium limestone within west-central Alberta. This assessment report describes the exploration conducted within metallic and industrial minerals permit 9396010038 which encompasses the northern part of Brazeau Range of the Alberta Foothills.

This report contains analytical data for samples collected in 1994, 1995, and 1997, as well as geologic observations made while collecting these samples and interpretation of the results.

3. GEOGRAPHIC SETTING AND ACCESS

Metallic and industrial minerals permit 9396010038 encompasses the northern part of Brazeau Range near Nordegg, Alberta. Nordegg, with year-round facilities is located 79 km west of Rocky Mountain House on Highway 11 (Fig. 3.1). It has a gas station, motel, restaurant, store, and a Heritage Centre with information on the surrounding area including former coal mines. Its population is less than 200; its local economy is based on oil and gas, tourism, the Nordegg Lime Quarry, lumbering, and the Nordegg Correctional Institute. Rocky Mountain House has a population of 5400. The economy of Rocky Mountain House is based mostly on agriculture, lumber, oil and gas, and tourism.

The ridges and mountains immediately north of Highway 11 extend northwesterly for about 15 km. Shunda Mountain reaches a maximum elevation of 2060 m with elevation on the valley floor slightly less than 1500 m. Timberline is at an elevation of approximately 2000 m. Access to the area is via the Shunda Creek road or the Forestry Trunk Road with turnoffs ½ km and two km west of Nordegg, respectively (Figs. 7.1 and 7.4). A number of bush trails, cut lines, and logging roads crisscross the area and are passible for all-terrain vehicles.

Between Nordegg and Gap on North Saskatchewan River, Storm Mountain reaches an elevation of 2038 m and other peaks rise to more than 1950 m (Fig. 7.4). Timber line is at about 1900 m. Access is via the Forestry Trunk Road about two km west of Nordegg or a former coal-mine road immediately south of the town of Nordegg and through the grounds of the Nordegg Correctional Institute. Gap on North Saskatchewan River can be reached by a 4-wheel-drive road that follows the power lines immediately north of North Saskatchewan River. Bush trails and cut lines crisscross the area and are passible for all-terrain vehicles. Most bush roads shown on the

1:50,000 topographic maps contain erosion bars that prevent passage by 4-wheel-drive vehicles.

The area is part of the eastern-slope montane forest ecological region. Below timber line vegetation consists of dense stands of aspen, lodgepole pine, white spruce, and less frequent stands of Douglas fir. In the subalpine zone vegetation consists of stunted subalpine fir and Englemann spruce and above timber line, of alpine foliage. Vegetation in areas of rugged limestone outcroppings is generally sparse. Areas of lowest relief are covered with dense stands of black spruce and thick undergrowth, with local muskegs and swamps.

In this report informal names are applied to previously unnamed geographic features for convenience.

4. PROPERTY, EXPLORATION, AND EXPENDITURES

4.1 METALLIC AND INDUSTRIAL MINERALS PERMIT 9396010038

In early 1996, Continental Lime Ltd. acquired metallic and industrial minerals (MAIM) permit 9396010038 to cover Paleozoic limestones near Nordegg, Alberta (Table 4.1 and Fig 4.1). The permit is divided into two parts by quarrying leases, and by Land Use Zones 4 and 8 as designated by the Alberta Eastern Slopes Policy (Alberta Forestry, Lands, and Wildlife, 1988).

The original area of MAIM permit 9396010038 totalled 8,716 hectares (Table 4.1 and Fig. 4.1). This has been reduced to 3,286 hectares, based on the exploration described herein.

4.2 1994, 1995, AND 1997 EXPLORATION

Between June 21 and 27, 1994 and between July 13 and 15, 1994 those parts of Brazeau Range within MAIM Permit 9396010038 were examined by Halferdahl & Associates Ltd. on behalf of Continental Lime Ltd. for high-calcium limestone (Dahrouge and Halferdahl, 1995). Limestone outcrops were examined, sampled, or both at 16 locations (Appendix 2A; Fig's. 7.1 and 7.4; Table 4.2). A total of 64 samples representing about 225 m of strata were collected from more than 445 m of strata examined.

Between September 23 and 25, 1995 Halferdahl & Associates Ltd. examined and sampled limestone outcrops at eight locations (Dahrouge and Halferdahl, 1996). A total of 32 samples representing about 74 m of strata were collected from more than 120 m of strata examined (Appendix 2B).

Between July 12 and 14, 1997 (Pana and Dahrouge, 1998) and September 17 and 21, 1997 Halferdahl & Associates Ltd. examined and sampled limestone outcrops at 18 locations. A total of 66 samples representing about 236 m of strata were collected from 288 m of strata examined (Appendix 2C).

TABLE 4.1 DESCRIPTION OF METALLIC AND INDUSTRIAL MINERALS PERMIT 9396010038 OF CONTINENTAL LIME LTD., NEAR NORDEGG

Comm. Date	Expiry Date	Land Description (Tp-RW5)	Size (Ha)
Permit Area (Fig. 4.1)			
1996-01-17	35811	39-14W5 (Sections: 35; 36W) 40-14W5 (Sections: 1SW,L12,L13; 2; 3NE; 9NE; 10; 11S, NW; 15; 16; 17E,L11,L14; 19N,L5,L6,L7,L8; 20; 21S,21NW; 28SW; 29; 30; 31E,L3,L4; 32S, 32NW) 40-15W5 (Sections: 24NE,L7,L8,L13,L14; 5S,L9S,L10S; 26WP*, 26SE; 34NP°, 34SEP*; 35SWP*, 35NWP°) 41-15W5 (Sections: 2SWP°; 3SP°,3N; 4NP°; 5NEP¹,L13,L14; 7N, 7SE; 8;9; 30SW) 41-16W5 (Sections: 12N,12SE; 13; 14N,14 SE; 22; 23; 24; 25; 26; 27)	8716
Reduced Permit Area (Fig. 4.1; This Report)			
35080	37272	39-14W5 (Sections: 35NE,L7,L8) 40-14W5 (Sections: 2SE,NW,L3,L5,L6,L10,L15; 10SE,NW,L3,L5,L6,L9,L10,L15; 11L3,L4; 15L3,L4,L5; 16NW,L5,L6,L7,L8,L9,L10,L15; 17L7,L8,L9,L16; 19N; 20NW,L1,L2,L7,L10,L15; 30L2,L3) 40-15W5 (Sections: 24L9,L16; 25L1,L5,L6,L7,L8,L9S, L10S; 26L6P*,L7,L8) 41-15W5 (Sections: 3L2,L3,L4P°,L5,L6,L7,L11,L12,L13; 4L9,L13,L14,L15,L16; 5L16; 7NE,L8,L14; 8S,L10,L11,L12; 9S,10L4,L5; 18S,L11,L12,L16; 19SE,L9,L10,L13,L14,L15; 30L4) 41-16W5 (Sections: 13NW,L1,L6,L7,L8,L9,L10,L15; 23L1,L8,L9,L14,L15,L16; 24SW,N,L2,L7,L8; 25SW,L1,L2,L7,L11,L12; 26S,L9,L10,L11,L12; 27SE,L9,L10)	3286

* Part lying outside land use zone 8
° Part lying outside land use zone 4

TABLE 4.2 LOCATIONS SAMPLED IN 1994, 1995, AND 1997

Location	Number of Samples	Measured Stratigraphic Thickness (m)	Sampled Stratigraphic Thickness (m)
Livingstone Formation **(Fig's. 7.1 and 7.4)**			
94-1 North Knob	4	17¾	17¾
94-2 Little Shunda Mountain	3	12¾	12¾
94-3 Shunda Mountain Road	3	12½	12½
94-4 Coliseum Mountain-North	9	34½	27
94-5 Coliseum Mountain-South	6	37¾	34¾
94-7 Mountain E of Martin Creek - Location 1	5	28½	10½
94-8 Mountain E of Martin Creek - Location 2	2	>21	14¼
94-9 South Ridge on Storm Mountain	7	16	13½
94-10 Dipslope Mountain	5	36½	23
94-11 At Gap on North Saskatchewan	8	49¼	38
95-1 South End of Ridge from Little Shunda Mt	4	10	9
95-2 Along Cut Line South of Little Shunda Mt.	1	6½	6½
95-3 Creek Valley S of Little Shunda Mt.	5	13¾	13¾
95-4 Creek Valley 2 km W of Shunda Mt	6	7¼	7¼
95-5 Shallow Creek Bed on SW Flank of Shunda Mt	5	>20	10
95-6 Dip Slope 2km S of Shunda Mountain	1	1¼	1¼
95-7 Approximate Dipslope on S Flank of Coliseum Mt	5	>28	11¾
95-8 North Side of Hwy 11, E of Nordegg turnoff	5	>33	14½
97-1 NW shore of Coyote Lake	3	12	11
97-2 Ridge Trending E from Coyote Lake	1	5	5
97-4 Tributary Creek NE of North Knob	1	4	4
97-6 Creek on SW Flank of Coliseum Mountain	7	25	15
97-7 Cliff Outcrops at W Bank of Martin Creek	6	39	29
97-9 Southwest Side of Ridge at N End of Dipslope Mt	6	23½	23½
97-10 Southwest Side of Ridge neart N End of Dipslope Mt	5	13	12
97-11 Southwest Flank of Dipslope Mt. 200 m Down Ridge	4	10¾	7¾
97-12 Low Point in Saddle on Dipslope Mountain	5	29½	27½
97-13 Cliff Between Second and Third Peaks on Dipslope	10	30½	28¾
97-14 South of Second Peak from SE End of Dipslope Mt.	3	7¾	7¾
97-15 Near Southernmost Peak of Dipslope Mountain	7	17	17
TOTALS	142	>603¾	466½
Banff Formation **(Fig's. 7.1 and 7.4)**			
94-3 Shunda Mountain Road	5	8½	8½
94-7 Mountain E of Martin Creek - Location 1	1	131	1
94-9 South Ridge on Storm Mountain	3	2	2
94-11 At Gap on North Saskatchewan	1	28¾	¾
97-3 Easterly Trending Ridge Top, N of North Knob	1	9	2
TOTALS	11	179¼	13¾
Palliser Formation **(Fig's. 7.1 and 7.4)**			
94-6 Coliseum Mountain	1	7	7
94-7 Mountain E of Martin Creek - Location 1	1	2	2
97-5 North Flank of Coliseum Mountain	5	47	31
97-8 Mountain E of Martin Creek	2	15	15
TOTALS	9	71	55

4.3 EXPLORATION EXPENDITURES

Between 1994 and 1997 exploration expenditures not including G.S.T. totalled $98,027.35, with $45,477.40 incurred in 1994, $19,224.31 in 1995, and $33,325.64 in 1997 (Appendix 1). These expenditures are allocated to MAIM permit 9396010038 as follows:

Assessment Period	Expiry Date	Required Expenditures	Assigned Expenditures
Years 1 and 2	1998-01-17	$16,430	$16,430
Years 3 and 4	2000-01-17	$32,860	$32,860
Years 5 and 6	2002-01-17	$32,860	$32,860
Years 7 and 8	-	$49,290	$15,877
		Total:	$98,027

5. PREVIOUS INVESTIGATIONS

Exploration for high-calcium limestone in the Foothills and Front Ranges of the Rocky Mountains in Alberta began prior to 1886 when Loders Lime opened the first quarry at Kananaskis (Matthews, 1956). Near Kananaskis, Loders Lime and its successor companies, Steel Brothers Canada Ltd. and Continental Lime Ltd., have quarried high-calcium limestone and produced lime for more than 100 years.

Brazeau Range of the Alberta Foothills, was mapped according to NTS map sheets by the following officers of the Geological Survey of Canada:

NTS Map Sheet	Reference
83 B/5 W½ (Alexo)	Erdman (1950)
83 C/8 (Nordegg)	MacKay (1941a) Douglas (1956)
83 C/9 (Chungo Creek)	MacKay (1941b, 1943) Douglas (1958)

Goudge (1945) examined limestones of the Palliser Formation and the Rundle Group along the former CNR line near Nordegg. Holter (1976) examined the Mount Hawk, Alexo, Palliser, and Banff Formations, and the Rundle Group near Nordegg. Hamilton (1987, 1988) examined limestone in the Cathedral Formation, Upper Lynx Group, and Alexo, Palliser, and Livingstone Formations near Abraham Lake, west of Nordegg. Hamilton (1987, 1988) and Holter (1990) investigated the Eldon Formation as a source of filler-grade limestone at Windy Point, 36 km southwest of Nordegg on the David Thompson Highway.

6. REGIONAL GEOLOGY

In west-central Alberta, Paleozoic limestones are known to occur within the Middle Cambrian Eldon Formation, the Upper Devonian Mt. Hawk Formation, the Upper Devonian Palliser Formation, the Upper Devonian to Lower Carboniferous Banff Assemblage and the Lower Carboniferous Rundle Assemblage (Table 6.1). The Palliser Formation at both Exshaw and Cadomin supplies limestone for the manufacture of cement (Holter, 1994).

Only the regional lithostratigraphic relationships of the Palliser Formation, the Banff Assemblage, and the Rundle Assemblage are described herein. Detailed lithostratigraphy of sections investigated from these units are in Appendices 2A, 2B, and 2C (Section 7). A detailed review of the regional stratigraphy is provided by Stott and Aitken (1993), Mossop and Shetsen (1994), Halbertsma (1994), and Richards et al. (1994).

6.1 STRATIGRAPHY

6.1.1 Palliser Formation

In west-central Alberta, the Lower to Middle Famennian Palliser Formation consists mainly of outer shelf and basinal carbonates of the Sassenach Basin (Halbertsma, 1994). The Palliser Formation is divisible into the Morro and overlying Costigan members, which are separated by an unconformity. The Morro Member comprises a lithologic suite dominated by carbonates with significant lateral facies variations. The Costigan Member consists of open-marine fossiliferous limestones and shales, with local evaporitic sedimentation. Within the Foothills and Front Ranges of Alberta, limestones of the Palliser Formation vary from less than 180 m to more than 270 m in thickness (Holter, 1976).

The Palliser Formation is overlain by shales of the Exhaw Formation, and siliciclastics and carbonates of the Banff Formation.

6.1.2 Banff Assemblage

In west-central Alberta, the Exshaw, Banff and Yohin formations comprise the Banff Assemblage (Richards et al. 1994). The Upper Famennian to Lowermost Tournaisian Exshaw Formation is dominated by fine-grained siliciclastics deposited in euxinic basin to shallow-neritic environment. In general, it is unconformably overlain by the Lower to Upper Tournaisian Banff Formation, which is a heterogeneous association of carbonates and fine-grained siliciclastics deposited on poorly differentiated carbonate platforms. Westward, the uppermost Banff Formation grades laterally into the Rundle Assemblage.

6.1.3 Rundle Assemblage

The Lower Carboniferous Rundle Assemblage extends from MacKenzie Mountains in the Arctic south through the Peace River Embayment to southeastern British Columbia. In west-central Alberta, it comprises shallow-marine platform and ramp carbonates which prograded westward over deeper water shales and carbonates of the Banff Assemblage. The lower Rundle Assemblage is subdivided into the transgressive carbonate Pekisko Formation, and two regressive

TABLE 6.1 GENERALIZED PALEOZOIC STRATIGRAPHY OF FOOTHILLS AND FRONT RANGES, WEST-CENTRAL ALBERTA*

System or Subsystem	Stratigraphic Unit		
	Assemblage / Group	Formation	
		S	N
Lower Carboniferous	Rundle Assemblage	Mount Head	
		[1] Livingstone	Turner Valley
			Shunda
			Pekisko
	Banff Assemblage	Banff	
		Exshaw	
		[1] Palliser	
		Alexo	
Upper Devonian	Fairholme Group°	Southesk	Mount Hawk
		Cairn	
Cambrian		Pika	
		Eldon	
		Stephen	
		Cathedral	

*Compiled from MacKenzie (1969), Richards et al. 1994, Switzer et al., 1994., and Holter, 1994.
° Fairholme Group of MacKenzie (1969) is partly equivalent to the Woodbend Group of Switzer et al., 1994.
[1] Current limestone production (*from* Holter, 1994)

successions of restricted-marine carbonates and subordinate anhydrite assigned to the Shunda and Turner Valley formations (Richards et al. 1994). In southern Alberta the Pekisko grades laterally into the uppermost Banff Formation. The Turner Valley Formation extends from east-central British Columbia to southwest Alberta. According to Richards et al. (1994), the Turner Valley Formation thickens to the southwest and for most of its length is 50 m to 120 m thick. The type section near Turner Valley is 152 m thick and divisible into four beds.

Earlier work by Douglas (1958), and MacQueen and Bamber (1968) indicate that the eastern peritidal sequences of the uppermost Pekisko, Shunda and lower Turner Valley grade south and southwestward into the more open-marine sequence of the Livingstone Formation (Table 6.1).

The upper Rundle Assemblage includes the transgressive Mount Head Formation.

6.2 STRUCTURE

In Front Ranges and Foothills of west-central Alberta, Paleozoic and Mesozoic strata have been repeated along several major thrust faults. Displacements along these faults are interpreted to be tens of kilometres. Within individual thrust sheets regional-scale folds exhibit a spatial relation to their leading edges. Near Nordegg, the main structural discontinuity is the northwest to southeast trending Brazeau Thrust (Fig. 6.1). The leading edge of the thrust sheet is folded into the asymmetrical to recumbent Brazeau Anticline.

7. PERMIT GEOLOGY

In Brazeau Range, Paleozoic limestones are present within the Palliser Formation and Banff and Rundle assemblages (e.g., Erdman, 1950; Douglas, 1956). The area of interest is part of the Brazeau Thrust sheet, a complex of faulted and folded Paleozoic and Mesozoic strata thrust onto the Cenozoic strata of the Paskapoo Formation (Douglas, 1958). The eastern and western boundaries of the Brazeau thrust sheet are defined by the northwest-striking Brazeau and Bighorn thrusts, respectively (Fig. 6.1). The northwest trending Brazeau Anticline is the principal structure of the area. A number of thrust faults have been mapped along the eastern margin of the anticline.

Near Nordegg, Holter (1976 and 1994) assigned limestones within the lowermost part of the Rundle Assemblage to the Livingstone Formation and tentatively to the overlying Shunda Formation. In contrast, Richards et al. (1994) show carbonates of the Livingstone Formation as overlying the Pekisko Formation and laterally equivalent to the Shunda and Turner Valley Formations. At Shunda Mountain, Douglas (1958) assigned limestones of the lower part of the Rundle Assemblage to the Pekisko and Shunda formations, and the overlying dolomitic intervals to the upper part of the Rundle Assemblage.

Following Holter (1976, 1994), throughout this report the lower part of the Rundle Assemblage will be referred to as the Livingstone Formation.

7.1 GEOLOGY OF BRAZEAU RANGE NORTH OF HIGHWAY 11

7.1.1 Stratigraphy

The exposed parts of the Palliser Formation are up to 252 m thick and consist of finely crystalline dolomite, and finely crystalline, mostly argillaceous dolomite and limestone (Douglas, 1956). The Palliser Formation is overlain by two metres of black shale constituting the Exshaw Formation. The overlying Banff Formation consists of a lower recessive unit of calcareous shales and cherty argillaceous limestone 83 m thick at Shunda Creek Gap, and an upper resistant unit of fine-grained, medium-bedded, limestone and dolomite with crinoid remnants that is 91 m thick on Coliseum Mountain (Douglas, 1956; Fig. 7.1).

According to Erdman (1950, p. 11) the overlying Rundle Assemblage

> "outcrops as a peripheral strip around the Brazeau Range, and forms an almost continuous dip-slope on the southwestern flank... . The lowest member is a massive, light-weathering, coarse-grained limestone".

Previously measured thicknesses of the Livingstone Formation from Brazeau Range follow:

Location	Reference	Thick. (m)
Shunda Mountain	Douglas (1958)	32½
Nordegg Lime Quarry*	Matthews (1960)°	~50¾
Dizzy Creek*	Erdman (1950)	51¾

* South of Highway 11
° *cf* Holter (1976)

North of Highway 11 the Livingstone Formation outcrops along a 14-km band on the southwest side of Brazeau Range and on Shunda and Coliseum Mountains (Fig's. 7.1, 7.2, and 7.3). It consists of light- to medium-grey and medium-greyish-brown, medium-grained, thick-bedded to massive, crinoidal calcarenite (Appendicies 2A, 2B, and 2C). Sampled thicknesses of limestone units within the Livingstone Formation ranged from less than a few meters to 34¾ m; they are partly determined by the present erosional surface. On Shunda Mountain about 53 m of recessive, thin-bedded, argillaceous microcrystalline limestone with thin-bedded dolomite and about 109½ m of dolomite and argillaceous dolomite have been assigned to the Shunda Formation and the upper part of the Rundle Assemblage, respectively (Douglas, 1958).

7.1.2 Structure

North of Nordegg the main structural elements within Brazeau Range include Brazeau Anticline, and Coliseum Fault, which is a splay from the Brazeau Thrust (Fig's. 7.1, 7.2, and 7.3). North of Highway 11 the asymmetrical Brazeau Anticline trends northwesterly; one limb dips gently to moderately to the southwest and the other steeply northeast to overturned. Local faults and folds are present on both limbs.

7.2 GEOLOGY OF BRAZEAU RANGE SOUTH OF HIGHWAY 11

7.2.1 Stratigraphy

The stratigraphy described in Section 7.1 extends southeasterly onto the southern part of Brazeau Range, so its account is not repeated here.

Near Nordegg (Fig's. 7.4 and 7.5), the Livingstone Formation consists of a lower unit of light- to medium-grey, crinoidal calcarenite; a sequence of variably argillaceous dolomite and dolomitic limestones; and an upper unit of light- to medium-grey, crinoidal calcarenite (Matthews, 1960 *cf.* Holter, 1994). Locally, the top of the upper calcarenite unit is eroded.

Eastward, facies changes in the Livingstone Formation result in a thinning of the middle dolomitic unit at Martin Creek and in numerous thin interbeds of calcarenite, argillaceous limestone, and dolomite at Storm Mountain (Fig. 7.6; Appendices 2A and 2C). On the west side of Dipslope Mountain about 24 m of variably dolomitic calcarenite overlay the Banff Formation (Samples 9735 to 9739; Appendix 2A). Towards the southeastern end of Dipslope Mountain a section of the Livingstone Formation consists of about 30 m of calcarenite, which is slightly dolomitic at the top. Father south at Gap on North Saskatchewan River, additional facies changes in the Livingstone Formation result in alternating units of calcarenite, dolomitic limestone, and dolomite (Appendix 2A).

Along Brazeau Range, local dolomitization accompanies several bedding-parallel faults (eg. Sample 11586, Dipslope Mountain). Possible hydrothermal dolomitization was discussed by Stoakes (1987) and Packard and Pellegrin (1989).

7.2.2 Structure

The main structural elements southeast of Nordegg are the same as those north of Highway 11, namely Brazeau Anticline and splays from Brazeau Thrust. Although mostly asymmetrical near Storm Mountain (Fig's. 7.4 and 7.6), parts of the Brazeau Anticline are symmetrical with dip slopes of 23° to 38° in the southwest limb that decrease to the west. Steep

dip-slopes are present at lower elevations in the northeast limb. Erdman (1950) mapped a second order northwest-trending syncline and a northwest-trending anticline within the northeast limb. Southeasterly to North Saskatchewan River the southwest limb forms dip slopes with moderate dips at higher elevations, particularly on Dipslope Mountain, and gentler dips at lower elevations.

8. SAMPLING AND ANALYSES

8.1 SAMPLING

Some 64 samples were collected in June and July 1994 (Appendix 2A), 32 in September 1995 (Appendix 2B), and 66 in July and September 1997 (Appendix 2C) by chipping outcrops perpendicular to bedding. Where bedding could not be identified, chips were taken in directions appropriate to topography with stratigraphic thickness deduced from other measurements where possible. Samples were collected from the places and stratigraphic units listed in Table 4.2. The 162 samples with a total stratigraphic thickness of about 535 m were collected from an investigated stratigraphic thickness that exceeds 850 m.

8.2 ANALYTICAL PROCEDURES

The 64 samples collected in 1994 were analyzed by Acme Analytical Laboratories Ltd. (Appendix 3A) according to inductively coupled plasma (ICP) techniques. This analytical technique when used to analyse limestone samples typically gives satisfactory results, but the Acme determinations of CaO and LOI in some samples required adjustment (Section 8.4). For ICP analyses the samples were crushed, ground, and pulverized, with 0.2 g of sample fused with 1.2 g of $LiBO_2$, and dissolved in 100 ml 5 % HNO_3. Acme was requested to determine LOI at a temperature higher than 1000°C or to ignite the sample for 2 h.

Fifteen check samples from those collected in 1994 were re-analyzed at the Central Laboratory of Continental Lime Inc., Salt Lake City, Utah by Standard ICP techniques (Appendices 3B and 6). LOI was not determined. Three of these samples were also analyzed by Loring Laboratories Ltd. (Appendix 3C) according to ASTM C25, except that MgO was determined by standard atomic absorption techniques. For the three samples, LOI was determined at 1050°C instead of 1000°C as specified by ASTM C25.

The 32 samples collected in 1995 were analyzed at the Central Laboratory of Continental Lime Inc. in Salt Lake City by ICP techniques (Appendix 4A). Six check samples from those collected

in 1995 were analyzed by Acme Analytical Laboratories Ltd. (Appendix 4B).

The 66 samples from 1997 were analyzed by the Quality Assurance Laboratory of Continental Lime Inc. (Appendices 5A and 5B). Eight check samples from those collected in 1997 were analyzed by Acme Analytical Laboratories Ltd. (Appendix 5C).

8.3 STATISTICAL EXAMINATION OF ANALYSES BY ANALYTICAL LABORATORIES

Appropriate tests for comparing analyses of individual samples reported by Acme Analytical Laboratories Ltd., the Quality Assurance Laboratory of Continental Lime Inc. (formerly the Central Analytical Laboratory of Continental Lime Inc.), and Loring Laboratories Ltd. are the test of differences (Snedecor, 1957), the sign test (Mendenhall et al., 1990), and the test of confidence intervals (Koch and Link, 1970). For the test of differences and the test of confidence intervals, determinations for each constituent in each sample by the two laboratories are paired; their differences comprise the sample data. For the sign test determinations for each constituent in each sample by the laboratories are paired with the sign of the difference comprising the sample data (Appendix 7).

Results of statistical tests are in Appendices 7A, 7B, and 7C and summarized in Table 8.1. For the 1994 analyses by Acme and Loring, differences and confidence intervals show no significant differences for CaO, adjusted CaO, MgO, and SiO_2. Signs were examined at a probability level of about 31 per cent; CaO, adjusted CaO, and SiO_2 show no significant difference. Signs are significant for MgO, however the sample size is small (n=3). For the 1994 analyses by Acme and Continental, differences and confidence intervals show no significant differences for CaO; while differences and confidence intervals are significant for MgO at a probability level of 5 per cent; and for adjusted CaO and SiO_2 at a probability level 10 per cent. Signs are significant at all levels for MgO and SiO_2; indicating more conservative estimates by Continental for these constituents.

For the 1995 analyses by Acme and Continental, differences and confidence intervals show no significant difference for both MgO and SiO_2. Differences and confidence intervals for CaO and adjusted CaO are significant at a probability level of five per cent; while signs are significant at a probability level of about 47 per cent; indicating a more conservative estimate of CaO by Continental.

For the 1997 analyses by Acme and Continental; differences, confidence intervals, and signs show no significant differences for adjusted CaO, MgO, SiO_2, and LOI. Differences and

TABLE 8.1: SUMMARY OF STATISTICAL TESTS FOR SAMPLES ANALYSED BY ACME ANALYTICAL LABORATORIES LTD., CONTINENTAL LIME INC., AND LORING LABORATORIES LTD.

For the sign test α is the level of significance associated with the rejection region (Appendices 7A, 7B, and 7C).

Ho: Constituent Determination$_{CONT}$ - Constituent Determination$_{ACME}$ = 0

Constituent	Statistic	Test of Differences				Test of Confidence Intervals						Sign Test						Difference		n
		t	$t_{\alpha=0.100}$	$t_{\alpha=0.050}$	$t_{\alpha=0.025}$	$t_{\alpha=0.100}$		$t_{\alpha=0.050}$		$t_{\alpha=0.025}$		M	RRα1		RRα2		RRα3	Range		
						μL	μU	μL	μU	μL	μU		L	U	L	U	L	U		μ	
1994 Acme - Continental																				
CaO	t	-0.232	1.812	2.228	2.634	-0.19	0.15	-0.23	0.19	-0.27	0.23	4	4	7	3	8	2	9	-0.41 to 0.53	-0.02	11
	Ho	-	Accept	Accept	Accept	Accept		Accept		Accept			Reject		Accept		Accept				
Adjusted CaO	t	-5.274	1.812	2.228	2.634	-0.30	-0.15	-0.32	-0.13	-0.33	-0.11	1	4	7	3	8	2	9	-0.41 to 0.03	-0.22	11
	Ho	-	Reject	Reject	Reject	Reject		Reject		Reject			Reject		Accept		Accept				
MgO	t	2.415	1.812	2.228	2.634	0.03	0.19	0.01	0.21	-0.01	0.22	11	4	7	3	8	2	9	0.01 to 0.53	0.11	11
	Ho	-	Reject	Reject	Accept	Reject		Reject		Accept			Reject		Reject		Reject				
SiO_2	t	5.106	1.812	2.228	2.634	0.05	0.11	0.05	0.12	0.04	0.12	11	4	7	3	8	2	9	0.01 to 0.16	0.08	11
	Ho	-	Reject	Reject	Reject	Reject		Reject		Reject			Reject		Reject		Reject				
1994 Acme - Loring																				
CaO	t	1.049	2.920	4.303	6.205	-0.14	0.29	-0.24	0.39	-0.38	0.53	2	0	3	-	-	-	-	-0.06 to 0.19	0.08	3
	Ho	-	Accept	Accept	Accept	Accept		Accept		Accept			Accept		-		-				
Adjusted CaO	t	-0.406	2.920	4.303	6.205	-0.55	0.413	-0.77	0.64	-1.09	0.952	1	0	3	-	-	-	-	-0.22 to 0.19	-0.07	3
	Ho	-	Accept	Accept	Accept	Accept		Accept		Accept			Accept		-		-				
MgO	t	1.342	2.920	4.303	6.205	-0.36	0.96	-0.67	1.28	-1.10	1.71	3	0	3	-	-	-	-	0.02 to 0.75	0.30	3
	Ho	-	Accept	Accept	Accept	Accept		Accept		Accept			Reject		-		-				
SiO_2	t	1.217	2.920	4.303	6.205	-0.13	0.32	-0.24	0.42	-0.38	0.57	2	0	3	-	-	-	-	-0.06 to 0.17	0.09	3
	Ho	-	Accept	Accept	Accept	Accept		Accept		Accept			Accept		-		-				
1995 Continental - Acme																				
CaO	t	-2.867	2.015	2.571	3.163	-1.31	-0.23	-1.46	-0.08	-1.62	0.08	1	2	4	1	5	0	6	-1.61 to 0.21	-0.77	6
	Ho	-	Reject	Reject	Accept	Reject		Reject		Accept			Reject		Reject		Accept				
Adjusted CaO	t	-2.639	2.015	2.571	3.163	-0.49	-0.07	-0.55	-0.01	-0.61	0.06	1	2	4	1	5	0	6	-0.48 to 0.21	-0.28	6
	Ho	-	Reject	Reject	Accept	Reject		Reject		Accept			Reject		Reject		Accept				
MgO	t	-1.024	2.015	2.571	3.163	-0.42	0.14	-0.49	0.21	-0.57	0.29	2	2	4	1	5	0	6	-0.82 to 0.01	-0.14	6
	Ho	-	Accept	Accept	Accept	Accept		Accept		Accept			Reject		Accept		Accept				
SiO_2	t	-0.103	2.015	2.571	3.163	-0.10	0.09	-0.13	0.12	-0.16	0.15	3	2	4	1	5	0	6	-0.22 to 0.09	0.00	6
	Ho	-	Accept	Accept	Accept	Accept		Accept		Accept			Accept		Accept		Accept				
1997 Continental - Acme																				
CaO	t	-2.296	1.860	2.306	2.752	-0.53	-0.06	-0.58	0.00	-0.64	0.06	1	2	7	1	8	0	9	-0.79 to 0.44	-0.29	9
	Ho	-	Reject	Accept	Accept	Reject		Accept		Accept			Reject		Reject		Accept				
Adjusted CaO	t	-1.066	1.860	2.306	2.752	-0.40	0.11	-0.46	0.17	-0.52	0.23	4	2	7	1	8	0	9	-0.66 to 0.44	-0.14	9
	Ho	-	Accept	Accept	Accept	Accept		Accept		Accept			Accept		Accept		Accept				
MgO	t	-0.315	1.860	2.306	2.752	-0.08	0.06	-0.10	0.08	-0.12	0.09	3	2	7	1	8	0	9	-0.22 to 0.24	-0.01	9
	Ho	-	Accept	Accept	Accept	Accept		Accept		Accept			Accept		Accept		Accept				
SiO_2	t	-0.764	1.860	2.306	2.752	-0.47	0.20	-0.55	0.27	-0.63	0.35	7	2	7	1	8	0	9	-1.55 to 0.13	-0.14	9
	Ho	-	Accept	Accept	Accept	Accept		Accept		Accept			Reject		Accept		Accept				
LOI	t	-0.121	1.860	2.306	2.752	-0.13	0.11	-0.16	0.14	-0.18	0.17	4	2	7	1	8	0	9	-0.22 to 0.17	-0.01	9
	Ho	-	Accept	Accept	Accept	Accept		Accept		Accept			Accept		Accept		Accept				

confidence intervals for CaO are significant at a probability level of ten per cent; while signs are significant at a probability level of about 14 per cent; indicating a more conservative estimate of CaO by Continental.

Although differences, confidence intervals, and sign tests are statistically significant for some constituents, the absolute amounts of the differences are considered small enough that the results from the various laboratories are acceptable.

8.4 ADJUSTMENTS TO REPORTED ANALYSES

Examination of the analytical reports by Acme Analytical Laboratories Ltd. (Appendices 3A, 4B, and 5C) indicates that some of the analytical determinations for CaO and LOI are not accurate. Of the various analyses completed by Acme in 1994, 1995, 1997, and those by Continental in 1997; one exceeds 56 per cent CaO, the maximum possible CaO content for pure $CaCO_3$ and some of the LOI values appear low. Low LOI determinations probably arise from the fact that the decomposition temperature of $CaCO_3$ is about 894°C, not much below the usual ignition temperature of 1000°C which may not be reached by all the limestone samples in the furnace, if the temperature calibration of the furnace is not accurate, or if temperature gradients in the furnace are significant.

Chemical analyses of limestone can be checked by subtracting the carbon dioxide equivalent to CaO plus that equivalent to MgO (total carbon dioxide equivalents are indicated CO_2 EQ) from the determined LOI (Appendices 8A, 8B, and 8C). If P_2O_5 has been determined, the percentage of CaO to use in this calculation is the determined CaO minus 1.31693 P_2O_5. LOI should exceed CO_2 EQ by a small amount to allow for moisture, oxidation of any pyrite, and other factors. Of the analyses completed by Acme, LOI minus CO_2 EQ is positive in 30 for 1994, positive in three for 1995, and positive in three for 1997; and for those by Continental it is positive for 38 in 1997.

For the 66 Acme analyses in 1994, seven in 1995, nine in 1997, and 61 by Continental in 1997, adjustments to determined values of CaO and LOI have been calculated by two methods: LOI-based and impurity-based (Appendices 8A, 8B, and 8C). The LOI-based method involves lowering the determined CaO in analyses with high CaO determinations and concomitantly raising the determined LOI so that with the adjusted values of CaO and LOI, LOI minus CO_2 EQ equals 0.2. The equations for LOI-based adjustments follow:

$$CaO_F = \frac{99.80 - 0.21522\ CaO - 2.09175\ MgO - SiO_2 - R_2O_3 - others + 0.983\ P_2O_5}{1.56956}$$

$$LOI_F = \tfrac{1}{2}\ (\ 100.20 - 0.21522\ CaO + 0.09175\ MgO - SiO_2 - R_2O_5 - others - 0.983\ P_2O_5\ )$$

where the subscript $_F$ refers to the adjusted or calculated percentage (final) of CaO or LOI;
R_2O_3 is the sum of $Al_2O_3 + Fe_2O_3 + TiO_2 + P_2O_5 + MnO + Cr_2O_3$ as determined;
with any determination less than the detection limit set at half the detection limit; and
others is the sum of the rest of the constituents as determined in the analytical reports not already appearing in the equations, with any determination less than the detection limit set at half the detection limit.

The impurity-based method involves subtracting the sum of all the determined impurities from 100.00 per cent, assigning the remainder to $CaCO_3$, and calculating adjusted values for CaO and LOI based on this remainder. The equations for impurity-based adjustments follow:

$$CaO_F = \frac{99.80 - 2.09175\ MgO - SiO_2 - R_2O_3 - others + 0.983\ P_2O_5}{1.78478}$$

$$LOI_F = \frac{100.2548 + 0.39115\ MgO - 1.2526\ P_2O_5 - SiO_2 - R_2O_3 - others}{2.2742}$$

where the subscript $_F$, R_2O_3, and *others* have the same meanings as for the previous two equations.

Review of the Acme analyses and Continental analyses adjusted to obtain preferred values for CaO and LOI (Codes 4 and 5 of Appendices 8A, 8B, and 8C) indicates that the CaO and LOI values adjusted by either method are very close, the CaO values adjusted by the LOI method being equal to or less than those adjusted by the impurity-based method. The adjusted analyses are summarized in Appendices 9A, 9B, and 9C.

9. CONCLUSIONS

North of Highway 11, several sections of the lower part of the Rundle Assemblage, up to several meters thick contain more than 54% CaO. At the northwestern closure of the Brazeau anticline CaO concentrations range from 52.58 % to 55.30 %, with MgO and SiO_2 ranging from 0.44% to 2.50% and from 0.17% to 0.43%, respectively. However, rapid facies changes result in interbeds of variably dolomitic limestone and dolomite. At Coliseum Mountain and along Highway 11, the lower part of the Rundle Assemblage consists of interbedded calcarenite, variably dolomitic limestone, and dolomite. Higher MgO concentrations at Coliseum Mountain and south of Highway 11 at Dipslope Mountain (Sample 11586) are spatially and probably genetically related to fluid-circulated faults.

Stratigraphic units below the Rundle Assemblage contain lower concentrations of lime. Five samples of grey- to buff-grey, thin- to medium-bedded, silty limestone were collected from the Banff Formation along Shunda Mountain road during 1994. For these samples, CaO concentrations range from 52.25% to 52.77%, with MgO and SiO_2 of between 0.61% to 1.00% and 1.85% to 2.92%, respectively.

An isolated sample from the Upper Palliser Formation on the southeast spur of Coliseum Mountain contains 51.75% CaO, 2.45% MgO, and 1.58% SiO_2.

South of Highway 11 at two sections in the vicinity of Storm Mountain the lower part of the Rundle Assemblage exhibits highly variable CaO concentrations that range from 35.22% to 55.09%, with MgO and SiO_2 between 0.49% to 17.29% and 0.15% to 0.75%, respectively. Farther south, between Dipslope Mountain and Gap on North Saskatchewan River, sampled units within the lower part of the Rundle Assemblage yielded CaO concentrations of between 43.00% to 55.31%, with MgO and SiO_2 between 0.45% to 8.90% and 0.09% to 8.80%, respectively.

Several carbonate intervals within the Banff Formation were sampled at Storm Mountain and at Gap on North Saskatchewan River. At Storm Mountain a ½-m bed of limestone produced a CaO concentration of 52.60%, with 0.72 MgO% and 3.53% SiO_2.

On the east bank of Martin Creek, sampled units within the Palliser Formation contain concentrations of CaO that range from 46.71% to 51.19%, with MgO and SiO_2 ranging from 2.80% to 6.16% and from 1.88% to 2.16%, respectively.

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11. QUALIFICATIONS

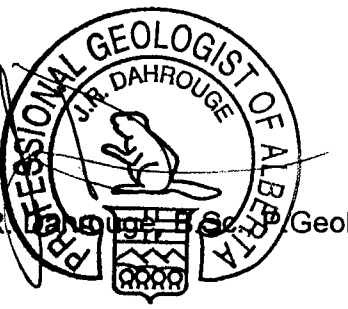
D. I. Pană obtained a Diploma of Geological and Geophysical Engineer from the University of Bucharest in 1980 (equivalent to an M.Sc. in North America) and a Ph.D. in Structural Geology and Petrology at the University of Alberta, Edmonton in 1998. He has more than 15 years of experience in mineral exploration and regional mapping, including several years as a senior research Geologist with the Geological Survey of Romania. He is a member of the Geological Society of America.

The work described in the report was under the supervision J.R. Dahrouge who obtained degrees in geology and computing science from the University of Alberta, Edmonton in 1988 and 1994, respectively. He has nine years of experience in mining exploration. He is a member of the Canadian Institute of Mining and Metallurgy and is registered as P. Geol. in the Association of Professional Engineers, Geologists, and Geophysicists of Alberta.

Neither D.I. Pană or J.R. Dahrouge hold any direct or indirect interest in metallic and industrial minerals permit 9396010038, which is the subject of this report.

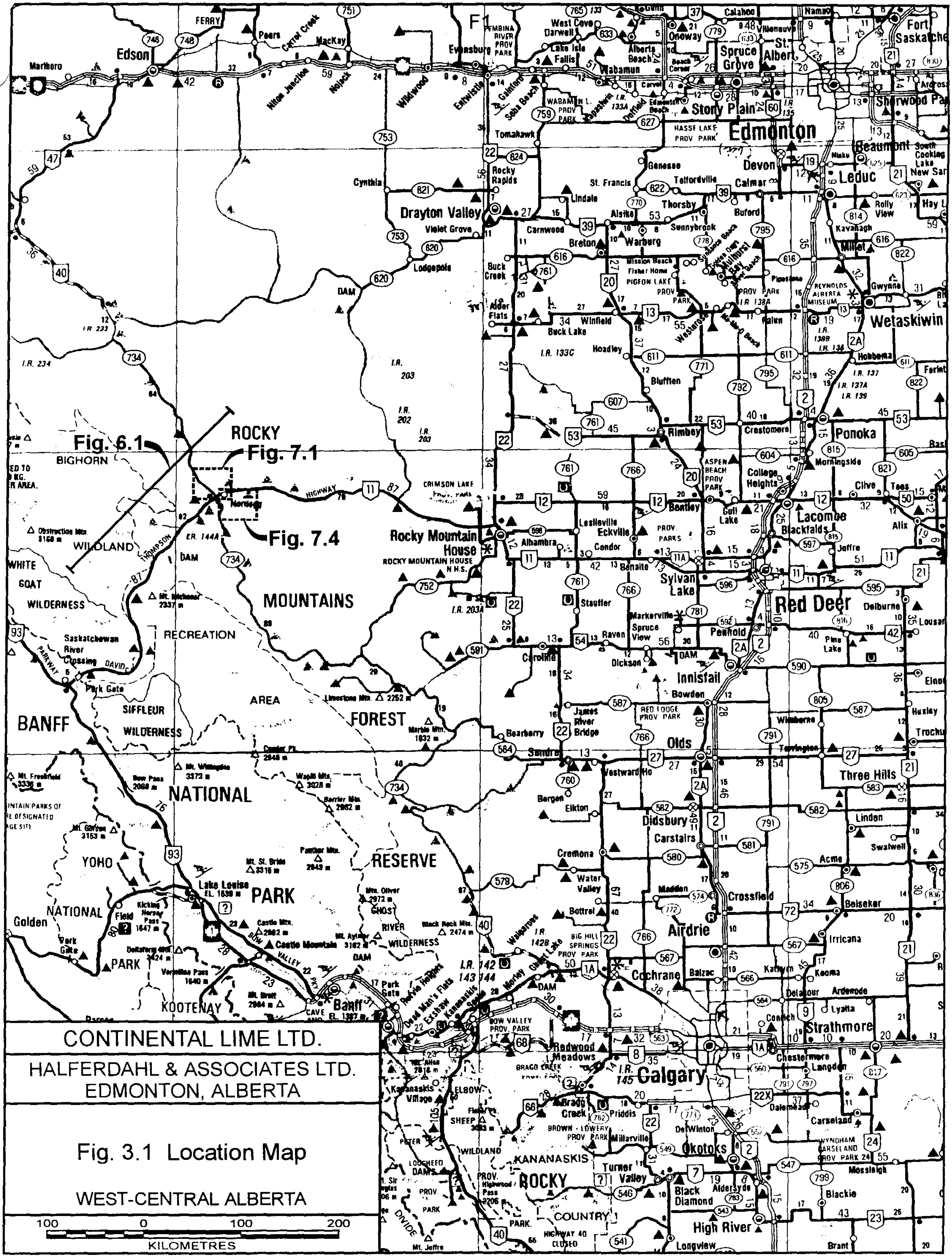
[redacted]

Dinu Pana, Ph.D.,



J.R. Dahrouge, B.Sc., P.Geol.

Edmonton, Alberta
1998 05 15



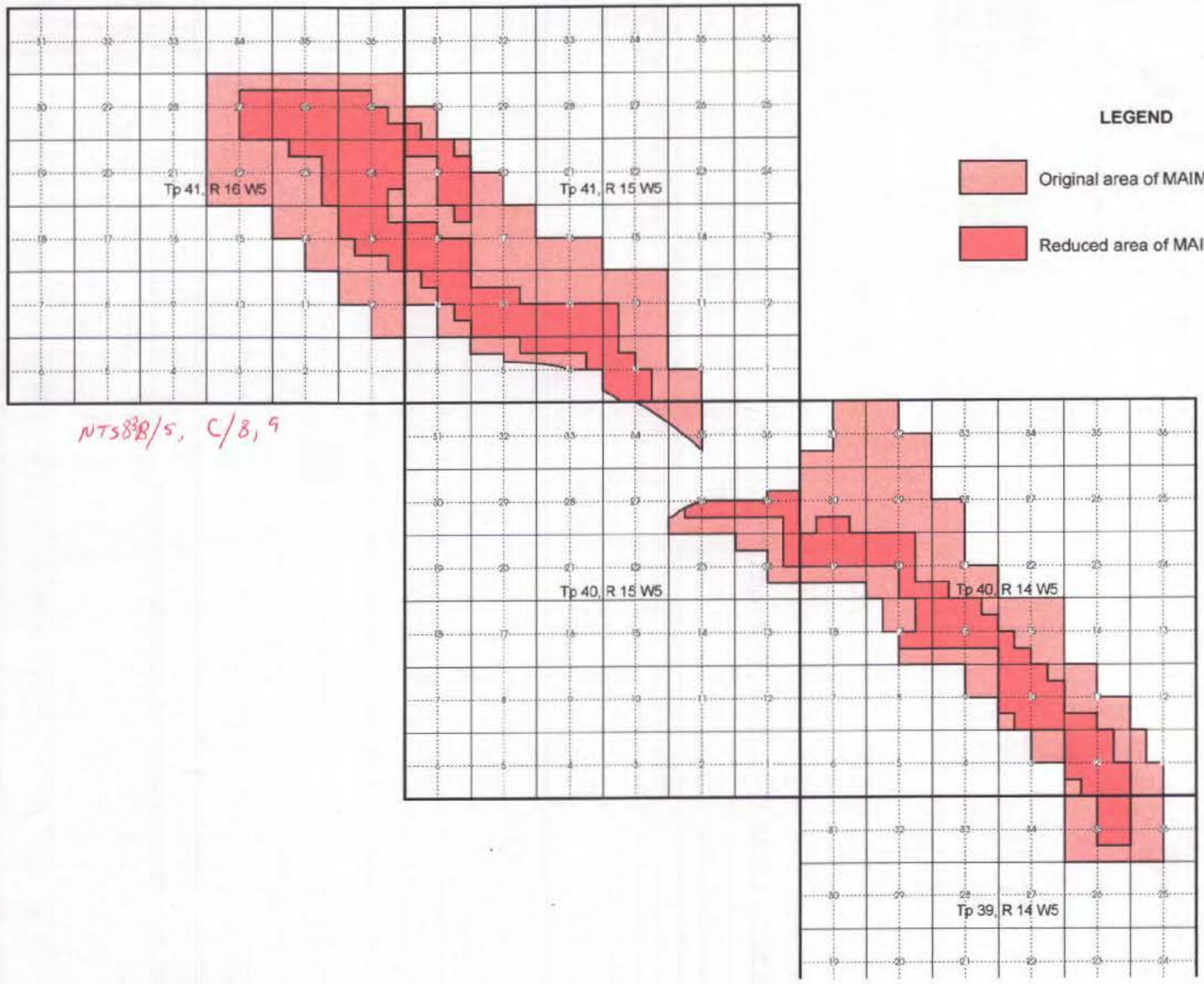
CONTINENTAL LIME LTD.

HALFERDAHL & ASSOCIATES LTD.
EDMONTON, ALBERTA

Fig. 3.1 Location Map

WEST-CENTRAL ALBERTA

100 0 100 200
KILOMETRES



NTS 83B/5, C/8, 9

LEGEND

Original area of MAIM Permit 9396010038 (8716 ha.)

Reduced area of MAIM Permit 9396010038 (3286 ha.)

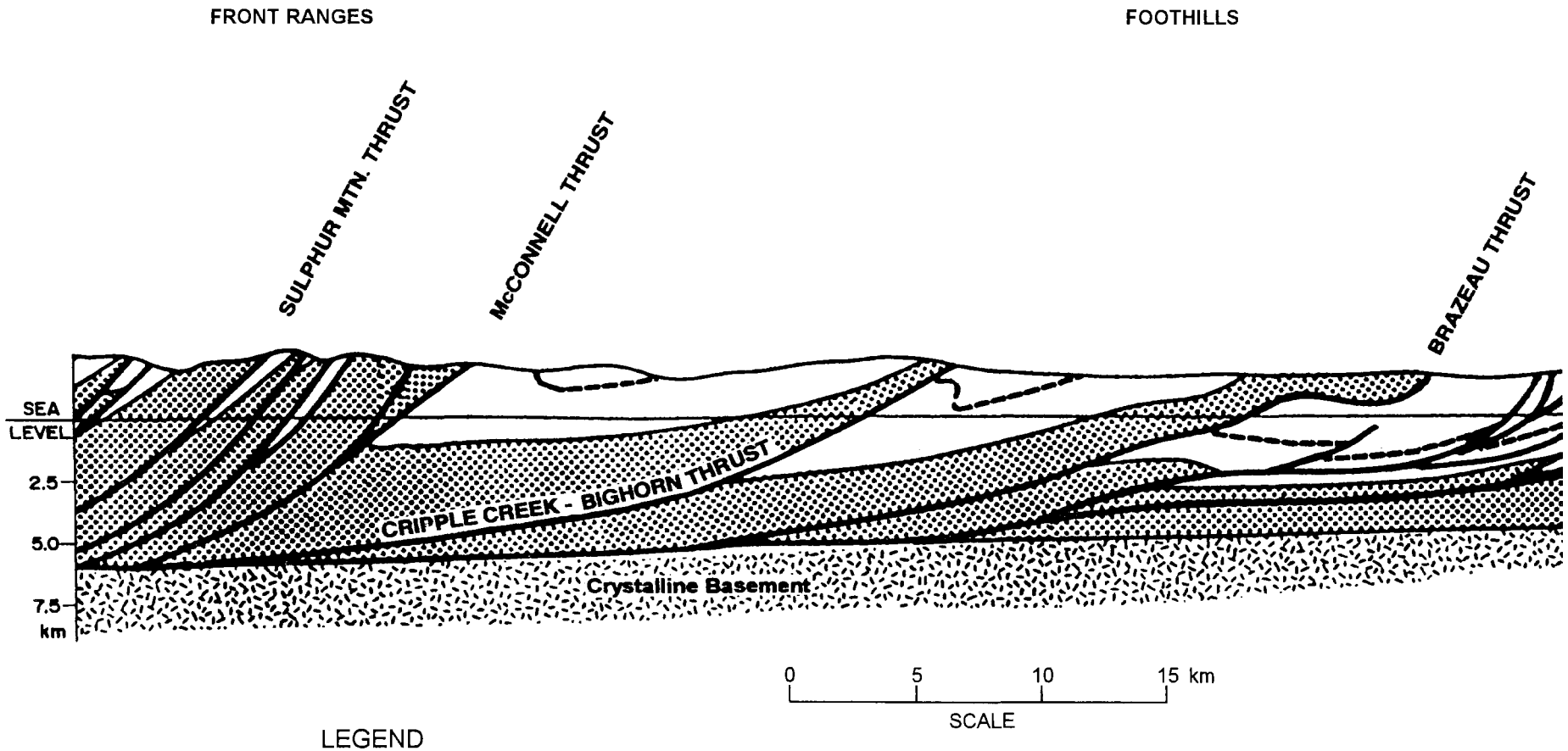
CONTINENTAL LIME LTD.

HALFERDAHL & ASSOCIATES LTD.
EDMONTON, ALBERTA

Fig. 4.1 Location of Metallic and Industrial Minerals Permit 9396010038

WEST CENTRAL ALBERTA

WM 1998.05



LEGEND

- MESOZOIC CLASTICS (CARDIUM MARKER)
- PALEOZOICS, MAINLY CARBONATES
- SHIELD TYPE BASEMENT

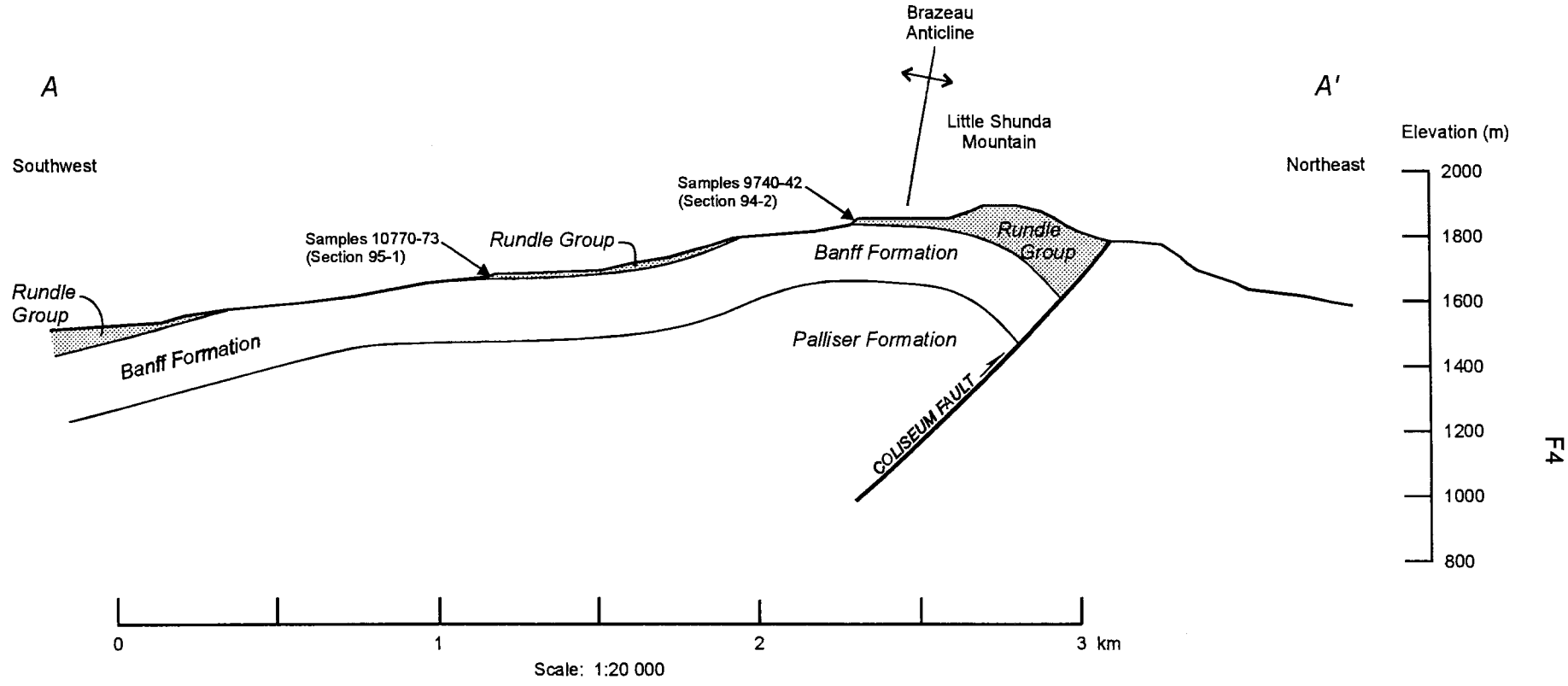
After Jones and Workum (1978)
For location of section see fig. 3.1.

CONTINENTAL LIME LTD.

HALFERDAHL & ASSOCIATES LTD.
EDMONTON, ALBERTA

Fig. 6.1 Schematic Cross-Section Through Brazeau Range and Front Range of the Rocky Mountains
WEST-CENTRAL ALBERTA

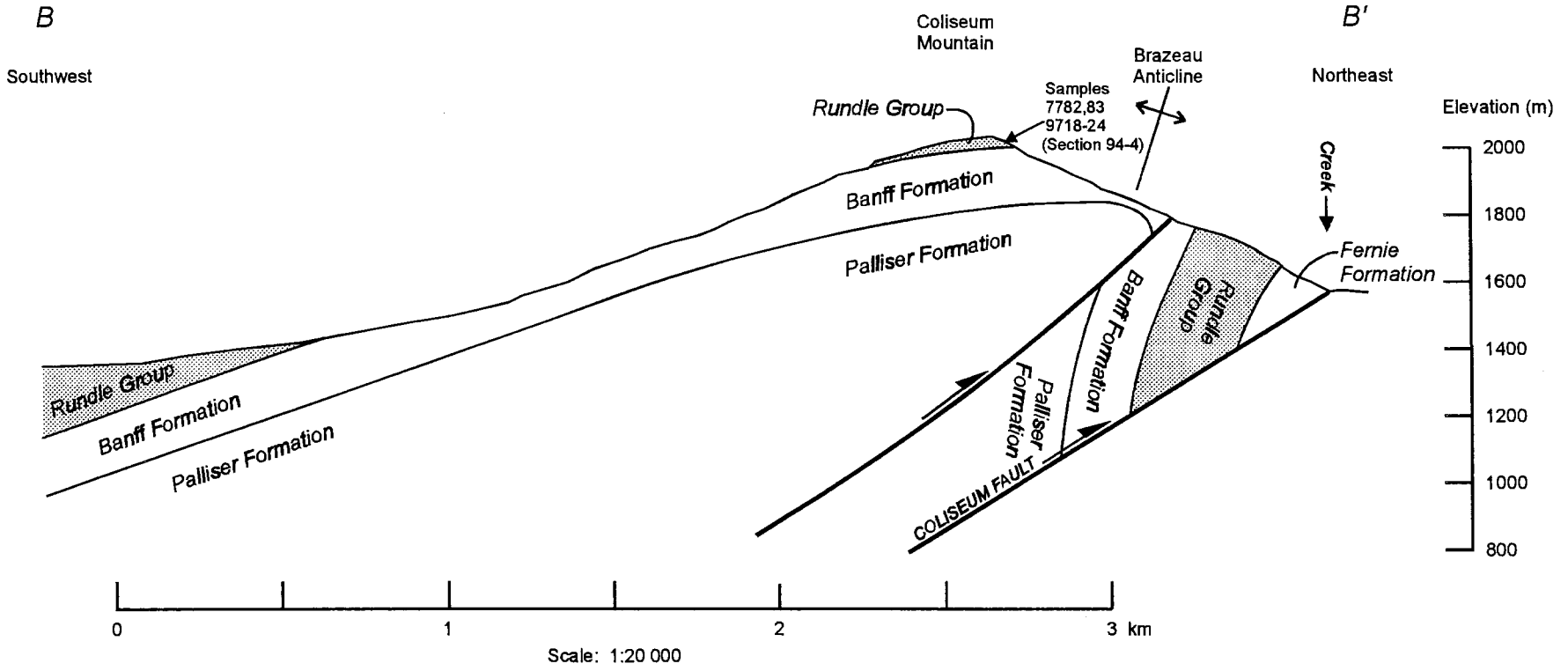
WM 1998.05



F4

For location of section see Fig. 7.1

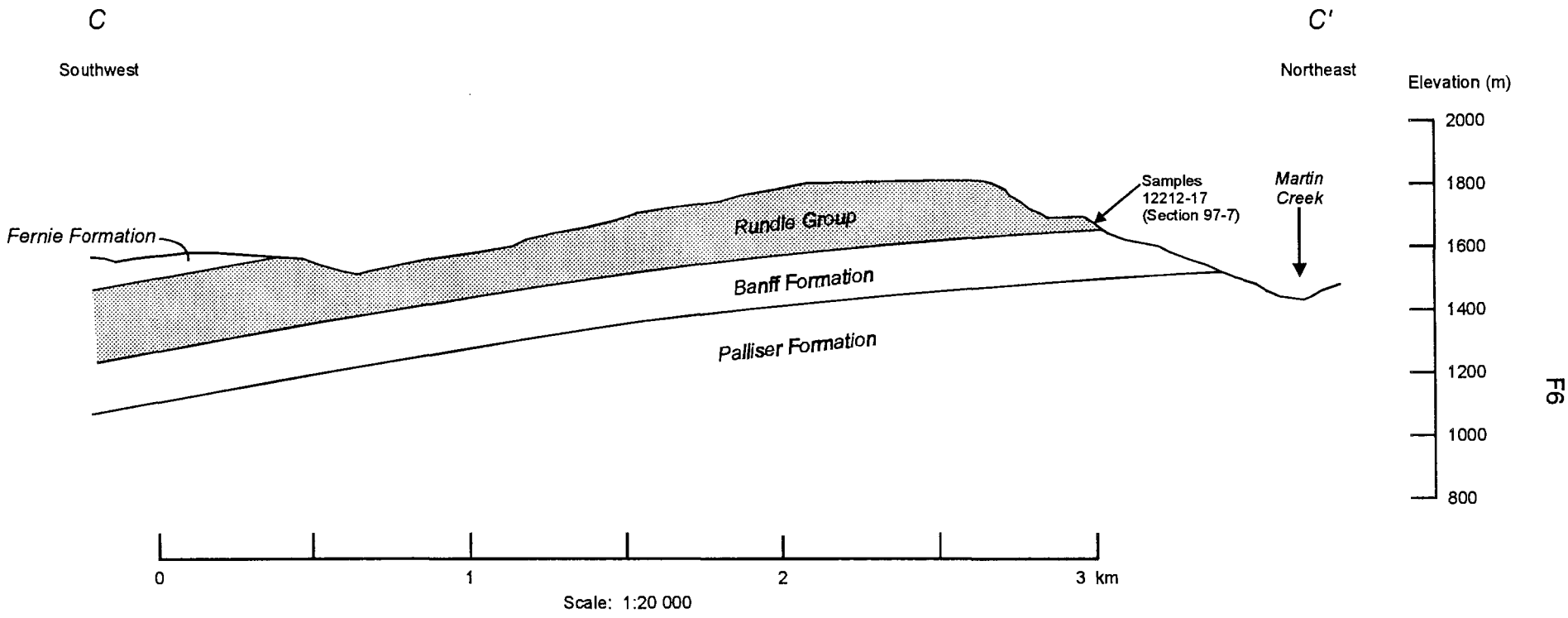
CONTINENTAL LIME LTD.
HALFERDAHL & ASSOCIATES LTD. EDMONTON, ALBERTA
Fig. 7.2 Cross-Section Through Little Shunda Mountain WEST-CENTRAL ALBERTA
WM 1998.04



F5

For location of section see Fig. 7.1

CONTINENTAL LIME LTD.
HALFERDAHL & ASSOCIATES LTD. EDMONTON, ALBERTA
Fig. 7.3 Cross-Section Through Coliseum Mountain WEST-CENTRAL ALBERTA
WM 1998.04



F6

For location of section see Fig. 7.4

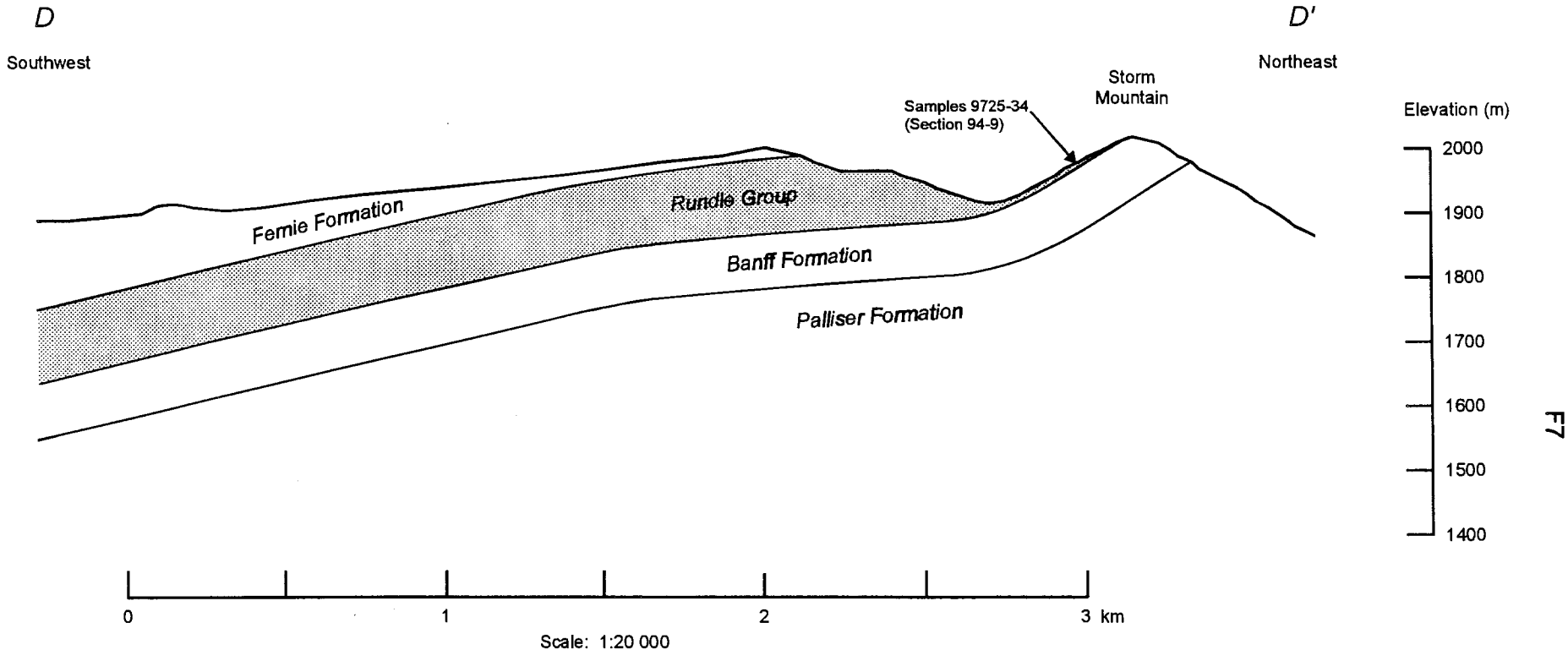
CONTINENTAL LIME LTD.

HALFERDAHL & ASSOCIATES LTD.
EDMONTON, ALBERTA

Fig. 7.5 Cross-Section Through Ridge Southeast of Nordegg

WEST-CENTRAL ALBERTA

WM 1998.04



F7

For location of section see Fig. 7.4

CONTINENTAL LIME LTD.
HALFERDAHL & ASSOCIATES LTD. EDMONTON, ALBERTA
Fig. 7.6 Cross-Section Through Storm Mountain WEST-CENTRAL ALBERTA
WM 1998.04

APPENDIX 1: STATEMENT OF EXPENDITURES FOR METALLIC AND INDUSTRIAL MINERALS PERMIT 9396010038

Description		Rate ($)	Time*	Amount ($)	G.S.T. ($)	Total ($)
1994 EXPLORATION						
Geological Consulting						
L.B. Halferdahl, Ph.D., P.Geol.	Organizing and preparing for field exploration	[redacted]				
J. Dahrouge, B.Sc., Sp.C., P.Geol	"					
W. McGuire	"					
L.B. Halferdahl, Ph.D., P.Geol.	Geologic mapping, sampling, and travel					
J. Dahrouge, B.Sc., Sp.C., P.Geol	"					
W. McGuire	"					
L.B. Halferdahl, Ph.D., P.Geol.	Data review, organizing, and reporting					
J. Dahrouge, B.Sc., Sp.C., P.Geol	Data review and reporting					
W. McGuire	Data review and drafting					
- analyses	- Acme (64 samples)	-	-	$ 1,144.64	$ 80.12	$ 1,224.76
	- Loring (3 samples)	-	-	$ 116.25	$ 8.14	$ 124.39
	- Continental (11 samples)	-	-	$ 181.50	-	$ 181.50
- expenses related to field work	- accommodations, meals, and other	-	-	$ 2,218.84	$ 130.22	$ 2,349.06
	- helicopter charges	-	-	$ 3,126.00	$ 218.82	$ 3,344.82
	- truck rental and fuel	-	-	$ 787.10	$ 55.10	$ 842.20
- expenses related to office work	- toll and fax charges	-	-	$ 478.07	$ 33.47	$ 511.54
	TOTAL 1994 EXPENDITURES:			$ 45,477.40	$ 3,145.62	$ 48,623.02
1995 EXPLORATION						
Geological Consulting						
J. Dahrouge, B.Sc., Sp.C., P.Geol	Organizing and preparing for field exploration	[redacted]				
W. McGuire	"					
J. Dahrouge, B.Sc., Sp.C., P.Geol	Geologic mapping, sampling, and travel					
W. McGuire	"					
L.B. Halferdahl, Ph.D., P.Geol.	Data review, organizing, and reporting					
J. Dahrouge, B.Sc., Sp.C., P.Geol	Data review and reporting					
W. McGuire	Data review and drafting					
- analyses	- Acme (6 samples)	-	-	$ 97.02	$ 6.79	$ 103.81
	- Continental (32 samples)	-	-	$ 528.00	-	$ 528.00
- expenses related to field work	- accommodations, meals, and other	-	-	$ 1,006.49	$ 69.22	$ 1,075.71
	- truck rental	-	-	$ 224.40	$ 15.71	$ 240.11
- expenses related to office work	- binding, photocopying, toll charges, etc.	-	-	$ 436.40	$ 30.55	$ 466.95
	TOTAL 1995 EXPENDITURES:			$ 19,224.31	$ 1,307.51	$ 20,531.82

* All time charges are per day, except for W. McGuire office charges which are per hour.

APPENDIX 1: CONTINUED

	Description	Rate	Time	Amount ($)	G.S.T. ($)	Total ($)
	1997 EXPLORATION					
Geological Consulting						
D. Pana, Ph.D.	Organizing and preparing for field exploration	[redacted]				
W. McGuire	"					
D. Pana, Ph.D.	Geologic mapping, sampling, and travel					
J. Dahrouge, B.Sc., Sp.C., P.Geol	"					
R. Ryziuk	"					
W. McGuire	"					
D. Pana, Ph.D.	Data review, organizing, and reporting					
J. Dahrouge, B.Sc., Sp.C., P.Geol	Data review and reporting					
W. McGuire	Data review and drafting					
- analyses	- Acme (8 samples)	-	-	$ 124.96	$ 8.75	$ 133.71
	- Continental (66 samples)	-	-	$ 1,105.50	-	$ 1,105.50
- expenses related to field work	- accommodations, meals, and other	-	-	$ 1,355.28	$ 73.26	$ 1,428.54
	- helicopter charges	-	-	$ 623.51	$ 43.65	$ 667.16
	- quad rental	-	-	$ 528.00	$ 36.96	$ 564.96
	- vehicle rental	-	-	$ 867.65	$ 60.74	$ 928.39
- expenses related to office work	- digital maps, photocopying, plotting, report reproduction, toll charges, etc.	-	-	$ 1,066.74	$ 74.68	$ 1,141.42
	TOTAL 1997 EXPENDITURES:			$ 33,325.64	$ 2,233.81	$ 35,559.45
	TOTAL EXPENDITURES:			$ 98,027.35	$ 6,686.94	$ 104,714.29

I, Jody R. Dahrouge, hereby certify that the costs outlined above were expended for the assessment of metallic and industrial minerals permit 9396010038.

PROFESSIONAL GEOLOGIST OF ALBERTA J.R. DAHROUGE

Jody R. Dahrouge, B.Sc., Sp.C., P.Geol.

APPENDIX 2A: DESCRIPTIONS AND COMPOSITIONS OF THE CHIP SAMPLES COLLECTED IN 1994

Note: Stratigraphic thicknesses are based on measured attitudes of bedding as listed below with appropriate interpolations. Samples are listed in order from stratigraphic top to bottom. They consist of chips at intervals of 20 to 30 cm.

Sample	Formation	Strat. Thick. (m)	Description	CaO %	MgO %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	Sr ppm	MnO ppm	P_2O_5 ppm
Section 94 - 1: North Knob (Fig. 7.1)											
-	-	-	Covered	-	-	-	-	-	-	-	-
9754	Livingstone	2½	Dolomitic Calcarenite, light- to medium-grey weathered,medium-grey to medium-brownish-grey fresh, medium-grained, crumbly weathered sections, attitude of bedding 116°/30°SW	47.63	6.48	0.86	0.19	<0.05	197	<100	200
9753	Livingstone	5¼	Calcarenite, light- to medium-grey weathered, light-grey to light-brownish-grey fresh, grains 1 - 3 mm, upper half with abundant crinoid fragments and debris, some rugose corals, minor coarse calcite lining and filling vugs, crumbly weathered sections, attitude of bedding 119°/32°SW	54.67	0.70	0.43	0.13	<0.05	264	<100	200
9752	Livingstone	5¾	Calcarenite, light-grey weathered, medium-grey fresh, grains ~2 mm, minor crinoid fragments	54.83	0.57	0.47	0.15	<0.05	309	<100	300
9751	Livingstone	4¼	Calcarenite, light-grey weathered, light-brownish-grey fresh, grains ½ - 2 mm, rugose corals near base of section, attitude of bedding 116°/29°SW	54.74	0.53	0.37	0.12	<0.05	293	<100	300
-	-	< 1	Covered	-	-	-	-	-	-	-	-
-	Banff	-	Argillaceous Limestone, greyish-rusty-brown weathered, platy rubble (not sampled)	-	-	-	-	-	-	-	-
Section 94 - 2: Little Shunda Mountain (Fig. 7.1)											
9742	Livingstone	1	Calcarenite, light-grey weathered, light-greyish-brown fresh, medium- to coarse-grained, thin- to medium-bedded, birds-eye texture, crumbly and weathered, elevation at top 1850 m	54.72	0.60	0.42	0.15	<0.05	275	<100	400
9741	Livingstone	3¼	Calcarenite, light-grey weathered, light-greyish-brown fresh, fine- to medium-grained becoming coarse-grained near top, medium-bedded, local crinoid fragments and debris	54.54	0.55	0.41	0.18	<0.05	269	<100	200
9740	Livingstone	8½	Calcarenite, light-grey weathered, medium- to dark-grey fresh becoming light-brownish-grey near top, medium-grained becoming fine- to medium-grained near top, crinoid fragments and debris, crumbly weathered sections	54.95	0.49	0.29	0.17	<0.05	256	<100	200
-	-	-	Covered	-	-	-	-	-	-	-	-

APPENDIX 2A: CONTINUED

Sample	Formation	Strat. Thick. (m)	Description	CaO %	MgO %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	Sr ppm	MnO ppm	P_2O_5 ppm
Section 94 - 3 : Shunda Mountain Road (Fig. 7.1)											
9757	Livingstone	3¼	Calcarenite, light-grey with buff and black stains on weathered surfaces, light greyish-brown fresh, medium- to coarse-grained, thick-bedded, crinoid debris and fragments, minor coarse calcite filling vugs	54.53	0.94	0.48	0.16	<0.05	246	<100	200
9756	Livingstone	4	Calcarenite, light-grey with buff and black stains on weathered surfaces, light greyish-brown fresh, medium-grained, thick-bedded, crinoid fragments and debris, minor coarse calcite filling vugs, attitude of bedding 83°/26°S, attitude of joints 15°/79°NE	54.94	0.55	0.37	0.14	<0.05	256	<100	100
9755	Livingstone	5 1/3	Calcarenite, light-grey weathered, light- to medium-grey fresh with some light-greyish-brown grains, grain size to 2 mm, generally massive	54.95	0.50	0.36	0.12	<0.05	261	<100	300
-	Livingstone	-	Covered	-	-	-	-	-	-	-	-
-	Banff	-	Covered	-	-	-	-	-	-	-	-
7797	Banff	1	Silty Limestone, grey to buff-grey weathered, medium-grey fresh, thin-bedded, fine- to medium-grained, calcite veinlets on fractures	52.68	0.61	2.92	0.75	0.29	287	200	200
7796	Banff	1½	Silty Limestone, grey weathered, dark-grey fresh, fine-grained, massive to thick-bedded, minor fractures with trace of rust on some surfaces, attitude of bedding 100°/17°S (equivalent to upper 1 m of 7793)	52.58	0.99	2.28	0.50	0.22	295	200	300
7795	Banff	1½	Silty Limestone, grey- to buff-grey weathered, medium-grey fresh, fine- to medium-grained, thin-bedded, some calcite veinlets on fractures (equivalent to lower 2 m of 7793)	52.77	0.86	2.12	0.58	0.25	297	100	100
7794	Banff	1½	Silty Limestone, grey weathered, dark-grey fresh, fine-grained, massive to thick-bedded, minor fractures with trace of rust on some surfaces	52.69	1.00	1.85	0.43	0.18	293	100	100
7793	Banff	-	Silty Limestone, grey- to grey-buff weathered, grey- to dark-brownish-grey fresh, fine- to medium-grained, thin- to medium-bedded, some calcite veinlets to 2 mm parallel to bedding, attitude of bedding 120°/17°SW, elevation at base 1465 m; sample represents ~3 m of strata, offset across road approximately 50 m at 145o from top of 7794 (equivalent to 7795 and 7796)	52.25	0.73	2.79	0.66	0.28	288	200	100

APPENDIX 2A: CONTINUED

Sample	Formation	Strat. Thick. (m)	Description	CaO %	MgO %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	Sr ppm	MnO ppm	P_2O_5 ppm
Section 94 - 4: Coliseum Mountain - North (Fig. 7.1)											
9724	Livingstone	¾	Silty Dolomitic Limestone and Calcarenite interbedded, light-grey weathered, dark-greyish-brown fresh, fine- to medium-grained, thin-bedded	47.72	6.22	1.70	0.19	<0.05	174	<100	400
9723	Livingstone	1¾	Calcarenite, light-grey weathered, greyish-brown fresh, medium-grained, medium-bedded, attitude of bedding 115°/9°SW, atttitude of joints 97°/82°E	54.18	1.09	0.41	0.13	0.10	230	<100	<100
9722	Livingstone	2	Calcarenite with 15-cm Dolomitic Limestone interbed, thin-bedded, calcarenite: light-grey weathered, dark-greyish-brown fresh, fine- to medium-grained, massive	52.09	3.13	0.43	0.15	<0.05	233	<100	500
9720	Livingstone	2½	Calcareous Dolomite, light-brownish-grey weathered, dark-grey fresh, very fine grained, thin- to medium-bedded, platy in uppermost ¼ m, recessive (1¾ sampled, ½ covered, ¼ sampled), attitude of bedding (?) 89°/9°S	38.52	14.79	0.70	0.19	<0.05	118	<100	700
9721	Livingstone	¼	Dolomite, brown weathered, dark-grey fresh, very fine grained, recessive, platy	30.58	22.17	1.37	0.35	<0.05	88	<100	800
-	Livingstone	1	Covered, probably similar to 9721	-	-	-	-	-	-	-	-
9718	Livingstone	2¾	Dolomitic Limestone, light-grey weathered, light-greyish-brown fresh, fine- to medium-grained, thick-bedded to massive, local brachiopods, rugose corals, fenestella, and crinoidal debris, some crumbly weathered sections	48.69	5.27	1.08	0.17	0.43	200	<100	500
-	Livingstone	6½	Covered, probably similar to 9721	-	-	-	-	-	-	-	-
9719	Livingstone	7	Dolomitic limestone, medium-grey, medium-grained, locally gritty (3 sampled, 4 covered)	41.66	11.99	0.63	0.18	<0.05	119	<100	900
7783	Livingstone	6	Calcarenite, light-grey weathered, brownish-grey fresh, medium-grained, generally massive, resistant at base and crumbly near top, minor crinoid fragments, attitude of bedding 134°/9°SW	53.07	2.09	0.25	0.18	<0.05	253	<100	200
7782	Livingstone	4	Calcarenite, light-grey weathered, brownish-grey fresh, fine-to medium-grained, generally massive and resistant, dolomitic interval 0 - 5 cm thick $1^2/_3$ m from sample base, attitude of bedding 134°/9°SW, elevation at base 1992 m	54.49	0.90	0.25	0.17	<0.05	282	<100	100
-	Banff	-	Covered, recessive	-	-	-	-	-	-	-	-

APPENDIX 2A: CONTINUED

Sample	Formation	Strat. Thick. (m)	Description	CaO %	MgO %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	Sr ppm	MnO ppm	P_2O_5 ppm
Section 94 - 5: Coliseum Mountain - South (Fig. 7.1)											
7781	Livingstone	4	Limestone, light-grey weathered, dark-grey fresh, very fine grained (4 m of strata but lower 2 m overlaps 7780)	53.52	1.59	0.40	0.19	<0.05	264	<100	200
7780	Livingstone	10½	Dolomitic Limestone, light-grey weathered, dark-grey fresh, very fine grained, minor interbeds of Fossiliferous Calcarenite, attitude of bedding (variable) 124°-138°/12°-14°SW, offset 28 m at 78° from 7781	46.34	7.95	0.50	0.19	<0.05	206	<100	600
-	Livingstone	~3	Covered	-	-	-	-	-	-	-	-
9375	Livingstone	7¾	Dolomitic Calcarenite, light-grey weathered, dark-brownish-grey fresh, grains less than 2 mm, beds less than 20 cm, brachiopods and crinoids, attitude of bedding 112°/10°SW, offset 80 m at 140° from 7780	45.44	7.81	0.63	0.27	<0.05	175	<100	300
9374	Livingstone	5¾	Calcarenite, light-grey-buff weathered, light- to medium-grey fresh, medium- to coarse-grained, crumbly, crinoids	53.65	1.62	0.25	0.21	0.12	219	<100	100
9373	Livingstone	5¾	Calcarenite, light-grey-buff weathered, light- to medium-grey fresh, medium-grained, top 2½ m with brachiopods and crinoids	54.93	0.46	0.20	0.22	<0.05	241	<100	200
9372	Livingstone	1	Calcarenite, light-grey-buff weathered, dark-brownish-grey fresh , fine- to medium-grained, massive to thick-bedded, trace of rust along fracture surfaces, brachiopods and crinoids, dolomitic in top 10 cm, stylolites	54.47	0.71	0.32	0.21	<0.05	304	<100	100
-	Banff	-	Calcareous Dolomite, black weathered, dark-grey-brown fresh, very fine grained, recessive, not sampled	-	-	-	-	-	-	-	-
Section 94 - 6: Isolated Sample on Coliseum Mountain (Fig. 7.1)											
9371	Palliser	7	Silty Limestone, buff to light-grey weathered, greyish-brown fresh, very fine grained (micritic), thin-bedded, crinoid fragments, calcite blebs and along fractures, attitude of bedding 120°/12°SW	51.75	2.45	1.58	0.48	0.19	254	100	200

APPENDIX 2A: CONTINUED

Sample	Formation	Strat. Thick. (m)	Description	CaO %	MgO %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	Sr ppm	MnO ppm	P_2O_5 ppm
Section 94 - 7: Mountain East of Martin Creek - Location 1 (Fig. 7.1)											
7790	Livingstone	4¼	Silty Dolomitic Limestone, grey weathered, grey to dark-grey fresh, fine- to medium- grained, partly covered	49.87	3.48	1.88	0.50	0.22	253	200	400
-	Livingstone	1¾	Covered	-	-	-	-	-	-	-	-
7789	Livingstone	1¼	Silty Limestone, grey weathered, dark-grey to dark-greyish-black fresh, fine- to very fine grained (micritic)	51.64	1.65	2.32	0.58	0.23	279	100	400
-	Livingstone	4½	Covered	-	-	-	-	-	-	-	-
7788	Livingstone	2½	Silty Dolomitic Limestone, grey weathered, dark-grey fresh, fine-grained, medium-bedded, with calcite stringers	44.31	7.76	2.59	0.55	0.25	217	200	500
7787	Livingstone	1½	Dolomitic Limestone in upper 1 m, grey weathered, dark-grey fresh, fine- to very fine grained, with chert lenses less than 1½ mm, medium-bedded, attitude of bedding 140°/58°NE. Micritic Limestone in lower ½ m, grey weathered, dark-grey, fresh, fine- to very fine grained, massive	50.90	3.10	1.01	0.32	0.10	298	100	300
-	Livingstone	11¾	Covered	-	-	-	-	-	-	-	-
7786	Livingstone	1	Dolomitic Calcarenite, greyish-brown weathered, dark-grey fresh, fine-grained, thin-bedded, partly fractured with trace of rust on fracture surfaces, calcite stringers to 1 mm, attitude of bedding 140°/58°NE	49.65	4.21	1.37	0.19	0.11	192	100	300
-	Banff	< 130	Covered	-	-	-	-	-	-	-	-
7784	Banff	1	Silty Calcareous Dolomite, brownish-grey weathered, dark-brownish-grey fresh, fine-grained, very thin bedded, abundant fractures, attitude of bedding 80°/40°N	30.57	21.76	1.06	0.25	<0.05	83	<100	1100
7785	Palliser	~2	Silty Calcareous Dolomite, dark-grey to dark-brownish-grey weathered with black stains on exposed surfaces, dark-greyish-brown fresh, fine-grained, massive to thick-bedded	31.49	21.07	0.83	0.24	<0.05	86	<100	800
Section 94 - 8: Mountain East of Martin Creek - Location 2 (Fig. 7.1)											
-	Livingstone	-	Covered	-	-	-	-	-	-	-	-
7792	Livingstone	9¼	Silty Limestone, grey weathered, medium-grey fresh, fine-to medium-grained, massive to medium-bedded, minor calcite veinlets to 2 mm, partly fractured, only partly exposed, attitude of bedding 132°/68°NE	51.16	2.05	2.19	0.50	0.23	259	200	200
-	Livingstone	1¾	Covered	-	-	-	-	-	-	-	-
7791	Livingstone	5	Silty Dolomitic Limestone, grey weathered, medium-grey fresh, fine- to medium-grained, local brachiopod fragments	46.67	6.17	2.26	0.50	0.20	254	200	500
-	Livingstone	< 5	Covered	-	-	-	-	-	-	-	-

APPENDIX 2A: CONTINUED

Sample	Formation	Strat. Thick. (m)	Description	CaO %	MgO %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	Sr ppm	MnO ppm	P_2O_5 ppm
Section 94 - 9: South Ridge on Storm Mountain (Fig. 7.4)											
9734	Livingstone	2½	Dolomitic Limestone with some lenses, laminations and interbeds less than 1½ cm of Silty Dolomite, light-grey weathered, dark-grey to black fresh, fine- to medium-grained, medium-bedded; interbeds are generally more resistant and stand out on weathered surfaces as thin light-buff-brown layers	50.25	3.14	4.36	0.17	<0.05	269	<100	200
9733	Livingstone	3	Argillaceous Dolomite and Limestone interbeds, light-grey weathered, medium-grey or light-brown fresh, finely bedded, minor chert layers and lenses to 1 mm	41.39	8.31	8.27	0.16	0.41	189	<100	400
9732	Livingstone	1½	Silty Dolomitic Calcarenite, light-grey weathered, medium-brownish-grey fresh, grains less than ½ mm, beds 10 - 30 cm, minor fracturing, ½-cm silty layer near base, attitude of bedding 139°/28°SW	50.41	4.07	2.29	0.15	<0.05	321	<100	400
-	Livingstone	1½	Covered	-	-	-	-	-	-	-	-
9731	Livingstone	1	Dolomitic Calcarenite, light-grey weathered, medium-brownish-grey, medium- to coarse-grained, locally abundant crinoid debris and fragments, some crumbly weathered intervals, elevation 1950 m	44.29	9.44	0.46	0.16	<0.05	172	<100	500
9730	Livingstone	2¼	Calcarenite, light-grey weathered, generally medium-grey with some light-brownish-grey intervals, medium- to coarse-grained, abundant crinoid debris and fragments, some light-brown coarse calcite (?) filling vugs, offset from base of 9731 upslope	53.08	2.09	0.39	0.14	<0.05	242	<100	100
9729	Livingstone	1	Dolomite, light-grey weathered, light-brownish-grey fresh, fine- to medium-grained, calcite crystals less than 3 mm filling vugs	30.70	22.68	0.52	0.17	<0.05	70	<100	600
-	Livingstone	1	Covered	-	-	-	-	-	-	-	-
9728	Livingstone	2¼	Calcarenite, light-grey weathered, dark-brownish-grey fresh, fine- to medium-grained becoming fine-grained at top of interval, thick-bedded to massive	54.48	0.70	0.75	0.21	<0.05	275	<100	100
9727	Banff	¾	Argillaceous Limestone, light-brownish-grey weathered, dark-grey fresh, fine- to medium-grained, platy, trace of rust on weathered surfaces	48.46	1.21	7.81	1.67	0.59	396	200	800
9726	Banff	½	Silty Limestone, light-grey weathered, dark-grey to black fresh, very fine grained to cryptocrystalline, conchoidal fracture on some pieces, attitude of bedding 148°/21°SW	52.60	0.71	3.53	0.72	0.19	326	100	500
9725	Banff	¾	Argillaceous Dolomitic Limestone, light-brown weathered, dark-grey fresh, recessive, platy, abundant brachiopods, elevation at base 1960 m	43.25	6.49	6.81	1.32	0.70	290	100	500

APPENDIX 2A: CONTINUED

Sample	Formation	Strat. Thick. (m)	Description	CaO %	MgO %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	Sr ppm	MnO ppm	P_2O_5 ppm
Section 94 - 10: Dipslope Mountain (Fig. 7.4)											
-	Livingstone	~12½	Calcarenite(?), inaccessible, not sampled	-	-	-	-	-	-	-	-
9739	Livingstone	7	Calcarenite, light-grey weathered, brownish-grey fresh, fine-to medium-grained, thick-bedded to massive, some crinoid debris and fragments	54.87	0.58	0.28	0.15	<0.05	286	<100	200
9737	Livingstone	8¼	Calcarenite, light- to medium-grey weathered, light-brown to light- brownish-grey fresh, medium- to coarse-grained, massive, abundant crinoid debris and fragments, birds-eye texture, some crumbly and weathered sections, attitude of bedding 145°/45°SW, offset 30 m at 145° from bottom of 9739	54.66	0.66	0.29	0.19	<0.05	277	<100	300
9736	Livingstone	4	Calcarenite, light- to medium-grey weathered, light-brown to light-brownish-grey fresh, medium- to coarse-grained, massive, abundant crinoid debris and fragments, birds-eye texture, some crumbly and weathered sections particularly in lower 1½ m	54.81	0.62	0.34	0.16	<0.05	238	<100	300
-	Livingstone	1	Covered	-	-	-	-	-	-	-	-
9738	Livingstone	1	Calcarenite, light-grey weathered, medium-grey fresh with some medium-brownish-grey intervals, massive, abundant crinoid debris and fragments, crumbly and weathered	54.28	0.98	0.41	0.18	<0.05	211	<100	100
9735	Livingstone	2¾	Limestone, light-grey weathered, light- to medium-grey fresh, grains less than 1 mm, massive, attitude of bedding 144°/39°SW, elevation at base 2028 m	53.94	1.30	0.42	0.16	<0.05	296	<100	<100

APPENDIX 2A: CONTINUED

Sample	Formation	Strat. Thick. (m)	Description	CaO %	MgO %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	Sr ppm	MnO ppm	P_2O_5 ppm
Section 94 - 11: At Gap on North Saskatchewan River (Fig. 7.4)											
-	Livingstone	-	Covered	-	-	-	-	-	-	-	
9351	Livingstone	3¾	Dolomitic Calcarenite, dark-grey weathered, dark-greyish-brown fresh, fine-grained, massive to thick-bedded (~½ m), resistant, trace calcite stringers, attitude of bedding 141°/53°SW	43.46	10.19	1.40	0.24	0.10	207	<100	500
9352	Livingstone	3	Argillaceous Dolomite, dark-brown-grey weathered, dark-brown fresh, very fine grained, thin- to medium-bedded, recessive, slightly fractured	31.48	17.60	7.54	0.31	0.12	160	<100	800
9353	Livingstone	2	Silty Dolomite, buff weathered, dark-brown fresh, thin-bedded, recessive, very fine grained, fractured, with minor amounts of coarse calcite, and trace amounts of anhydrite (?) as blebs and filling fractures	31.35	20.04	2.54	0.28	0.08	134	<100	1000
9354	Livingstone	~7¼	Calcarenite, light-grey to grey weathered with minor rusty patches, medium-grey fresh, medium-grained, massive to thick-bedded, attitude of bedding 145°/54°SW	54.69	0.75	0.29	0.18	<0.05	332	<100	400
9355	Livingstone	~4½	Cherty Limestone, light-grey to grey weathered with minor thin dark-brown-black weathered patches, light-grey to brownish-grey fresh, fine-grained, massive to thick-bedded, attitude of bedding 145°/54°SW	49.81	0.71	8.89	0.18	<0.05	250	<100	100
9356	Livingstone	~4½	Calcarenite, light-grey to grey weathered with minor rusty patches, medium-grained, medium-grey fresh, massive to thick-bedded, few rugose corals, attitude of joints 124°/64°NE	55.24	0.49	0.20	0.20	<0.05	276	<100	200
9357	Livingstone	~6¾	Calcarenite, light-grey weathered, grey- to dark-greyish-brown fresh, medium-grained, attitude of bedding 145°/45°SW	55.05	0.45	0.31	0.16	<0.05	270	<100	100
9358	Livingstone	~6	Calcarenite, light-grey weathered, grey- to dark-greyish-brown fresh, fine- to medium-grained, partly fractured, trace calcite stringers to 2 mm, attitude of bedding 132°/68°SW	54.83	0.63	0.24	0.20	<0.05	308	<100	<100
-	Banff	~28½	Covered	-	-	-	-	-	-	-	-
9001	Banff	¼	Argillaceous Dolomitic Limestone, light-grey weathered, medium-grey fresh, fine-grained, platy, attitude of bedding 140°/40°SW	25.66	9.89	27.95	3.26	1.13	145	300	700

APPENDIX 2B: DESCRIPTIONS AND COMPOSITIONS OF THE CHIP SAMPLES COLLECTED IN 1995

Note: Stratigraphic thicknesses are based on measured attitudes of bedding as listed below with appropriate interpolations. Samples are listed in order from stratigraphic top to bottom. They consist of chips at intervals of 20 to 30 cm.

Sample	Formation	Strat. Thick. (m)	Description	CaO (%)	MgO (%)	SiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	$SrCO_3$ ppm	MnO ppm	P_2O_5 ppm
Section 95-1: South End of Ridge Trending Southerly from Little Shunda Mountain (Fig. 7.1)											
10773	Livingstone	~2¼	Dolomitic Limestone, light-grey weathered with some brown material on beds, medium-grey fresh, grains to 2 mm, beds up to 25 cm, up to 25% solitary and colonial corals, attitude of bedding 165°/12° SW	49.42	4.78	0.38	0.058	0.087	365	32	<70
10772	Livingstone	1	Calcarenite, light-grey fresh, crinoids	54.54	0.47	0.10	0.020	0.020	485	19	<70
-	Livingstone	½	Covered	-	-	-	-	-	-	-	-
10771	Livingstone	~3⅛	Calcarenite, light-grey fresh, coarse-grained, some crinoids in upper part	54.79	0.44	0.10	0.017	0.034	521	16	<70
-	Livingstone	½	Covered	-	-	-	-	-	-	-	-
10770	Livingstone	~2½	Calcarenite, light-grey weathered and fresh, grains up to 1½ mm, minor jointing, about ½ m covered near middle, attitude of bedding 101°/11° SW	54.96	0.39	0.12	0.019	0.026	502	17	<70
-	-	-	Covered	-	-	-	-	-	-	-	-
Section 95-2: Along Cut Line South of Little Shunda Mountain (Fig. 7.1)											
10769	Livingstone	~6½	Micritic Limestone, light-grey weathered, medium- to dark-grey fresh, micritic to 1 mm grains, coarse-grained in bottom ½ m, beds up to 15 cm, some crinoid stems, rare gastropods, attitude of bedding 128°/29° SW	53.76	1.10	0.64	0.040	0.029	481	12	<70
Section 95-3: Creek Gorge about 2¼ km West of Shunda Mountain (Fig. 7.1)											
10728	Livingstone	~1	Calcarenite, light-grey fresh, coarse-grained	54.28	0.61	0.27	0.034	0.034	486	14	75
10727	Livingstone	4½	Calcarenite, light-grey weathered, medium- to dark-grey fresh, grains to 2½ mm, beds to 25 cm, some crinoid stems; top 1 m with up to 5% subround dark-brownish-grey to black pellets up to 2 mm in diameter	54.32	0.57	0.21	0.022	0.027	451	17	73
10726	Livingstone	2⅛	Calcarenite, light-grey with white and pink blotches weathered, medium- to dark-grey fresh, grains to 1½ mm, beds 30 to 60 cm, crinoids	54.53	0.64	0.13	0.023	0.033	470	17	<70
10775	Livingstone	3	Calcarenite, pinkish-grey weathered, light- to medium-grey fresh, grains to 3 mm, beds 10 to 25 cm, some crinoid stems, rare brachiopods, some milky-white calcite filling vugs up to 2 mm in diameter	53.69	1.09	0.30	0.030	0.035	445	20	<70
10774	Livingstone	3	Calcarenite, light-grey with white and pink blotches weathered, medium-grey fresh, coarse-grained, beds 30 to 60 cm, crinoid and coral fragments	53.94	0.86	0.24	0.052	0.050	431	22	<70

APPENDIX 2B: CONTINUED

Sample	Formation	Strat. Thick. (m)	Description	CaO (%)	MgO (%)	SiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	$SrCO_3$ ppm	MnO ppm	P_2O_5 ppm
Section 95-4: Creek Valley about 2 km West of Shunda Mountain (Fig. 7.1)											
10734	Livingstone	2	Calcarenite, medium-grey weathered, dark-grey fresh, fine- to medium-grained	54.81	0.51	0.65	0.020	0.037	509	19	<70
10733	Livingstone	1¾	Calcarenite, dark-grey, fine-grained	54.56	0.45	0.14	0.028	0.034	518	18	<70
10732	Livingstone	½	Calcarenite, medium- to dark-grey weathered, very dark grey fresh, fine-grained	54.66	0.47	0.20	0.030	0.044	562	18	<70
10731	Livingstone	1¼	Calcarenite, brownish-grey weathered, light- to medium-grey fresh, grains to 2½ mm, beds ~20 cm, some crinoids, rare brachiopods, attitude of bedding 126°/30° SW	54.58	0.46	0.11	0.017	0.025	468	17	<70
10730	Livingstone	1½	Calcarenite, medium-brownish-grey weathered, medium-grey fresh, grains to 1¾ mm, beds 10 to 20 cm	54.94	0.42	0.11	0.019	0.028	497	19	<70
10729	Livingstone	¼	Limestone, brownish-grey weathered, medium- to dark-grey fresh, micritic, beds to 7½ cm, recessive	54.85	0.38	0.09	0.016	0.025	580	18	<70
-	-	-	Covered	-	-	-	-	-	-	-	-
Section 95-5: Shallow Creek Bed on Southwest Flank of Shunda Mountain (Fig. 7.1)											
10736	Livingstone	1⅔	Dolomitic Limestone, medium-brownish-grey weathered, medium-grey fresh, micritic, beds 7 to 12 cm, attitude of bedding 140°/23° SW	46.79	7.00	0.51	0.038	0.029	322	20	<70
10735	Livingstone	1⅓	Dolomitic Limestone, dark-grey, micritic, some calcite veins to ½ mm parallel to bedding	44.50	8.25	1.10	0.101	0.048	304	28	<70
-	Livingstone	10-15	Covered	-	-	-	-	-	-	-	-
10762	Livingstone	4	Calcarenite, medium- to dark-grey, coarse-grained, crinoids	53.47	1.24	0.45	0.030	0.018	433	23	<70
-	Livingstone	1	Covered	-	-	-	-	-	-	-	-
10761	Livingstone	2	Calcarenite, light-grey fresh and weathered, grains up to 4 mm, beds to 30 cm, rare crystalline calcite filling vugs to 3 mm, abundant crinoids, rare horn corals, attitude of bedding 115°/21° SW	54.34	0.54	0.28	0.028	0.021	416	25	<70
10760	Livingstone	~1	Limestone, brownish-grey weathered, medium- to dark-grey fresh, micritic, beds up to 15 cm, some jointing	55.03	0.35	0.13	0.023	0.018	459	24	<70
Section 95-6: Dip Slope 2 km South of Shunda Mountain (Fig. 7.1)											
10763	Livingstone	~1¼	Calcarenite, light-grey weathered, light- to medium-grey fresh, grains to 4 mm, to 40% crinoid stems and oscicles, attitude of bedding 100-101°/18-23° SW	54.45	0.64	0.44	0.056	0.033	428	19	<70
-	-	-	Covered	-	-	-	-	-	-	-	-

APPENDIX 2B: CONTINUED

Sample	Formation	Strat. Thick. (m)	Description	CaO (%)	MgO (%)	SiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	$SrCO_3$ ppm	MnO ppm	P_2O_5 ppm
Section 95-7: Approximate Dipslope on Southwest Flank of Coliseum Mountain (Fig. 7.1)											
10759	Livingstone	3¼	Calcarenite, medium- to dark-grey weathered, medium-grey fresh, grains up to 1½ mm, beds 10 to 20 cm, rare chert stringer to ⅛ mm	54.34	0.82	0.35	0.035	0.028	424	14	<70
10758	Livingstone	¾	Dolomitic Calcarenite, light-grey-buff weathered, light- to medium-grey fresh, grains to 3 mm, beds greater than 25 cm, top 30 cm with some brachiopods, crinoids, and horn corals, attitude of bedding 119°/22° SW	51.57	2.58	0.49	0.044	0.035	423	17	<70
-	Livingstone	15½-18½	Covered	-	-	-	-	-	-	-	-
10757	Livingstone	3	Calcarenite, medium-brownish-grey fresh, grains ½ to 2 mm, thick-bedded to massive	54.69	0.47	0.25	0.033	0.023	421	14	<70
10756	Livingstone	3⅛	Calcarenite, light-grey weathered, light- to medium-grey fresh, grains 1 to 3 mm, massive, rare brachiopods and crinoids, attitude of bedding 117°/27° SW	54.51	0.41	0.09	0.017	0.015	485	12	<70
-	Livingstone	1	Covered	-	-	-	-	-	-	-	-
10755	Livingstone	~1½	Limestone, light-grey weathered, medium-grey to medium-brownish-grey fresh, micritic with some sparite, beds up to 20 cm, joints up to 15/m, attitude of joints 024°/90°	54.73	0.34	0.18	0.016	0.016	408	17	<70
Section 95-8: North Side of Highway 11 about ⅛ to b km East of Nordegg Turnoff (Fig. 7.1)											
10767	Livingstone	6	Dolomitic Calcarenite, medium-grey, fine- to medium-grained, some brachiopods; fine-grained lighter-grey calcarenite near top; middle of section with ½-m layer of coarse calcarenite; top 30 cm with few chert layers, attitude of bedding 140°/13° SW	48.14	5.79	0.47	0.063	0.050	342	17	95
-	Livingstone	13¾-17¾	Covered	-	-	-	-	-	-	-	-
10768	Livingstone	~2	Dolomitic Limestone, buff-grey to light-grey weathered, light-brownish-grey fresh, grains to ¾ mm, thick-bedded to massive	43.12	9.96	0.73	0.105	0.063	237	31	175
10766	Livingstone	1¾	Dolomitic Calcarenite, light-grey weathered, medium-brownish-grey fresh, grains generally ½ to 2 mm, massive	50.41	3.82	0.58	0.075	0.045	365	19	76
-	Livingstone	~4½	Covered	-	-	-	-	-	-	-	-
10765	Livingstone	1	Calcarenite, light-grey weathered, light- to medium-grey fresh, grains to 3 mm, massive, abundant crinoids	54.62	0.54	0.23	0.030	0.022	418	17	92
10764	Livingstone	4	Calcarenite, light-grey weathered, light- to medium-grey fresh, grains ½ to 3 mm, massive, some crinoids and horn corals, carbonaceous- to dolomitic-lined stylolite up to ¼ mm at about 3 m from base of sample, attitude of bedding 132°/18° SW	53.64	1.05	0.24	0.054	0.043	426	23	84
-	-	-	Covered	-	-	-	-	-	-	-	-

APPENDIX 2C: DESCRIPTIONS AND COMPOSITIONS OF THE CHIP SAMPLES COLLECTED IN 1997

Note: Stratigraphic thicknesses are based on measured attitudes of bedding as listed below with appropriate interpolations. Samples are listed in order from stratigraphic top to bottom. They consist of chips at intervals of 20 to 30 cm.

Sample	Formation	Strat. Thick.(m)	Description	CaO (%)	MgO (%)	SiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	$SrCO_3$ (ppm)	MnO (ppm)	P_2O_5 (ppm)
Section 97.1: NW Shore of Coyote Lake (Fig. 7.1)											
11576	Livingstone	¼	Calcarenite, medium-light grey fresh, white-grey weathered , coarse grained, thin-bedded	41.76	11.12	1.34	0.087	0.093	293	37	157
-	-	1	covered	-	-	-	-	-	-	-	-
11577	Livingstone	5½	Calcarenite, medium- to light-grey, coarse grained, thick bedded, attitude of bedding 128°/15° SW	52.58	2.50	0.43	0.053	0.050	422	27	122
11578	Livingstone	5¼	Calcarenite, as above, attitude of bedding 130°/15° SW	55.21	0.46	0.23	0.032	0.038	468	28	<70
Section 97.4: Ridge Trending Southeast from Coyote Lake (Fig. 7.1)											
11579	Livingstone	5	Calcarenite, light-brownish-grey fresh, white-grey weathered, medium grained, massive, attitude of bedding 127°/25° SW	55.30	0.44	0.17	0.028	0.032	467	29	<70
Section 97-3: Easterly Trending Ridge Top North of North Knob (Fig. 7.1)											
-	Banff	3	Dolomitic limestone, dark grey fresh, light-grey weathered, micritic, attitudes of bedding 103°/30° NE, 70°/55° NW	-	-	-	-	-	-	-	-
-	-	4	covered	-	-	-	-	-	-	-	-
11580	Banff	2	Limestone, dark-grey fresh, white-grey weathered, cryptocrystalline, beds 5 - 30 cm thick	53.87	0.77	1.17	0.184	0.569	549	45	148
Section 97-4: Tributary Creek Northeast of North Knob (Fig. 7.1)											
11581	Livingstone	4	Limestone, beds 15 to 40 cm thick, coarse-grained, medium-light grey fresh, white-grey weathered, attitude of bedding 103°/40° NE, vertical cleavage trending N-S	55.13	0.43	0.30	0.038	0.052	660	28	<70

APPENDIX 2C: CONTINUED

Sample	Formation	Strat. Thick.(m)	Description	CaO (%)	MgO (%)	SiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	$SrCO_3$ (ppm)	MnO (ppm)	P_2O_5 (ppm)
Section 97-5: North Flank of Coliseum Mountain (Fig. 7.1)											
11609	Upper Palliser	10	Limestone, very dark-grey to black fresh, greyish-brown weathered, some pinkish material on weathered surfaces, micritic, numerous fractures and joints, and abundant white secondary calcite blebs and stringers, attitude of bedding 115°/73° NE	53.41	0.98	1.90	0.286	0.176	469	105	78
11608	Upper Palliser	6	Limestone, as above, attitude of bedding 110°/68° NE	53.87	0.73	1.72	0.251	0.122	490	61	<70
		16	covered, offset 45 m at 270° from base of 11608								
11607	Upper Palliser	7½	Limestone, brownish-grey to very dark-grey fresh, grey weathered, beds 10 50 cm thick, rusty-brown material on fractures, thin white calcite stringers	52.31	1.69	2.17	0.369	0.224	449	95	122
11606	Upper Palliser	6	Lime mudstone, dark-greyish brown fresh, dark-grey weathered, crytocrystalline, attitude of bedding 119°/40° NE	53.41	1.07	1.69	0.233	0.157	459	57	<70
11605	Upper Palliser	1½	Limestone, very dark-grey fresh, grey weathered, micritic, massive, attitude of bedding 119°/41° NE	48.42	5.23	1.25	0.178	0.141	363	84	<70
Section 97-6: Creek on Southwest Flank of Coliseum Mountain (Fig. 7.1)											
11558	Livingstone	2¼	Wackestone, dark-grey fresh, buff-grey weathered, bituminous staining along stylolites, 20% of grains up to 2 mm; beds 5-25 cm thick	49.08	5.29	0.46	0.072	0.076	377	19	157
11557	Livingstone	2¼	Lime mudstone to wackestone, medium- to dark-grey fresh, greyish-brown weathered, few dark grains up to 1 mm, thickness of beds 5-15 cm	45.65	8.34	0.55	0.094	0.100	309	25	<70
-	Livingstone	7	Interbedded dolomite and dolomitic limestone, mostly covered	-	-	-	-	-	-	-	-
-	Livingstone	3	Dolomite, brownish-grey fresh, buff-grey weathered, micritic	-	-	-	-	-	-	-	-
11556	Livingstone	1½	Wackestone, as above, beds to ½ m	48.05	6.27	0.29	0.057	0.090	304	33	91
11555	Livingstone	2	Wackestone, as above, massive wackstone with few grains up to 3 mm	55.18	0.49	0.29	0.051	0.038	468	18	85
11554	Livingstone	2	Wackestone, light-grey fresh, grey weathered, few solitary corals near the middle of the interval	55.10	0.44	0.39	0.098	0.067	432	23	<70
11553	Livingstone	2½	Wackestone, light-grey fresh, grey weathered, massive, few grains up to 2 mm	55.23	0.46	0.23	0.059	0.059	440	27	<70
11552	Livingstone	2½	Wackestone, light-grey fresh, rusty brown patches on grey weathered surface, massive, few sucrosic pieces with slow HCl reaction, attitude of bedding 118°/18° SW	54.86	0.74	0.27	0.042	0.044	482	27	<70

APPENDIX 2C: CONTINUED

Sample	Formation	Strat. Thick.(m)	Description	CaO (%)	MgO (%)	SiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	$SrCO_3$ (ppm)	MnO (ppm)	P_2O_5 (ppm)
Section 97-7: Cliff Outcrops on the Western Bank of Martin Creek (Fig. 7.4)											
n/s	Livingstone	5 - 10	Dolomite, thin-bedded, mostly covered	-	-	-	-	-	-	-	-
12214	Livingstone	7	Calcarenite, resistant, dark grey, fossiliferous, grains 1 - 3 mm, beds 5 - 15 cm thick, forms weathered top of cliff section	55.07	0.49	0.49	0.039	0.043	517	14	<70
12217	Livingstone	7	Calcarenite, medium to dark brownish-grey, grains 1 - 5 mm, beds 10 cm - 1 m thick	55.09	0.56	0.29	0.044	0.034	529	16	<70
12213	Livingstone	5	Calcarenite, resistant, dark grey, grains 1 - 5mm, beds 20 - 40 cm thick, massive forming base of upper vertical cliff	54.18	1.29	0.37	0.044	0.043	438	19	<70
12212	Livingstone	1	Calcarenite, brownish-grey, patchy dolomitization	35.22	17.29	0.58	0.110	0.099	156	45	198
12216	Livingstone	5	Calcarenite, very limy, light brownish-grey, grains up to 3 mm: lower 2 m is resistant and massive forming upper part of vertical cliff; upper 3 m less resistant forming a recessive break between upper and lower cliffs	39.96	13.23	0.60	0.111	0.097	231	43	339
12215	Livingstone	4	Calcarenite, resistant, very limy, light brownish-grey, grains up to 3 mm, massive forming base of vertical cliff	53.56	1.88	0.29	0.053	0.047	388	20	74
Section 97-8: Northern Flank of Mountain East of Martin Creek and South of Highway 11 (Fig. 7.4)											
11652	Upper Palliser	8	Limestone, dark-grey fresh, white-grey weathered, microcrystalline, beds 7 to 25 cm thick, attitude of bedding 113°/27° NE, sheared parallel to bedding mostly in the uppermost 3 m	51.19	2.80	1.88	0.324	0.174	449	188	164
11651	Upper Palliser	7	Limestone, dark-grey fresh, white-grey weathered, cryptocrystalline, beds 3 10 cm thick, sheared parallel to bedding	46.71	6.16	2.16	0.373	0.188	383	169	<70
Section 97-9: Southwest Side of Ridge at North End of Dipslope Mountain (Fig. 7.4)											
11587	Livingstone	7½	Calcarenite, medium grey fresh, white-grey weathered, coarse grained, beds 10 - 25 cm thick, attitudes of bedding 150°/50° SW, 146°/47° SW	55.19	0.51	0.20	0.029	0.032	528	16	88
11586	Livingstone	1½	Sheared limestone, with patchy dolomitization mostly on bedding, bedding parallel shearing	43.10	7.37	6.25	0.058	0.148	327	38	84
11585	Livingstone	6¼	Calcarenite, coarse grained, light-grey fresh, white-grey weathered, crinoids, thick-bedded, attitude of bedding 153°/46°	54.51	0.71	0.15	0.037	0.118	498	18	166
11584	Livingstone	4¾	Calcarenite, light-greyish-brown fresh, white-grey weathered, grains up to 4 mm, very fossiliferous, crinoids, thick-bedded	52.71	1.86	0.31	0.051	0.046	402	25	<70
11583	Livingstone	3¼	Calcarenite, light-grey fresh, white-grey weathered, grains up to 3 mm, very fossiliferous, whole brachiopods and crinoid stems, thick-bedded, attitude of bedding 162°/46° SW	50.64	3.85	0.58	0.091	0.079	411	42	78
11582	Livingstone	¼	Limestone, thin bedded, dark-grey fresh, white-grey weathered, micritic, massive, opaque to glassy look, attitude of bedding 158°/50° SW	46.84	6.98	0.70	0.116	0.105	353	48	73

APPENDIX 2C: CONTINUED

Sample	Formation	Strat. Thick.(m)	Description	CaO (%)	MgO (%)	SiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	$SrCO_3$ (ppm)	MnO (ppm)	P_2O_5 (ppm)
Section 97.10: Southwest Side of Ridge near North End of Dipslope Mountain (Fig. 7.4)											
11592	Livingstone	2	Calcarenite, medium grey, coarse grained, crinoids, attitudes of bedding 144°/42° SW, 144°/50° SW	54.94	0.52	0.10	0.022	0.039	514	19	71
11591	Livingstone	2½	Calcarenite, light grey, coarse grained, crinoids, massive, crumbly in lower 3 m, with erratic joint patterns, attitude of bedding 150°/45° SW	54.95	0.52	0.14	0.027	0.033	494	19	77
11590	Livingstone	2¾	Calcarenite, light grey, coarse grained, fossiliferous, crinoids, massive	53.05	1.78	0.32	0.049	0.062	420	28	128
-	Livingstone	1	Dolomite, not sampled	-	-	-	-	-	-	-	-
11589	Livingstone	4½	Calcarenite, medium to light grey, coarse grained, beds 15 - 25 cm thick	47.62	6.62	0.30	0.136	0.112	386	48	109
11588	Livingstone	¼	Limestone, thin bedded, bedding-parallel shearing, dark-grey fresh, white-grey weathered, cryptocrystalline, massive, opaque to glassy look, attitude of bedding 135°/38° SW	54.81	0.56	0.34	0.031	0.092	570	43	103
Section 97.11: Southwest Flank of Dipslope Mountain 200 m Down Ridge (Fig. 7.4)											
11596	Livingstone	5½	Limestone, coarse grained, thick bedded, medium-grey fresh, white-grey weathered	54.90	0.52	0.21	0.029	0.035	482	20	152
11595	Livingstone	3	Limestone, as above	44.94	8.90	0.36	0.065	0.110	262	52	<70
11594	Livingstone	2	Limestone, as above	54.97	0.55	0.21	0.029	0.072	546	29	75
11593	Livingstone	1/3	Limestone, fine-grained, medium-grey weathered, medium- to light-grey fresh, foliated to thin plates, few black bands, attitude of bedding 137°/48° SW	54.86	0.58	0.24	0.033	0.087	594	42	<70
Section 97.12: Low point in saddle on Dipslope Mountain (Fig. 7.4)											
11597	Livingstone	6	Calcarenite, light-grey weathered, medium-grey fresh, crinoids, coarse-grained, thick-bedded, upper ½ - ¾ m contains vugs up to 1 cm in size, attitude of bedding	46.75	6.96	0.61	0.071	0.064	347	27	137
11604	Livingstone	2	Wackestone, light-grey weathered, light-grey fresh, grains to 1 mm, top 20 cm with abundant solitary corals, attitude of bedding 136°/38° W	45.94	8.07	0.49	0.064	0.093	341	30	<70
-	Livingstone	2	Wackestone, as above (not sampled)	-	-	-	-	-	-	-	-
11598	Livingstone	7	Wackestone, as above	53.87	1.54	0.38	0.054	0.048	497	18	<70
11599	Livingstone	5½	Calcarenite, light- to medium-grey fresh, coarse-grained, crinoidal, massive	51.44	3.09	0.32	0.052	0.064	492	29	97
11600	Livingstone	5	Calcarenite, as above	52.15	2.45	0.17	0.036	0.043	458	26	<70

APPENDIX 2C: CONTINUED

Sample	Formation	Strat. Thick.(m)	Description	CaO (%)	MgO (%)	SiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	$SrCO_3$ (ppm)	MnO (ppm)	P_2O_5 (ppm)
Section 97.13: Cliff Section at Top of East Side of Ridge Between Second and Third Peaks from Southeast End of Dipslope Mountain (Fig. 7.4)											
11603	Livingstone	½	Lime mudstone, medium grey fresh, light-grey mottled brownish weathered, micritic, beds less than 10 cm thick, few calcite stringers up to 2 mm	51.09	2.94	1.20	0.057	0.061	401	23	204
11602	Livingstone	2	Wackestone (top 1½ m), light to medium grey, grains to 3 mm in size, rare crinoid osicle, beds up to15 cm thick, Lime mudstone (lower ½ m), dark-grey fresh, light-grey weathered, beds 2 - 3 cm, attitude of bedding 148°/30° W	54.74	0.59	0.40	0.028	0.047	447	20	75
11601	Livingstone	3½	Wackestone, light-brownish-grey to medium-grey fresh, light-grey weathered, beds to 15 cm thick, grains to 3 mm, rare crinoid osicles	54.88	0.55	0.27	0.029	0.042	419	21	106
11575	Livingstone	3	Calcarenite, medium-grey fresh, light-grey weathered, grains to 3 mm, beds 5 - 10 cm thick, brown weathered material on fracture surfaces	54.84	0.81	0.22	0.033	0.045	407	21	289
11574	Livingstone	2	Calcarenite, light-grey fresh and weathered, grains to 2 mm, rare crinoid osicles and brachiopods, beds 10 to 50 cm thick, attitude of bedding 136°/40° SW	53.60	1.69	0.39	0.048	0.077	388	21	364
-	-	1¼	Inaccessible, partly covered, not sampled	-	-	-	-	-	-	-	-
11573	Livingstone	2¾	Wackestone to Lime mudstone, brownish-grey to light-grey fresh, buff-grey weathered, grains up to 1 mm, beds 10 - 30 cm thick	54.90	0.54	0.19	0.032	0.051	568	20	129
11572	Livingstone	3	Calcarenite, light-grey fresh and weathered, grains up to 3 mm, crinoids, secondary coarse white calcite blebs up to 1 cm, beds 10 cm thick to massive	55.09	0.62	0.16	0.031	0.054	539	20	70
11571	Livingstone	3	Wackestone, light-grey fresh, light-grey weathered, grains to 1 mm, massive, brown weathered material on fracture surfaces	55.34	0.45	0.11	0.031	0.055	458	22	96
11570	Livingstone	4	Wackestone, light- to medium-grey fresh, light-grey weathered, grains to 1 mm, massive, brown weathered material on fracture surfaces	54.98	0.50	0.12	0.037	0.119	455	24	<70
11569	Livingstone	4	Wackestone, light brownish-grey fresh, light-grey weathered, grains to 1 mm, massive, secondary coarse white calcite blebs 1 - 3 cm across	55.22	0.46	0.25	0.034	0.063	533	29	<70

APPENDIX 2C: CONTINUED

Sample	Formation	Strat. Thick.(m)	Description	CaO (%)	MgO (%)	SiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	$SrCO_3$ (ppm)	MnO (ppm)	P_2O_5 (ppm)
Section 97.14: South of Second Peak from Southeast End of Dipslope Mountain (Fig. 7.4)											
11568	Livingstone	3	Limestone, light- to medium-grey fresh, light-grey weathered, wackestone with grains up to 1 mm, massive	55.23	0.45	0.13	0.026	0.065	524	23	<70
11567	Livingstone	3	Limestone, light-grey weathered and fresh, calcarenite with grains up to 1 mm, massive, includes a 0.5 m bed of recrystallyzed, cryptocrystalline white to very light-grey limestone	55.25	0.50	0.13	0.030	0.063	520	27	<70
11566	Livingstone	1¾	Limestone, light- to medium-grey fresh, light-grey with some buff stain on weathered surfaces, wackstone with some black grains up to 1 mm, attitude of bedding 128°/33°W, some coarse white calcite stringers up to 3 mm, especially near top.	54.68	0.72	0.56	0.067	0.115	558	41	<70
Section 97.15: Near Southernmost Peak of Dipslope Mountain Overlooking the Gap on the North Saskatchewan River (Fig. 7.4)											
11565	Livingstone	3¼	Limestone, light- to medium-grey fresh, light-grey weathered, calcarenite with crinoids and black grains up to 1 mm, some coarse white secondary calcite blebs up to 4 mm, attitude of bedding 145°/38° W	55.10	0.56	0.21	0.036	0.067	542	22	109
11564	Livingstone	1½	Limestone, as above, attitude of bedding 152°/38°W	55.19	0.49	0.22	0.026	0.050	470	25	98
11563	Livingstone	3	Limestone, light-grey fresh and weathered, calcarenite with grains up to 2 mm, thickness of beds from 5 to 25 cm, attitude of bedding 140°/36° W	55.19	0.49	0.13	0.031	0.046	463	19	<70
11562	Livingstone	1¼	Limestone, as above, brownish material on weathered surfaces and joins, scattered crinoids, thickness of beds from 10 to 30 cm, attitude of bedding 154°/32° W	55.02	0.46	0.09	0.024	0.041	453	18	<70
11561	Livingstone	3¼	Limestone, light- to medium-grey fresh, light-grey weathered, wackestone with 30% grains up to 2 mm	55.31	0.48	0.13	0.021	0.059	498	21	<70
11560	Livingstone	2¼	Limestone, as above, some buff weathered material thickness of beds from 5 to 30 cm	55.09	0.55	0.25	0.044	0.071	540	23	<70
11559	Livingstone	2½	Limestone, light-grey fresh and weathered, wackestone with 30% dark-grey subangular grains up to 3 mm, thickness of beds up to 0.5 m, attitude of bedding 126°/31° W	54.58	0.61	0.36	0.056	0.092	517	34	82

APPENDIX 3A: ANALYTICAL REPORTS FOR WHOLE ROCK ICP ANALYSES FROM ACME ANALYTICAL LABORATORIES LTD., FOR SAMPLES COLLECTED IN 1994

ACME ANALYTICAL LABORATORIES LTD. 852 E. HASTINGS ST. VANCOUVER B.C. V6A 1R6 PHONE(604)253-3158 FAX(604)253-1716

WHOLE ROCK ICP ANALYSIS

Halferdahl & Associates Ltd. File # 94-1903 Page 1

10 - 10509 - 81st Ave, Edmonton AB T6E 1X7 Submitted by: L.B. Halferdahl

SAMPLE#	SiO2 %	Al2O3 %	Fe2O3 %	MgO %	CaO %	Na2O %	K2O %	TiO2 %	P2O5 %	MnO %	Cr2O3 %	Ba ppm	Ni ppm	Sr ppm	Zr ppm	Y ppm	Nb ppm	Sc ppm	LOI %	SUM %
7776	1.52	.35	.10	3.52	50.20	.04	.09	.02	.02	<.01	.002	10	33	178	16	<10	<10	<2	43.7	99.60
7777	.98	.24	.08	3.21	51.03	.04	.15	<.01	.09	<.01	.005	9	25	194	196	<10	<10	<2	43.9	99.78
7778	3.90	.80	.26	10.60	40.51	.05	.25	.02	.06	.01	.008	19	24	228	22	<10	<10	<2	43.7	100.20
7779	.76	.20	<.05	8.23	45.88	.02	<.05	.01	.05	<.01	.004	6	18	151	<10	<10	<10	<2	44.7	99.93
7780*	.50	.19	<.05	7.95	46.34	.05	<.05	.01	.06	<.01	.002	<5	21	206	16	<10	<10	<2	44.8	99.93
7781*	.40	.19	<.05	1.59	53.52	.04	<.05	<.01	.02	<.01	.002	<5	23	264	<10	<10	<10	<2	43.9	99.72
7782*	.25	.17	<.05	.90	54.49	.04	<.05	<.01	.01	<.01	<.002	<5	10	282	<10	<10	<10	<2	43.9	99.82
7783*	.25	.18	<.05	2.09	53.07	.06	<.05	<.01	.02	<.01	.005	<5	20	253	<10	<10	<10	<2	44.1	99.81
7784*	1.06	.25	<.05	21.76	30.57	.06	<.05	.01	.11	<.01	.004	6	19	83	81	<10	<10	<2	47.0	100.94
7785*	.83	.24	<.05	21.07	31.49	.06	.06	.01	.08	<.01	.003	12	18	86	<10	<10	<10	<2	47.0	100.86
7786*	1.38	.20	.13	4.26	49.60	.03	.08	<.01	.03	.01	.005	5	28	191	<10	<10	<10	<2	44.1	99.85
RE 7786*	1.36	.18	.09	4.16	49.70	.04	.08	<.01	.03	.01	.003	<5	26	193	<10	<10	<10	<2	44.2	99.88
7787*	1.01	.32	.10	3.10	50.90	.04	<.05	.04	.03	.01	.005	<5	16	298	14	<10	<10	<2	44.2	99.79
7788*	2.59	.55	.25	7.76	44.31	.04	.30	.03	.05	.02	.005	13	22	217	20	<10	<10	<2	44.2	100.14
7789*	2.32	.58	.23	1.65	51.64	.04	.16	.03	.04	.01	.004	10	18	279	10	<10	<10	<2	43.3	100.04
7790*	1.88	.50	.22	3.48	49.87	.04	.09	.04	.04	.02	.002	7	<10	253	19	<10	<10	<2	43.8	100.02
7791*	2.26	.50	.20	6.17	46.67	.04	.07	.03	.05	.02	.004	12	14	254	11	<10	<10	<2	44.0	100.05
7792*	2.19	.50	.23	2.05	51.16	.04	.18	.02	.02	.02	.006	12	21	259	<10	<10	<10	<2	43.6	100.05
7793*	2.79	.66	.28	.73	52.25	.04	.15	.02	.01	.02	<.002	10	14	288	12	<10	<10	<2	43.1	100.09
7794*	1.85	.43	.18	1.00	52.69	.05	.16	.02	.01	.01	.009	10	25	293	11	<10	<10	<2	43.7	100.15
7795*	2.12	.58	.25	.86	52.77	.03	.13	.01	.01	.01	<.002	12	19	297	11	<10	<10	<2	43.3	100.11
7796*	2.28	.50	.22	.99	52.58	.04	.20	.03	.03	.02	<.002	36	16	295	<10	<10	<10	<2	43.2	100.13
7797*	2.92	.75	.29	.61	52.68	.04	.08	.03	.02	.02	.003	36	10	287	10	<10	<10	<2	42.7	100.19
9001*	27.95	3.26	1.13	9.89	25.66	.15	1.53	.19	.07	.03	.005	132	13	145	87	<10	<10	3	31.0	100.92
9351*	1.40	.24	.10	10.19	43.46	.05	<.05	.04	.05	<.01	.007	<5	<10	207	17	<10	<10	<2	44.6	100.22
9352*	7.54	.31	.12	17.60	31.48	.05	.08	<.01	.08	<.01	.004	6	19	160	52	<10	<10	<2	43.4	100.70
9353*	2.54	.28	.08	20.04	31.35	.03	<.05	.01	.10	<.01	.006	7	13	134	<10	<10	<10	<2	45.9	100.41
9354*	.29	.18	<.05	.75	54.99	.04	<.05	<.01	.04	<.01	.003	<5	<10	332	<10	12	<10	<2	43.7	100.09
9355*	8.89	.18	<.05	.71	49.81	.04	<.05	<.01	.01	<.01	<.002	<5	12	250	<10	12	<10	<2	40.5	100.18
9356*	.20	.20	<.05	.49	55.24	.05	<.05	<.01	.02	<.01	.002	<5	23	276	<10	16	<10	<2	43.9	100.16
9357*	.31	.16	<.05	.45	55.32	.04	<.05	<.01	.01	<.01	.002	<5	<10	270	11	24	<10	<2	43.7	100.03
9358*	.24	.20	<.05	.63	55.19	.05	<.05	.01	<.01	<.01	.003	<5	13	308	18	<10	<10	<2	43.6	99.97
9359	39.98	.58	.37	.30	31.44	.07	<.05	.01	1.71	.01	.003	315	16	344	17	31	<10	2	25.4	99.99
9360	.51	.16	.10	.89	54.58	.04	<.05	<.01	.05	<.01	.005	<5	13	247	<10	<10	<10	<2	43.7	100.12
9361	.55	.19	.14	17.69	35.70	.04	<.05	.01	.08	.01	.006	<5	11	131	<10	<10	<10	<2	46.1	100.53
STANDARD LIMESTONE	6.91	1.51	.61	.39	49.23	.06	.25	.07	.06	.02	.005	90	28	291	34	<10	<10	<2	39.9	99.07

.200 GRAM SAMPLES ARE FUSED WITH 1.2 GRAM OF LiBO2 AND ARE DISSOLVED IN 100 MLS 5% HNO3. Ba IS SUM AS BaSO4 AND OTHER METALS ARE SUM AS OXIDES.
- SAMPLE TYPE: LIMESTONE Samples beginning 'RE' are duplicate samples.

DATE RECEIVED: JUL 4 1994 DATE REPORT MAILED: July 8/94. SIGNED BY [redacted] D.TOYE, C.LEONG, J.WANG; CERTIFIED B.C. ASSAYERS

* Sample from MAIM Permit 9396010038.

APPENDIX 3A: CONTINUED

Halferdahl & Associates Ltd. FILE # 94-1903 Page 2

SAMPLE#	SiO2 %	Al2O3 %	Fe2O3 %	MgO %	CaO %	Na2O %	K2O %	TiO2 %	P2O5 %	MnO %	Cr2O3 %	Ba ppm	Ni ppm	Sr ppm	Zr ppm	Y ppm	Nb ppm	Sc ppm	LOI %	SUM %
9362	.93	.22	.14	6.39	48.05	.03	<.05	.02	.05	<.01	.007	12	15	161	18	<10	<10	<2	44.2	100.07
9363	2.08	.38	.14	18.27	36.06	.02	.11	.04	.06	.01	.007	10	14	139	21	<10	<10	<2	45.8	103.00
9364	5.15	.52	.20	12.21	37.88	.02	.18	.02	.05	<.01	.006	13	17	202	14	<10	<10	<2	43.6	99.87
9365	6.00	.79	.25	11.25	38.29	.02	.24	.04	.04	<.01	.006	18	17	198	14	<10	<10	<2	43.0	99.96
9366	4.40	.59	.15	16.14	34.52	.02	.18	.04	.04	<.01	.014	14	53	141	22	<10	<10	<2	44.5	100.63
9367	10.50	.38	.16	6.31	42.89	.01	.21	.05	.02	<.01	.006	7	30	294	35	<10	<10	<2	39.9	100.48
RE 9367	10.46	.34	.16	6.35	43.00	.02	.20	.02	.01	<.01	.005	5	28	297	32	<10	<10	<2	39.9	100.51
9368	.43	.20	<.05	1.16	54.32	.01	<.05	.01	.03	<.01	.004	<5	24	256	<10	<10	<10	<2	43.8	100.00
9369	.47	.20	<.05	1.43	54.09	.02	<.05	.01	.01	<.01	.005	<5	16	246	<10	<10	<10	<2	43.6	99.89
9371*	1.58	.48	.19	2.45	51.75	.02	.10	.03	.02	.01	<.002	10	<10	254	10	<10	<10	<2	43.3	99.97
9372*	.32	.21	<.05	.71	54.47	.01	.09	.01	.01	<.01	.003	5	<10	304	12	<10	<10	<2	44.1	99.98
9373*	.20	.22	<.05	.46	54.93	.02	.13	.01	.02	<.01	.002	<5	<10	241	<10	<10	<10	<2	43.8	99.82
9374*	.25	.21	.12	1.62	53.77	.02	<.05	<.01	.01	<.01	.003	<5	27	219	<10	<10	<10	<2	43.5	99.56
9375*	.63	.27	<.05	7.81	45.44	.03	<.05	.01	.03	<.01	.004	5	<10	175	<10	<10	<10	<2	45.1	99.35
STANDARD LIMESTONE	6.83	1.33	.51	.49	50.01	.03	.21	.06	.04	.02	.003	85	14	254	31	<10	<10	<2	39.9	99.48

Sample type: LIMESTONE. Samples beginning 'RE' are duplicate samples.

* Sample from MAIM Permit 9396010038.

ACME ANALYTICAL LABORATORIES LTD. 852 E. HASTINGS ST. VANCOUVER B.C. V6A 1R6 PHONE(604)253-3158 FAX(604)253-1716

WHOLE ROCK ICP ANALYSIS

Halferdahl & Associates Ltd. File # 94-2234 Page 1

18 - 10509 - 81st Ave, Edmonton AB T6E 1X7 Submitted By: L.B. Halferdahl

SAMPLE#	SiO2 %	Al2O3 %	Fe2O3 %	MgO %	CaO %	Na2O %	K2O %	TiO2 %	P2O5 %	MnO %	Cr2O3 %	Ba ppm	Ni ppm	Sr ppm	Zr ppm	Y ppm	Nb ppm	Sc ppm	LOI %	SUM %
9002	.41	.22	<.05	2.90	52.14	.01	<.05	.01	.02	<.01	<.002	<5	<10	199	<10	<10	<10	<2	44.2	99.94
9003	.45	.17	<.05	2.00	53.51	.01	<.05	.02	.01	<.01	.004	<5	<10	170	<10	<10	<10	<2	43.9	100.10
9004	1.24	.35	.23	6.36	46.90	<.01	.17	<.01	<.01	<.01	.002	6	18	143	<10	<10	<10	<2	44.7	99.98
9005	.48	.16	<.05	1.03	54.28	.01	<.05	<.01	<.01	<.01	<.002	<5	<10	196	<10	<10	<10	<2	44.0	99.99
9006	.38	.18	<.05	.56	54.92	.02	<.05	<.01	.01	<.01	.002	<5	<10	187	<10	<10	<10	<2	43.9	100.00
9301	.41	.21	<.05	5.48	49.18	<.01	<.05	.02	.02	.07	.003	15	23	152	<10	<10	<10	<2	44.5	99.97
9651	.37	.14	<.05	.58	54.74	.01	<.05	.01	<.01	<.01	.002	<5	<10	200	<10	<10	<10	<2	44.1	99.98
9652	.33	.18	<.05	.59	55.00	.02	<.05	.02	.01	<.01	<.002	<5	10	181	<10	<10	<10	<2	43.7	99.88
9653	.33	.16	<.05	.46	55.04	.02	<.05	.01	.02	<.01	<.002	<5	<10	198	<10	<10	<10	<2	43.9	99.99
RE 9653	.34	.17	<.05	.47	55.01	.02	<.05	<.01	<.01	<.01	.005	<5	<10	199	<10	<10	<10	<2	43.9	99.94
9654	.41	.17	<.05	.82	54.53	.01	.14	.01	<.01	<.01	.005	<5	11	215	<10	<10	<10	<2	43.9	100.03
9655	.48	.20	<.05	.57	54.85	.02	<.05	<.01	.02	<.01	.010	6	30	244	<10	<10	<10	<2	43.8	99.99
9656	.89	.17	<.05	6.33	48.09	.01	<.05	<.01	.01	<.01	.003	<5	11	177	<10	<10	<10	<2	44.6	100.13
9657	.56	.16	<.05	6.49	48.07	.02	<.05	.01	<.01	<.01	<.002	<5	14	168	12	<10	<10	<2	44.7	100.04
9658	.66	.21	<.05	3.86	50.97	.02	<.05	.03	<.01	<.01	.004	5	<10	191	<10	<10	<10	<2	44.3	100.08
9659	.34	.17	<.05	.55	54.70	.02	<.05	<.01	.01	<.01	.002	<5	<10	200	<10	<10	<10	<2	43.9	99.73
9660	.39	.19	<.05	3.04	51.86	.02	<.05	.01	.01	<.01	.003	<5	14	161	<10	<10	<10	<2	44.3	99.85
9661	.46	.18	<.05	.54	54.64	.01	<.05	.01	.01	<.01	.005	<5	14	267	11	13	<10	<2	44.0	99.89
9662	2.30	.62	.21	1.36	52.05	.01	.26	.05	<.01	<.01	.003	15	<10	261	<10	<10	<10	<2	43.2	100.10
9663	.47	.14	<.05	1.37	54.14	.02	<.05	.01	.02	<.01	<.002	<5	11	178	<10	<10	<10	<2	43.8	100.01
9664	.59	.18	<.05	.58	54.76	.01	<.05	.01	<.01	<.01	.003	<5	19	227	<10	<10	<10	<2	43.8	99.97
9665	.75	.20	<.05	4.14	50.62	<.01	<.05	.02	.04	<.01	.003	5	10	209	<10	<10	<10	<2	44.2	100.01
9666	.77	.22	<.05	23.39	29.30	<.01	.11	<.01	.07	<.01	.004	7	25	71	<10	<10	<10	<2	47.0	100.88
9667	.67	.20	<.05	2.88	52.15	.01	<.05	<.01	<.01	<.01	<.002	<5	<10	203	<10	<10	<10	<2	44.1	100.04
9668	1.38	.42	.29	22.89	28.84	<.01	.15	.03	.07	.01	.004	8	26	86	<10	<10	<10	<2	46.7	100.80
9669	.63	.17	<.05	2.64	52.42	.01	<.05	<.01	<.01	<.01	.003	<5	15	207	<10	<10	<10	<2	44.1	100.00
9670	.57	.18	<.05	3.50	51.52	.01	<.05	<.01	<.01	<.01	<.002	7	28	185	<10	<10	<10	<2	44.2	100.01
9671	.41	.16	<.05	3.41	51.63	.02	<.05	<.01	.02	<.01	<.002	<5	12	159	<10	<10	<10	<2	44.2	99.88
9672	.58	.16	<.05	1.52	53.54	.03	<.05	.01	<.01	<.01	.005	7	<10	229	<10	<10	<10	<2	43.9	99.78
9701	.42	.19	<.05	2.12	53.04	<.01	.08	<.01	<.01	.05	<.002	22	12	168	<10	<10	<10	<2	43.9	99.83
9702	.40	.19	<.05	.58	54.86	.01	<.05	.03	<.01	.07	.004	19	<10	180	<10	<10	<10	<2	43.7	99.87
9703	.39	.15	.41	22.39	29.78	<.01	<.05	.03	.04	.10	.006	13	34	39	<10	<10	<10	<2	47.1	100.41
9704	.53	.20	<.05	4.18	50.98	.02	<.05	.02	<.01	.02	<.002	17	<10	170	<10	<10	<10	<2	44.0	99.97
9705	.51	.19	.22	21.88	30.31	<.01	<.05	.01	.06	.04	.002	14	<10	52	<10	<10	<10	<2	47.1	100.33
9706	.76	.25	.20	6.46	47.43	<.01	.13	<.01	<.01	.03	.005	9	16	213	<10	<10	<10	<2	44.6	99.90
STANDARD LIMESTONE	7.13	1.36	.53	.46	50.00	.04	.24	.08	.02	.02	.003	83	19	266	17	<10	<10	<2	39.9	99.83

.200 GRAM SAMPLES ARE FUSED WITH 1.2 GRAM OF LIBO2 AND ARE DISSOLVED IN 100 MLS 5% HNO3. Ba IS SUM AS BaSO4 AND OTHER METALS ARE SUM AS OXIDES.
- SAMPLE TYPE: LIMESTONE Samples beginning 'RE' are duplicate samples.

DATE RECEIVED: JUL 25 1994 DATE REPORT MAILED: July 27/94 SIGNED BY [redacted] D.TOYE, C.LEONG, J.WANG; CERTIFIED B.C. ASSAYERS

* Sample from MAIM Permit 9396010038.

APPENDIX 3A: CONTINUED

Halferdahl & Associates Ltd. FILE # 94-2234 Page 2

SAMPLE#	SiO2 %	Al2O3 %	Fe2O3 %	MgO %	CaO %	Na2O %	K2O %	TiO2 %	P2O5 %	MnO %	Cr2O3 %	Ba ppm	Ni ppm	Sr ppm	Zr ppm	Y ppm	Nb ppm	Sc ppm	LOI %	SUM %
9707	.74	.24	.16	6.09	47.69	<.01	.13	.01	.02	.04	.004	6	<10	224	<10	<10	<10	<2	44.5	99.65
9708	.72	.25	.19	6.46	47.17	<.01	<.05	.01	.05	.01	<.002	8	<10	198	<10	<10	<10	<2	44.6	99.49
9709	.71	.20	.28	9.35	43.42	<.01	.15	<.01	.06	.05	.004	14	<10	147	<10	<10	<10	<2	45.4	99.65
9710	.61	.21	.29	10.29	42.49	<.01	.11	<.01	.05	.07	.004	16	<10	128	<10	<10	<10	<2	45.5	99.64
9711	.59	.22	.25	7.87	45.58	<.01	.13	.01	.04	.05	.006	19	22	173	<10	<10	<10	<2	45.0	99.77
9712	.56	.24	.15	6.49	47.75	<.01	.16	<.01	.05	.03	.003	7	<10	201	<10	<10	<10	<2	44.4	99.86
9713	.42	.21	<.05	1.08	54.62	<.01	.13	<.01	.02	.04	.003	8	13	163	<10	<10	<10	<2	43.3	99.85
9714	.42	.20	.34	4.59	50.16	<.01	.08	.01	.04	.10	.003	7	<10	176	<10	<10	<10	<2	44.1	100.07
RE 9714	.41	.18	.32	4.63	50.34	<.01	<.05	<.01	.03	.10	.009	7	<10	176	<10	<10	<10	<2	44.1	100.17
9715	.33	.16	<.05	.49	55.70	<.01	<.05	<.01	.04	.01	.004	6	14	229	<10	<10	<10	<2	43.1	99.87
9716	.33	.17	<.05	.41	55.77	.01	.08	<.01	<.01	.01	.010	<5	37	243	13	<10	<10	<2	43.1	99.93
9717	.31	.15	<.05	3.96	51.53	<.01	.14	.01	.04	.01	.004	<5	13	238	<10	<10	<10	<2	43.9	100.09
9718*	1.08	.17	.43	5.27	48.69	<.01	.07	<.01	.05	<.01	.014	<5	38	200	18	<10	<10	<2	44.3	100.11
9719*	.63	.18	<.05	11.99	41.66	<.01	<.05	<.01	.09	<.01	.004	<5	22	119	<10	<10	<10	<2	45.3	99.93
9720*	.70	.19	<.05	14.79	38.52	<.01	.12	.01	.07	<.01	.005	<5	23	118	10	<10	<10	<2	45.6	100.03
9721*	1.37	.35	<.05	22.17	30.58	<.01	.11	.02	.08	<.01	.005	7	<10	88	<10	<10	<10	<2	45.9	100.65
9722*	.43	.15	<.05	3.13	52.09	.02	<.05	.02	.05	<.01	.007	<5	26	253	<10	<10	<10	<2	43.9	99.87
9723*	.41	.13	.10	1.09	54.35	.01	.09	<.01	<.01	<.01	.002	<5	15	230	12	<10	<10	<2	43.8	100.02
9724*	1.70	.19	<.05	6.22	47.72	<.01	<.05	.03	.04	<.01	.005	<5	11	174	<10	<10	<10	<2	44.0	99.93
9725*	6.81	1.32	.70	6.49	43.25	.01	.54	.09	.05	.01	.006	80	16	290	22	<10	<10	<2	40.7	100.05
9726*	3.53	.72	.19	.71	52.60	.02	.20	.05	.05	.01	.008	19	23	326	<10	<10	<10	<2	41.9	100.05
9727*	7.81	1.67	.59	1.21	48.46	.03	.79	.05	.08	.02	.007	251	31	396	22	<10	<10	<2	39.2	100.01
9728*	.75	.21	<.05	.70	54.92	.01	<.05	<.01	<.01	<.01	.003	7	<10	275	<10	<10	<10	<2	43.4	100.06
9729*	.52	.17	<.05	22.68	30.70	<.01	<.05	<.01	.06	<.01	.004	<5	30	70	<10	<10	<10	<2	46.4	100.62
9730*	.39	.14	<.05	2.09	53.55	.01	<.05	.01	.01	<.01	.006	<5	28	242	<10	<10	<10	<2	43.7	99.94
9731*	.46	.16	<.05	9.44	44.29	<.01	.06	.01	.03	<.01	.005	6	30	172	<10	<10	<10	<2	45.0	99.51
9732*	2.29	.15	<.05	4.07	50.41	.01	.16	<.01	.04	<.01	.009	<5	33	321	<10	11	<10	<2	42.9	100.09
9733*	8.27	.16	.41	8.31	41.39	.01	<.05	<.01	.04	<.01	.085	5	132	189	<10	<10	<10	<2	41.0	99.72
9734*	4.36	.17	<.05	3.14	50.25	.02	<.05	<.01	.02	<.01	.009	<5	36	269	<10	<10	<10	<2	42.0	100.01
9735*	.42	.16	<.05	1.30	54.63	.02	<.05	.01	<.01	<.01	.005	<5	28	296	<10	<10	<10	<2	43.4	100.00
9736*	.34	.16	<.05	.62	55.31	.02	<.05	.01	.03	<.01	.007	<5	18	238	<10	<10	<10	<2	43.5	100.03
9737*	.29	.19	<.05	.66	55.54	.02	.12	<.01	.03	<.01	.008	<5	34	277	<10	11	<10	<2	43.1	100.00
9738*	.41	.18	<.05	.98	55.32	.02	<.05	<.01	.01	<.01	.006	<5	10	211	<10	<10	<10	<2	43.0	100.00
9739*	.28	.15	<.05	.58	55.64	.02	<.05	<.01	.02	<.01	.005	<5	21	286	<10	11	<10	<2	43.3	100.06
9740*	.29	.17	<.05	.49	55.78	.02	<.05	<.01	.02	<.01	.006	<5	11	256	<10	<10	<10	<2	43.1	99.91
STANDARD LIMESTONE	6.77	1.26	.52	.46	50.36	.02	.31	.06	.06	.02	.004	74	20	254	20	<10	<10	<2	39.9	99.79

Sample type: LIMESTONE. Samples beginning 'RE' are duplicate samples.

* Sample from MAIM Permit 9396010038.

Halferdahl & Associates Ltd. FILE # 94-2234 Page 3

SAMPLE#	SiO2 %	Al2O3 %	Fe2O3 %	MgO %	CaO %	Na2O %	K2O %	TiO2 %	P2O5 %	MnO %	Cr2O3 %	Ba ppm	Ni ppm	Sr ppm	Zr ppm	Y ppm	Nb ppm	Sc ppm	LOI %	SUM %
9741 *	.41	.18	<.05	.53	54.54	.04	.15	<.01	.02	<.01	.003	<5	23	269	11	<10	<10	<2	43.7	99.63
9742 *	.42	.15	<.05	.60	54.72	.02	<.05	.03	.04	<.01	.004	5	13	275	<10	<10	<10	<2	43.8	99.85
9751 *	.37	.12	<.05	.53	54.74	<.01	.13	.01	.03	<.01	<.002	<5	14	293	<10	<10	<10	<2	43.7	99.67
9752 *	.47	.15	<.05	.57	54.95	.01	<.05	.04	.03	<.01	.008	<5	30	309	<10	11	<10	<2	43.7	99.97
9753 *	.43	.13	<.05	.70	54.67	.02	<.05	.01	.02	<.01	.003	<5	13	264	<10	<10	<10	<2	43.9	99.97
9754 *	.86	.19	<.05	6.48	47.63	<.01	.21	<.01	.02	<.01	.004	<5	<10	197	<10	<10	<10	<2	44.6	100.02
9755 *	.36	.12	<.05	.50	55.06	.02	.08	.04	.03	<.01	.006	7	<10	261	<10	11	<10	<2	43.7	99.95
9756 *	.36	.14	<.05	.54	55.10	.01	<.05	.01	.01	<.01	.003	5	22	256	<10	12	<10	<2	43.7	99.91
RE 9756 *	.38	.14	<.05	.55	55.11	.02	<.05	<.01	.01	<.01	.003	<5	10	256	<10	12	<10	<2	43.7	100.00
9757 *	.48	.16	<.05	.94	54.53	.02	<.05	.02	.02	<.01	.003	8	19	246	<10	<10	<10	<2	43.8	100.01
9758	.36	.17	<.05	.54	55.42	<.01	<.05	.02	.01	<.01	.002	<5	<10	247	<10	<10	<10	<2	43.2	99.76
9759	.36	.18	<.05	1.19	54.35	<.01	.12	.03	.02	<.01	.002	5	18	238	<10	<10	<10	<2	43.6	99.89
9760	.34	.16	.08	5.10	49.60	<.01	<.05	.02	.05	.01	.003	1325	17	219	<10	<10	<10	<2	44.4	100.07
9761	.41	.13	.28	18.10	36.25	<.01	.21	.02	.06	.05	.005	37	<10	83	<10	<10	<10	<2	46.8	100.33
9762	.46	.19	.25	10.59	42.06	<.01	.22	.03	.05	.05	.004	97	15	136	<10	<10	<10	<2	45.9	99.84
9763	.56	.23	.21	8.96	44.41	<.01	.09	<.01	.06	.02	<.002	23	15	162	<10	<10	<10	<2	45.3	99.87
9764	1.21	.57	.14	4.03	50.07	<.01	<.05	.04	.04	<.01	.004	8	18	430	<10	<10	<10	<2	43.9	100.09
9765	2.00	.92	.29	3.61	49.77	<.01	.14	.05	.03	.01	.003	16	27	499	<10	<10	<10	<2	43.1	99.99
9766	1.11	.49	.22	4.51	49.54	<.01	.09	.01	.03	.05	<.002	13	28	399	<10	<10	<10	<2	44.0	100.10
9767	1.60	.73	.25	3.63	50.14	.01	.25	.03	.03	.01	<.002	21	<10	424	<10	<10	<10	<2	43.4	100.14
9768	.85	.35	.20	4.72	49.44	<.01	.23	.04	.02	.03	.004	18	40	304	<10	<10	<10	<2	44.2	100.13
9769	.80	.35	.20	5.39	48.78	<.01	.16	.01	.02	.02	.003	14	36	308	<10	<10	<10	<2	44.3	100.08
9770	1.24	.63	.20	3.74	50.36	.01	.24	.01	.03	<.01	.006	15	27	439	<10	<10	<10	<2	43.6	100.13
9771	.37	.14	<.05	1.00	54.67	<.01	<.05	.01	.03	<.01	.002	5	20	263	<10	<10	<10	<2	43.7	99.96
9772	.41	.16	<.05	2.59	52.75	.02	<.05	.01	<.01	<.01	.002	6	15	234	<10	<10	<10	<2	44.0	99.97
9773	.54	.15	<.05	2.48	52.61	.01	.23	<.01	<.01	<.01	<.002	7	23	234	<10	<10	<10	<2	44.0	100.06
9774	.73	.17	<.05	6.38	47.38	<.01	<.05	<.01	.08	<.01	.003	7	24	154	<10	<10	<10	<2	44.9	99.71
9775	.69	.15	<.05	5.01	49.90	<.01	<.05	.03	.03	<.01	<.002	<5	15	179	<10	<10	<10	<2	44.2	100.03
STANDARD LIMESTONE*	7.11	1.30	.57	.46	50.03	.02	.28	.07	.09	.02	.004	85	20	265	19	<10	<10	<2	39.9	99.91

Sample type: LIMESTONE. Samples beginning 'RE' are duplicate samples.

* Sample from MAIM Permit 9396010038.

APPENDIX 3B: ANALYTICAL REPORTS FOR CHECK ANALYSES BY ICP FROM THE CENTRAL ANALYTICAL LABORATORY OF CONTINENTAL LIME INC., FOR SAMPLES COLLECTED IN 1994°

Central Lab ICP Date of run 01-25-95

		Halferdahl & Associates Ltd. Stone									
	%	%	%	%	%	%	ppm	ppm	%	%	
Sample	CaCO3	CaO	MgCO3	MgO	Fe2O3	Al2O3	SrCO3	MnO	P2O5	SiO2	TOTAL
7781 *	96.26	53.93	3.18	1.52	0.055	0.055	399	19	<.010	0.32	99.90
7782 *	97.70	54.74	1.84	0.88	0.034	0.033	432	23	<.010	0.20	99.85
9009	96.90	54.29	2.11	1.01	0.050	0.058	443	32	0.208	0.17	99.55
9012	97.48	54.62	1.27	0.61	0.128	0.183	529	29	0.068	0.65	99.83
9015	96.18	53.89	1.59	0.76	0.206	0.325	510	33	0.106	1.13	99.59
9022	97.55	54.66	1.11	0.53	0.075	0.152	489	56	0.230	0.63	99.80
9274	98.18	55.01	0.66	0.32	0.131	0.139	400	36	0.184	0.30	99.64
9356 *	98.53	55.21	1.01	0.48	0.076	0.112	451	24	<.010	0.15	99.92
9357 *	98.51	55.20	0.91	0.44	0.030	0.022	397	23	<.010	0.26	99.78
9360	97.30	54.52	1.79	0.86	0.102	0.056	378	34	0.018	0.31	99.61
9369	96.70	54.18	2.51	1.20	0.037	0.037	439	20	<.010	0.46	99.79
9373 *	98.67	55.28	0.85	0.41	0.055	0.068	479	30	<.010	0.19	99.89
9406	98.72	55.31	0.59	0.28	0.044	0.067	390	38	0.136	0.16	99.76
9413	98.50	55.19	0.60	0.29	0.053	0.122	384	39	0.146	0.26	99.72
9430	94.49	52.94	1.58	0.75	0.412	0.671	566	67	0.117	2.37	99.70
9439	98.39	55.12	0.75	0.36	0.044	0.071	462	44	0.208	0.18	99.69
9447	98.08	54.95	0.88	0.42	0.060	0.062	528	61	0.336	0.14	99.61
9460	97.57	54.67	1.09	0.52	0.042	0.073	542	48	0.680	0.25	99.77
9473	98.11	54.97	0.56	0.27	0.036	0.046	488	40	0.840	0.13	99.78
9482	98.46	55.17	0.97	0.47	0.042	0.092	537	53	0.076	0.19	99.90
9489	88.00	49.30	9.42	4.50	0.257	0.520	473	58	0.267	1.34	99.86
9501	98.60	55.24	0.66	0.31	0.089	0.073	406	37	0.177	0.17	99.81
9513	98.44	55.15	0.76	0.36	0.068	0.121	306	56	0.170	0.13	99.72
9514	95.19	53.33	4.12	1.97	0.059	0.080	392	50	0.089	0.12	99.70
9526	98.97	55.45	0.58	0.28	0.050	0.080	421	39	0.088	0.14	99.95
9541	98.79	55.35	0.63	0.30	0.030	0.043	437	35	0.123	0.09	99.75
9546	97.97	54.89	1.20	0.57	0.037	0.104	470	34	0.121	0.27	99.76
9559	98.52	55.20	0.65	0.31	0.047	0.100	462	33	0.072	0.20	99.63
9571	96.51	54.07	2.93	1.40	0.039	0.086	411	26	0.102	0.19	99.90
9581	87.77	49.17	6.17	2.95	0.351	0.751	591	66	1.082	3.56	99.75
9591	73.36	41.11	3.98	1.90	1.145	1.588	648	185	0.345	19.05	99.55
9602	98.85	55.38	0.49	0.23	0.008	0.016	412	10	0.148	0.06	99.61
9606	98.80	55.36	0.56	0.27	0.041	0.068	481	29	0.236	0.11	99.86
9608	94.58	52.99	5.06	2.42	0.024	0.047	371	19	0.063	0.07	99.89
9611	98.91	55.42	0.47	0.23	0.030	0.045	293	18	0.151	0.12	99.76
9615	97.34	54.54	2.10	1.00	0.016	0.021	448	11	0.041	0.16	99.73

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* Sample from MAIM Permit 9396010038.

° As received by facsimile January 31, 1995.

APPENDIX 3B: CONTINUED

Central Lab ICP Date of run 01-25-95

		Halferdahl & Associates Ltd. Stone									
	%	%	%	%	%	%	ppm	ppm	%	%	
Sample	CaCO3	CaO	MgCO3	MgO	Fe2O3	Al2O3	SrCO3	MnO	P2O5	SiO2	TOTAL
9620	84.79	47.51	14.42	6.89	0.024	0.061	367	21	0.098	0.24	99.67
9636	97.50	54.63	1.99	0.95	0.022	0.054	363	25	0.083	0.11	99.79
9645	96.95	54.32	1.69	0.81	0.170	0.201	674	37	0.077	0.68	99.84
9646	97.02	54.36	2.02	0.97	0.066	0.079	474	19	0.101	0.36	99.70
9663	97.21	54.46	2.31	1.11	0.027	0.026	302	19	<.010	0.29	99.90
9669	94.66	53.04	4.57	2.18	0.045	0.090	383	29	<.010	0.48	99.90
9679	97.97	54.89	0.85	0.41	0.097	0.260	495	40	0.072	0.57	99.87
9680	98.69	55.30	0.75	0.36	0.027	0.051	451	31	0.057	0.16	99.79
9686	90.38	50.64	7.46	3.57	0.133	0.461	501	49	0.327	0.89	99.70
9689	97.43	54.59	1.74	0.83	0.050	0.121	534	39	0.079	0.28	99.75
9695	98.92	55.42	0.69	0.33	0.022	0.037	490	35	0.055	0.14	99.92
9732*	89.99	50.42	7.40	3.54	0.060	0.052	591	25	<.010	2.26	99.83
9737*	98.18	55.01	1.14	0.55	0.035	0.024	491	16	<.010	0.24	99.69
9739*	98.38	55.12	1.10	0.53	0.036	0.051	525	20	<.010	0.16	99.79
9752*	98.32	55.09	1.02	0.49	0.026	0.041	520	21	<.010	0.31	99.78
9756*	98.57	55.23	0.96	0.46	0.020	0.033	429	20	<.010	0.21	99.83
9757*	97.60	54.68	1.62	0.78	0.027	0.036	418	22	<.010	0.36	99.70
9780	98.38	55.12	0.77	0.37	0.037	0.067	486	28	0.262	0.22	99.79
9782	98.82	55.37	0.56	0.27	0.021	0.039	447	36	0.096	0.12	99.71

* Sample from MAIM Permit 9396010038.

APPENDIX 3C: ANALYTICAL REPORT FOR CHECK ANALYSES BY WET CHEMISTRY FROM LORING LABORATORIES LTD., FOR SAMPLES COLLECTED IN 1994

To: HALFERDAHL & ASSOCIATES LTD.,
18, 10509 - 81st Avenue,
Edmonton, Alberta T6E 1X7

ATTN: L.B. Halferdahl

File No. 36849
Date October 19, 1994
Samples Pulp

Certificate of Assay
LORING LABORATORIES LTD.

SAMPLE NO.	% CaO	% MgO	% LOI at 1050 °C	Acid Insol %	% R2O3
"Assay Analysis"					
9357*	52.22	0.43	43.87	0.37	0.12
9663	54.27	0.99	43.80	0.29	0.12
9669	53.21	1.79	43.75	0.48	0.17
9732*	50.22	3.32	43.12	2.12	0.21
9756*	55.16	0.41	43.77	0.20	0.14

I Hereby Certify that the above results are those assays made by me upon the herein described samples....

[redacted]
Assayer

Rejects retained one month.
Pulps retained one month unless specific arrangements are made in advance.

* Sample from MAIM Permit 9396010038.

APPENDIX 4A: ANALYTICAL REPORT FOR ICP ANALYSES FROM THE CENTRAL ANALYTICAL LABORATORY OF CONTINENTAL LIME INC., FOR SAMPLES COLLECTED IN 1995*

11/Misc/Stone/Halferdahl

Sample	%	%	%	%	%	%	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%
	CaCO3	CaO	MgCO3	MgO	SiO2	Al2O3	Fe2O3	SrCO3	MnO	P2O5	BaO	K2O	Na2O	TiO2	Total
10726	97.33	**54.53**	1.33	**0.64**	0.13	0.023	0.033	470	17	<70	6	78	163	8	98.92
10727	96.94	**54.32**	1.20	**0.57**	0.21	0.022	0.027	451	17	73	5	87	145	7	98.48
10728	96.89	**54.28**	1.27	**0.61**	0.27	0.034	0.034	486	14	75	4	154	164	15	98.59
10729	97.89	**54.85**	0.80	**0.38**	0.09	0.016	0.025	580	18	<70	6	60	113	7	98.91
10730	98.07	**54.94**	0.89	**0.42**	0.11	0.019	0.028	497	19	<70	4	58	167	7	99.19
10731	97.41	**54.58**	0.97	**0.46**	0.11	0.017	0.025	468	17	<70	5	78	186	7	98.60
10732	97.56	**54.66**	0.97	**0.47**	0.20	0.030	0.044	562	18	<70	5	124	172	14	98.89
10733	97.38	**54.56**	0.95	**0.45**	0.14	0.028	0.034	518	18	<70	6	104	168	12	98.61
10734	97.83	**54.81**	1.07	**0.51**	0.65	0.020	0.037	509	19	<70	5	86	161	9	99.69
10735	79.42	**44.50**	17.25	**8.25**	1.10	0.101	0.048	304	28	<70	10	447	206	66	98.02
10736	83.51	**46.79**	14.65	**7.00**	0.51	0.038	0.029	322	20	<70	6	166	173	24	98.81
10755	97.68	**54.73**	0.72	**0.34**	0.18	0.016	0.016	408	17	<70	5	79	126	5	98.67
10756	97.29	**54.51**	0.85	**0.41**	0.09	0.017	0.015	485	12	<70	5	74	136	6	98.34
10757	97.62	**54.69**	0.99	**0.47**	0.25	0.033	0.023	421	14	<70	5	142	182	12	99.00
10758	92.04	**51.57**	5.39	**2.58**	0.49	0.044	0.035	423	17	<70	6	183	165	24	98.09
10759	96.98	**54.34**	1.71	**0.82**	0.35	0.035	0.028	424	14	<70	7	158	159	18	99.18
10760	98.21	**55.03**	0.74	**0.35**	0.13	0.023	0.018	459	24	<70	7	86	139	9	99.19
10761	96.99	**54.34**	1.13	**0.54**	0.28	0.028	0.021	416	25	<70	7	127	158	14	98.52
10762	95.44	**53.47**	2.60	**1.24**	0.45	0.030	0.018	433	23	<70	7	134	179	13	98.61
10763	97.19	**54.45**	1.34	**0.64**	0.44	0.056	0.033	428	19	<70	6	199	206	28	99.15
10764	95.73	**53.64**	2.19	**1.05**	0.24	0.054	0.043	426	23	84	17	225	261	27	98.36
10765	97.48	**54.62**	1.14	**0.54**	0.23	0.030	0.022	418	17	92	7	138	286	15	99.00
10766	89.96	**50.41**	7.99	**3.82**	0.58	0.075	0.045	365	19	76	8	378	262	38	98.76
10767	85.92	**48.14**	12.11	**5.79**	0.47	0.063	0.050	342	17	95	8	332	218	32	98.72
10768	76.95	**43.12**	20.85	**9.96**	0.73	0.105	0.063	237	31	175	12	502	258	55	98.82
10769	95.95	**53.76**	2.30	**1.10**	0.64	0.040	0.029	481	12	<70	7	170	174	22	99.06
10770	98.10	**54.96**	0.82	**0.39**	0.12	0.019	0.026	502	17	<70	4	73	128	10	99.16
10771	97.78	**54.79**	0.92	**0.44**	0.10	0.017	0.034	521	16	<70	5	68	134	9	98.93
10772	97.35	**54.54**	0.99	**0.47**	0.10	0.020	0.020	485	19	<70	4	83	95	8	98.55
10773	88.20	**49.42**	10.01	**4.78**	0.38	0.058	0.087	365	32	<70	6	292	191	26	98.83
10774	96.27	**53.94**	1.80	**0.86**	0.24	0.052	0.050	431	22	<70	5	224	174	27	98.50
10775	95.82	**53.69**	2.27	**1.09**	0.30	0.030	0.035	445	20	<70	6	142	174	12	98.54

* As received by modem

APPENDIX 4B: ANALYTICAL REPORT FOR CHECK ANALYSES BY WHOLE ROCK ICP FROM ACME ANALYTICAL LABORATORIES LTD., FOR SAMPLES COLLECTED IN 1995

ACME ANALYTICAL LABORATORIES LTD. 852 E. HASTINGS ST. VANCOUVER BC V6A 1R6 PHONE(604)253-3158 FAX(604)253-1716

WHOLE ROCK ICP ANALYSIS

Halferdahl & Associates Ltd. File # 96-1049

18 - 10509 - 81st Ave, Edmonton AB T6E 1X7 Submitted by: I.B. Halferdahl

SAMPLE#	SiO2 %	Al2O3 %	Fe2O3 %	MgO %	CaO %	Na2O %	K2O %	TiO2 %	P2O5 %	MnO %	Cr2O3 %	Ba ppm	Ni ppm	Sr ppm	Zr ppm	Y ppm	Nb ppm	Sc ppm	LOI %	SUM %
10731	.12	.07	<.04	.48	56.19	.05	<.04	.01	<.01	<.01	<.001	6	<20	288	13	<10	<50	<10	43.5	100.51
10732	<.02	.08	.04	.48	56.00	.06	<.04	.01	.04	<.01	.002	7	<20	320	<10	18	<50	<10	43.7	100.48
RE 10732	.19	.11	.07	.48	55.66	.07	<.04	<.01	.03	<.01	.002	8	<20	321	18	19	<50	<10	43.7	100.39
10735	1.32	.15	.07	9.07	44.29	.06	.06	.01	.03	<.01	.001	13	<20	176	145	<10	<50	<10	45.0	100.11
10755	.11	.07	<.04	.33	55.21	.06	<.04	.02	<.01	<.01	<.001	6	<20	239	27	<10	<50	<10	43.8	99.69
10769	.68	.09	.04	1.11	54.91	.06	<.04	.02	.04	<.01	.001	10	<20	279	15	<10	<50	<10	43.7	100.72
10771	.02	.03	.06	.43	55.21	.05	<.04	<.01	.01	<.01	.004	<5	28	299	68	<10	<50	<10	43.8	99.69
STANDARD SO-15	49.62	12.70	7.16	7.51	5.69	2.42	1.91	1.64	2.76	1.39	1.034	2169	82	388	713	19	<50	10	5.9	100.26

.200 GRAM SAMPLES ARE FUSED WITH 1.2 GRAM OF LIBO2 AND ARE DISSOLVED IN 100 MLS 5% HNO3. Ba IS SUM AS BaSO4 AND OTHER METALS ARE SUM AS OXIDES.
- SAMPLE TYPE: PULP Samples beginning 'RE' are Reruns and 'RRE' are Reject Reruns.

DATE RECEIVED: MAR 19 1996 DATE REPORT MAILED: March 25/96 SIGNED BY [redacted] D.TOYE, C.LEONG, J.WANG; CERTIFIED B.C. ASSAYERS

APPENDIX 5A: ANALYTICAL REPORTS FOR ICP ANALYSES FROM THE QUALITY ASSURANCE LABORATORY OF CONTINENTAL LIME INC., FOR SAMPLES COLLECTED IN JULY 1997*

11/Misc/Stone/Halferdahl Nordeg

Sample	%	%	%	%	%	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%
	CaCO3	CaO	MgCO3	MgO	Fe2O3	Al2O3	SrCO3	MnO	SiO2	BaO	K2O	Na2O	P2O5	TiO2	Total
12216	71.33	39.96	27.67	13.23	0.097	0.111	231	43	0.60	40	446	200	339	64	99.94
12213	96.71	54.18	2.69	1.29	0.043	0.044	438	19	0.37	12	153	168	<70	18	99.94
12212	62.86	35.22	36.17	17.29	0.099	0.110	156	45	0.58	17	458	218	198	58	99.94
12217	98.32	55.09	1.16	0.56	0.034	0.044	529	16	0.29	14	103	135	<70	12	99.94
12214	98.29	55.07	1.01	0.49	0.043	0.039	517	14	0.49	13	113	118	<70	14	99.96
12215	95.59	53.56	3.93	1.88	0.047	0.053	388	20	0.29	10	184	133	74	21	99.99

* As received by modem

APPENDIX 5B: ANALYTICAL REPORTS FOR ICP ANALYSES FROM THE QUALITY ASSURANCE LABORATORY OF CONTINENTAL LIME INC., FOR SAMPLES COLLECTED IN SEPTEMBER 1997*

Sample	%	%	%	%	%	%	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%
	LOI	CaCO3	CaO	MgCO3	MgO	Fe2O3	Al2O3	SrCO3	MnO	SiO2	BaO	K2O	Na2O	P2O5	TiO2	Total
11551	44.03	87.29	48.91	11.30	5.40	0.079	0.071	374	29	1.03	72	268	137	<70	66	99.87
11552	43.46	97.91	54.86	1.55	0.74	0.044	0.042	482	27	0.27	16	135	131	<70	122	99.91
11553	43.72	98.57	55.23	0.95	0.46	0.059	0.059	440	27	0.23	16	209	140	<70	21	99.95
11554	43.55	98.35	55.10	0.93	0.44	0.067	0.098	432	23	0.39	25	330	128	<70	88	99.93
11555	43.73	98.49	55.18	1.02	0.49	0.038	0.051	468	18	0.29	15	190	142	85	28	99.98
11556	44.62	85.76	48.05	13.12	6.27	0.090	0.057	304	33	0.29	23	216	178	91	43	99.41
11557	44.88	81.47	45.65	17.45	8.34	0.100	0.094	309	25	0.55	18	416	184	<70	88	99.76
11558	44.45	87.59	49.08	11.07	5.29	0.076	0.072	377	19	0.46	17	254	150	157	43	99.37
11559	43.80	97.41	54.58	1.27	0.61	0.092	0.056	517	34	0.36	16	258	141	82	65	99.31
11560	43.79	98.33	55.09	1.16	0.55	0.071	0.044	540	23	0.25	10	178	145	<70	31	99.95
11561	43.76	98.71	55.31	1.00	0.48	0.059	0.021	498	21	0.13	12	61	144	<70	13	99.99
11562	43.76	98.20	55.02	0.97	0.46	0.041	0.024	453	18	0.09	11	61	141	<70	22	99.39
11563	43.82	98.51	55.19	1.02	0.49	0.046	0.031	463	19	0.13	20	84	145	<70	37	99.81
11564	43.84	98.49	55.19	1.03	0.49	0.050	0.026	470	25	0.22	11	84	174	98	28	99.91
11565	43.85	98.34	55.10	1.17	0.56	0.067	0.036	542	22	0.21	21	127	143	109	29	99.91
11566	43.40	97.60	54.68	1.51	0.72	0.115	0.067	558	41	0.56	16	326	103	<70	63	99.96
11567	43.75	98.61	55.25	1.05	0.50	0.063	0.030	520	27	0.13	15	101	113	<70	51	99.97
11568	43.69	98.57	55.23	0.94	0.45	0.065	0.026	524	23	0.13	16	62	129	<70	50	99.82
11569	43.56	98.55	55.22	0.95	0.46	0.063	0.034	533	29	0.25	12	130	126	<70	36	99.93
11570	43.79	98.13	54.98	1.04	0.50	0.119	0.037	455	24	0.12	10	95	129	<70	233	99.54
11571	43.74	98.77	55.34	0.95	0.45	0.055	0.031	458	22	0.11	13	65	131	96	46	99.99
11572	43.96	98.31	55.09	1.30	0.62	0.054	0.031	539	20	0.16	16	85	150	70	30	99.95
11573	44.04	97.98	54.90	1.12	0.54	0.051	0.032	568	20	0.19	14	97	134	129	40	99.48
11574	44.01	95.66	53.60	3.53	1.69	0.077	0.048	388	21	0.39	20	219	154	364	68	99.83
11575	44.02	97.87	54.84	1.70	0.81	0.045	0.033	407	21	0.22	11	115	131	289	41	99.97
11576	44.98	74.53	41.76	23.27	11.12	0.093	0.087	293	37	1.34	15	388	199	157	113	99.44
11577	44.35	93.84	52.58	5.23	2.50	0.050	0.053	422	27	0.43	17	269	158	122	35	99.70
11578	43.67	98.53	55.21	0.96	0.46	0.038	0.032	468	28	0.23	6	106	140	<70	9	99.87
11579	43.77	98.70	55.30	0.92	0.44	0.032	0.028	467	29	0.17	6	103	133	<70	9	99.92

* As received by modem.

APPENDIX 5B: CONTINUED

Sample	%	%	%	%	%	%	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%
	LOI	CaCO3	CaO	MgCO3	MgO	Fe2O3	Al2O3	SrCO3	MnO	SiO2	BaO	K2O	Na2O	P2O5	TiO2	Total
11580	42.72	96.14	53.87	1.62	0.77	0.569	0.184	549	45	1.17	22	1061	106	148	219	99.90
11581	43.68	98.40	55.13	0.89	0.43	0.052	0.038	660	28	0.30	10	140	145	<70	17	99.78
11582	44.39	83.60	46.84	14.59	6.98	0.105	0.116	353	48	0.70	16	490	139	73	50	99.23
11583	44.22	90.39	50.64	8.06	3.85	0.079	0.091	411	42	0.58	15	439	153	78	35	99.31
11584	43.99	94.08	52.71	3.89	1.86	0.046	0.051	402	25	0.31	47	218	140	<70	183	98.47
11585	43.96	97.28	54.51	1.49	0.71	0.118	0.037	498	18	0.15	12	106	141	166	147	99.19
11586	41.71	76.93	43.10	15.41	7.37	0.148	0.058	327	38	6.25	15	164	143	84	91	98.88
11587	43.66	98.49	55.19	1.06	0.51	0.032	0.029	528	16	0.20	10	66	121	88	185	99.92
11588	43.70	97.83	54.81	1.18	0.56	0.092	0.031	570	43	0.34	16	110	89	103	34	99.57
11589	44.65	84.99	47.62	13.85	6.62	0.112	0.136	386	48	0.30	14	196	155	109	46	99.48
11590	43.97	94.68	53.05	3.72	1.78	0.062	0.049	420	28	0.32	20	198	130	128	69	98.93
11591	43.96	98.07	54.95	1.09	0.52	0.033	0.027	494	19	0.14	12	76	136	77	23	99.44
11592	43.89	98.06	54.94	1.08	0.52	0.039	0.022	514	19	0.10	10	62	132	71	12	99.39
11593	43.79	97.91	54.86	1.22	0.58	0.087	0.033	594	42	0.24	18	113	123	<70	41	99.58
11594	43.86	98.10	54.97	1.15	0.55	0.072	0.029	546	29	0.21	15	87	137	75	30	99.65
11595	45.15	80.21	44.94	18.61	8.90	0.110	0.065	262	52	0.36	10	256	183	<70	84	99.44
11596	43.88	97.99	54.90	1.08	0.52	0.035	0.029	482	20	0.21	8	86	150	152	12	99.43
11597	44.68	83.44	46.75	14.56	6.96	0.064	0.071	347	27	0.61	20	246	130	137	36	98.84
11598	43.96	96.15	53.87	3.23	1.54	0.048	0.054	497	18	0.38	11	206	127	<70	26	99.95
11599	44.24	91.80	51.44	6.45	3.09	0.064	0.052	492	29	0.32	17	141	137	97	15	98.78
11600	44.37	93.07	52.15	5.13	2.45	0.043	0.036	458	26	0.17	16	116	154	<70	19	98.52
11601	43.88	97.95	54.88	1.15	0.55	0.042	0.029	419	21	0.27	9	86	148	106	30	99.52
11602	43.76	97.69	54.74	1.24	0.59	0.047	0.028	447	20	0.40	15	92	120	75	21	99.49
11603	43.83	91.19	51.09	6.15	2.94	0.061	0.057	401	23	1.20	18	217	121	204	27	98.75
11604	44.95	81.99	45.94	16.88	8.07	0.093	0.064	341	30	0.49	8	250	159	<70	75	99.61
11605	44.15	86.43	48.42	10.94	5.23	0.141	0.178	363	84	1.25	54	767	121	<70	75	99.08
11606	43.34	95.33	53.41	2.23	1.07	0.157	0.233	459	57	1.69	17	1110	113	<70	128	99.82
11607	42.94	93.35	52.31	3.54	1.69	0.224	0.369	449	95	2.17	14	1897	117	122	178	99.95
11608	43.21	96.14	53.87	1.53	0.73	0.122	0.251	490	61	1.72	20	1272	81	<70	106	99.96
11609	43.17	95.32	53.41	2.04	0.98	0.176	0.286	469	105	1.90	14	1458	83	78	128	99.95
11651	43.75	83.36	46.71	12.89	6.16	0.188	0.373	383	169	2.16	14	1697	149	<70	180	99.23
11652	43.42	91.37	51.19	5.87	2.80	0.174	0.324	449	188	1.88	13	1564	121	164	138	99.87

APPENDIX 5C: ANALYTICAL REPORT FOR CHECK ANALYSES BY WHOLE ROCK ICP FROM ACME ANALYTICAL LABORATORIES LTD., FOR SAMPLES COLLECTED IN 1997

ACME ANALYTICAL LABORATORIES LTD. 852 E. HASTINGS ST. VANCOUVER BC V6A 1R6 PHONE(640)253-3158 FAX(604)253-1716

WHOLE ROCK ICP ANALYSIS

Halferdahl & Associates Ltd. PROJECT LOT 1 File # 9800585

18 - 10509 - 81st Ave, Edmonton AB T6E 1X7 - Submitted by: L.B. Halferdahl

SAMPLE#	SiO2 %	Al2O3 %	Fe2O3 %	MgO %	CaO %	Na2O %	K2O %	TiO2 %	P2O5 %	MnO %	Cr2O3 %	Ba ppm	Ni ppm	Sr ppm	Zr ppm	Y ppm	Nb ppm	Sc ppm	LOI %	C/TOT %	S/TOT %	SUM %
11561	.07	.05	<.04	.51	55.57	.06	<.04	.01	<.01	<.01	.002	16	<20	280	<10	<10	<10	<10	43.6	11.55	<.01	99.96
11571	.09	.05	<.04	.48	55.39	.05	<.04	.01	<.01	<.01	.002	6	<20	256	<10	16	<10	<10	43.7	11.53	.02	99.85
11576	1.30	.12	.10	11.34	41.94	.09	<.04	.01	.02	<.01	.002	5	<20	165	<10	<10	<10	<10	45.0	12.01	.03	99.98
RE 11576	1.21	.11	.10	11.12	42.02	.08	.04	.01	.01	<.01	.001	6	<20	165	<10	<10	<10	<10	45.2	12.01	.05	99.93
11579	.11	.06	<.04	.46	55.51	.06	<.04	.01	<.01	<.01	.001	45	<20	265	<10	<10	<10	<10	43.7	11.92	.03	99.98
11584	.27	.09	.07	1.89	53.49	.08	<.04	.01	<.01	<.01	.003	8	<20	219	<10	<10	<10	<10	44.0	11.81	.02	99.94
11586	7.80	.09	.14	7.13	42.66	.05	<.04	.02	.10	<.01	.004	22	<20	181	149	<10	<10	<10	41.9	10.72	.02	99.97
11600	.14	.06	.07	2.45	52.94	.06	<.04	<.01	<.01	<.01	.003	8	<20	264	<10	<10	<10	<10	44.2	11.85	.01	99.97
11603	1.24	.08	.05	2.96	51.61	.04	<.04	.02	.03	<.01	.002	8	<20	229	19	<10	<10	<10	43.9	11.75	.07	99.98

.200 GRAM SAMPLES ARE FUSED WITH 1.5 GRAM OF LIBO2 AND ARE DISSOLVED IN 100 MLS 5% HNO3. OTHER METALS ARE SUM AS OXIDES.
TOTAL C & S BY LECO (NOT INCLUDED IN THE SUM).
- SAMPLE TYPE: PULP Samples beginning 'RE' are Reruns and 'RRE' are Reject Reruns.

DATE RECEIVED: FEB 24 1998 DATE REPORT MAILED: Mar 5/98 SIGNED BY. [redacted] D. TOYE, C.LEONG, J. WANG; CERTIFIED B.C. ASSAYERS

Data FA ___

APPENDIX 6: ANALYTICAL PROCEDURES IN THE QUALITY ASSURANCE LABORATORY OF CONTINENTAL LIME INC.

Fusions Method For ICP Analysis

Lithium metaborate, which melts at 845° C, is used for sample dissolution. Lithium metaborate is well suited for attacking and dissolving acidic oxides. The procedure for fusion with lithium metaborate is as follows:

1. Weigh a 0.5 g sample of powdered rock, pulverized to minus 100 mesh, into a graphite crucible of approximately 30 ml capacity. Graphite crucibles must be manufactured from high-purity graphite, and they have a limited lifetime.

2. Add anhydrous lithium metaborate to the crucible and mix the contents well. The ratio of flux to sample should be 4:1. If resistant minerals such as zircon are present, a larger ratio must be used for a successful attack.

3. Fuse the mixture in a muffle furnace at 900° C for 15 minutes. Remove the crucible and swirl the contents. Replace the crucible in the muffle furnace for an additional 15 minutes at 900° C.

*
*

4. Remove the crucible from the muffle furnace and allow the fusion to cool to room temperature. Leave any graphite dust in the crucible. Immerse the crucible in a solution of 165 ml of water and 10 ml of concentrated nitric acid. An internal standard, cobalt, is added at this point. The solids will dissolve in 1-2 hrs.

The following analytical lines are used for ICP analysis:

P	213.618	Ti	334.941
Si	251.611	Al	396.152
Mn	257.610	Sr	407.771
Fe	259.940	Ba	455.403
Mg	280.270	Na	589.592
Ca	317.933	K	766.491

APPENDIX 7: TWO-TAILED STUDENTS *t*-TEST FOR DIFFERENCES, SIGN TEST, AND TEST OF CONFIDENCE INTERVALS FOR CONSTITUENT DETERMINATIONS OF SAMPLES COLLECTED FROM METALLIC AND INDUSTRIAL MINERALS PERMIT 9396010038

Notes: **CONT:** Analysis by the Central laboratory of Continental Lime Inc.

LOR: Analysis by Loring Laboratories Ltd.

ACME: Analysis by Acme Analytical Laboratories Ltd.

Adjusted CaO: Adjusted CaO analyses (Appendicies 8A, 8B, and 8C).

DEV: deviation (**d = D-dx**)

DIFF: difference (**D** = Constituent Determination$_{Lab1}$ - Constituent Determination$_{Lab2}$)

SD: squared deviation (d^2)

n: number of samples

d.o.f: degrees of freedom [**n-1**]

d_x: mean of differences in constituent

t_α: two-tailed

TWO-TAILED STUDENTS *t*-TEST OF DIFFERENCES (Snedecor, 1957)

For the test of differences determinations of the same sample from two laboratories are paired and their differences comprise the sample data for which the following hypothesis may be tested:

Ho: Constituent Determination$_{LAB1}$ - Constituent Determination$_{LAB2}$ = 0

Ha: Constituent Determination$_{LAB1}$ - Constituent Determination$_{LAB2}$ ≠ 0

The measured variation in the population of sample differences is given by

S_D2: variance of differences in constituent [Σd^2 / **d.o.f.**]

S_D: standard deviation of differences in constituent [$(S_D2)^{½}$]

and measured variation in sample differences is given by

S_d2: sample variance of differences in constituent [S_D2 / **n**]

S_d: sample standard deviation of differences in constituent [$(S_d2)^{½}$]

The students *t*-Test is used to test the hypothesis regarding sample differences.

t: test statistic [$(d_x-\mu$ / $s_d)$]

TWO-TAILED SIGN TEST (Mendenhall et al., 1990)

For the sign test the determinations of the same sample from two laboratories are paired and the sign of the differences comprise the sample data, with **M** equal to the number of positive differences. The hypothesis that both samples are derived from the same probability distribution with the same position is tested against the alternative that the distributions differ in position. Under the null hypothesis the probability that the sign of the differences is + or - is ½, and

APPENDIX 7: CONTINUED

M: number of positive differences

Ho: $P(\text{Constituent Determination}_{LAB1} > \text{Constituent Determination}_{LAB2}) = ½$

Ha: $P(\text{Constituent Determination}_{LAB1} > \text{Constituent Determination}_{LAB2}) \neq ½$

If both samples are derived from the same probability distribution then **M** will be binomially distributed with **p = ½** and the level of significance α associated with the rejection region is determined by

y: number of samples required to raise α to the required level of significance

p(x): binomial probability $[(n! / ((n-x)!(x)!))\ 0.5^{x}0.5^{n-x}]$

α: two-tailed level of significance $[p(0) + ... + p(0+y) + p(n-y) + ... + p(n)]$

RR: rejection region $[(0 \leq M \leq y,\ n-y \leq M \leq n)]$

TWO-TAILED STUDENTS *t*-TEST OF CONFIDENCE INTERVALS (Koch and Link, 1970)

For the test of confidence intervals the determinations of the same sample from two laboratories are paired and their differences comprise the sample data for which the following hypothesis may be tested:

Ho: $\text{Constituent Determination}_{LAB1} - \text{Constituent Determination}_{LAB2} = 0$

Ha: $\text{Constituent Determination}_{LAB1} - \text{Constituent Determination}_{LAB2} \neq 0$

If confidence intervals constructed about the mean difference exclude 0 then the null hypothesis is rejected.

Σ **w**: sum of observations

$\Sigma\ w_{DIFFERENCE}$: difference of the sum of observations $[\Sigma\ w_{LAB1} - \Sigma\ w_{LAB2}]$

$(\Sigma\ w_{DIFFERENCE})^2$: squared difference of the sum of observations $[(\Sigma\ w_{LAB1} - \Sigma\ w_{LAB1})^2]$

$(\Sigma\ w_{DIFFERENCE})^2 / n$: mean squared difference

SS: sum of squared deviations from the sample mean

s^2: sample variance [SS / d.o.f]

s: sample standard deviation $[(s^2)^{½}$ or $SS^{½}]$

$s / n^{½}$: standard deviation of sample means

$t(s / n^{½})$: test statistic at α level of significance $[(s / n½) \bullet (t_{\alpha})]$

μ_L: lower confidence limit $[d_x - t(s / n^{½})]$

μ_U: upper confidence limit $[d_x + t(s / n^{½})]$

APPENDIX 7A: TWO-TAILED STUDENTS *t*-TEST FOR DIFFERENCES, SIGN TEST, AND TEST OF CONFIDENCE INTERVALS FOR CONSTITUENT DETERMINATIONS OF SAMPLES COLLECTED IN 1994

CaO [ACME - LORING]

Sample	CaO (%)		Test of Differences and Confidence Intervals			Sign Test
	ACME	LOR	DIFF (D)	DEV (d)	SD (d^2)	Sign of DIFF
9357	55.32	55.22	0.10	0.02	0.00	+
9732	50.41	50.22	0.19	0.11	0.01	+
9756	55.10	55.16	-0.06	-0.14	0.02	-
Total (Σ w)	160.83	160.60	ΣW_{DIFF} =	0.23	0.00	SS = 0.03	M = 2
Mean (μ)	53.61	53.53	d_x =	0.08		S_D^2 = 0.02	
n =	3		d.o.f =	2			

TEST OF DIFFERENCES

S_D =	0.13	t =	1.049	tα = 0.100 =	2.920	Accept Ho:
S_{d2} =	0.01			tα = 0.050 =	4.303	Accept Ho:
S_d =	0.07			tα = 0.025 =	6.205	Accept Ho:

SIGN TEST

α = p(0)+p(1)+p(2)+P(3)	RR = (0,1,2,3)	α =	0.688	Reject Ho:
α = p(0)+p(3)	RR = (0,3)	α =	0.313	Accept Ho:

TEST OF CONFIDENCE INTERVALS

$(\Sigma w_{DIFF})^2$ =	0.05	$(\Sigma w_{DIFF})^2 / n$ =	0.02	SS =	0.03
s^2 = SS/d.o.f =	0.02	$s = (s^2)^{1/2}$ =	0.13	$s / n^{1/2}$ =	0.07

$t(s/n^{1/2})\alpha$ = 0.100 =	0.213	μL =	-0.137	μU =	0.290	Accept Ho:
$t(s/n^{1/2})\alpha$ = 0.050 =	0.315	μL =	-0.238	μU =	0.391	Accept Ho:
$t(s/n^{1/2})\alpha$ = 0.025 =	0.454	μL =	-0.377	μU =	0.530	Accept Ho:

Differences

Range of differences:	Max =	0.19	Min =	-0.06
μ of differences:	μ =	0.08		

APPENDIX 7A: CONTINUED

Adjusted CaO [$ACME_{ADJUSTED}$ - LORING]

Sample	CaO (%)		Test of Differences and Confidence Intervals			Sign Test
	ACME	LOR	DIFF (D)	DEV (d)	SD (d^2)	Sign of DIFF
9357	55.05	55.22	-0.17	-0.25	0.06	-
9732	50.41	50.22	0.19	0.11	0.01	+
9756	54.94	55.16	-0.22	-0.30	0.09	-
Total (Σ w)	160.40	160.60	ΣW_{DIFF} =	-0.20	-0.43	SS = 0.16	M = 1
Mean (μ)	53.47	53.53	d_x =	-0.07		S_D^2 = 0.08	
n =	3		d.o.f =	2			

TEST OF DIFFERENCES

S_D =	0.28	t = -0.406	tα = 0.100 =	2.920	Accept Ho:
S_{d2} =	0.03		tα = 0.050 =	4.303	Accept Ho:
S_d =	0.16		tα = 0.025 =	6.205	Accept Ho:

SIGN TEST

α = p(0)+p(1)+p(2)+P(3)	RR = (0,1,2,3)	α = 0.688	Reject Ho:
α = p(0)+p(3)	RR = (0,3)	α = 0.313	Accept Ho:

TEST OF CONFIDENCE INTERVALS

$(\Sigma w_{DIFF})^2$ =	0.04	$(\Sigma w_{DIFF})^2 / n$ =	0.01	SS =	0.16
s^2 = SS/d.o.f =	0.08	$s = (s^2)^{1/2}$ =	0.28	$s / n^{1/2}$ =	0.16

$t(s/n^{1/2})\alpha$ = 0.100 =	0.479	μL =	-0.546	μU =	0.413	Accept Ho:
$t(s/n^{1/2})\alpha$ = 0.050 =	0.706	μL =	-0.773	μU =	0.640	Accept Ho:
$t(s/n^{1/2})\alpha$ = 0.025 =	1.019	μL =	-1.085	μU =	0.952	Accept Ho:

Differences

Range of differences:	Max =	0.19	Min =	-0.22
μ of differences:	μ =	-0.07		

APPENDIX 7A: CONTINUED

CaO [ACME - CONTINENTAL]

Sample	CaO (%) ACME	CONT	Test of Differences and Confidence Intervals DIFF (D)	DEV (d)	SD (d^2)	Sign Test Sign of DIFF
7781	53.52	53.93	-0.41	-0.39	0.15	-
7782	54.49	54.74	-0.25	-0.23	0.05	-
9356	55.24	55.21	0.03	0.05	0.00	+
9357	55.32	55.20	0.12	0.14	0.02	+
9373	54.93	55.28	-0.35	-0.33	0.11	-
9732	50.41	50.42	-0.01	0.01	0.00	-
9737	55.54	55.01	0.53	0.55	0.30	+
9739	55.64	55.12	0.52	0.54	0.29	+
9752	54.95	55.09	-0.14	-0.12	0.01	-
9756	55.10	55.23	-0.13	-0.11	0.01	-
9757	54.53	54.68	-0.15	-0.13	0.02	-
Total (Σ w)	599.67	599.91	ΣW_{DIFF} =	-0.24	0.00	SS = 0.97	M = 4
Mean (μ)	54.52	54.54	d_x =	-0.02		S_D^2 = 0.10	
n =	11		d.o.f =	10			

TEST OF DIFFERENCES

S_D =	0.31	t =	-0.232	tα = 0.100 = 1.812	Accept Ho:
S_{d2} =	0.01			tα = 0.050 = 2.228	Accept Ho:
S_d =	0.09			tα = 0.025 = 2.634	Accept Ho:

SIGN TEST

α = p(0)+...+p(4)+p(7)+...+P(11)	RR = (0..4,7..11)	α = 0.387	Reject Ho:
α = p(0)+...+p(3)+p(8)+...+P(11)	RR = (0..3,8..11)	α = 0.194	Accept Ho:
α = p(0)+...+p(2)+p(9)+...+P(11)	RR = (0..2,9..11)	α = 0.073	Accept Ho:

TEST OF CONFIDENCE INTERVALS

$(\Sigma w_{DIFF})^2$ =	0.06	$(\Sigma w_{DIFF})^2 / n$ =	0.01	SS =	0.97
$s^2 = SS/d.o.f$ =	0.10	$s = (s^2)^{1/2}$ =	0.31	$s / n^{1/2}$ =	0.09

$t(s/n^{1/2})\alpha = 0.100$ =	0.171	μL =	-0.192	μU =	0.149	Accept Ho:
$t(s/n^{1/2})\alpha = 0.050$ =	0.210	μL =	-0.231	μU =	0.188	Accept Ho:
$t(s/n^{1/2})\alpha = 0.025$ =	0.248	μL =	-0.270	μU =	0.226	Accept Ho:

Differences

Range of differences:	Max =	0.53	Min =	-0.41
μ of differences:	μ =	-0.02		

APPENDIX 7A: CONTINUED

Adjusted CaO [$ACME_{ADJUSTED}$ - CONTINENTAL]

Sample	CaO (%) ACME	CaO (%) CONT	Test of Differences and Confidence Intervals DIFF (D)	DEV (d)	SD (d^2)	Sign Test Sign of DIFF
7781	53.52	53.93	-0.41	-0.19	0.04	-
7782	54.49	54.74	-0.25	-0.03	0.00	-
9356	55.24	55.21	0.03	0.25	0.06	+
9357	55.05	55.20	-0.15	0.07	0.01	-
9373	54.93	55.28	-0.35	-0.13	0.02	-
9732	50.41	50.42	-0.01	0.21	0.04	-
9737	54.66	55.01	-0.35	-0.13	0.02	-
9739	54.87	55.12	-0.25	-0.03	0.00	-
9752	54.83	55.09	-0.26	-0.04	0.00	-
9756	54.94	55.23	-0.29	-0.07	0.00	-
9757	54.53	54.68	-0.15	0.07	0.01	-
Total (Σ w)	597.47	599.91	ΣW_{DIFF} = -2.44	0.00	SS = 0.19	M = 1
Mean (μ)	54.32	54.54	d_x = -0.22		S_D^2 = 0.02	
n =	11		d.o.f = 10			

TEST OF DIFFERENCES

S_D =	0.14	t = -5.274	tα = 0.100 =	1.812	Reject Ho:
S_{d2} =	0.00		tα = 0.050 =	2.228	Reject Ho:
S_d =	0.04		tα = 0.025 =	2.634	Reject Ho:

SIGN TEST

α = p(0)+...+p(4)+p(7)+...+P(11)	RR = (0..4,7..11)	α = 0.387	Reject Ho:
α = p(0)+...+p(3)+p(8)+...+P(11)	RR = (0..3,8..11)	α = 0.194	Reject Ho:
α = p(0)+...+p(2)+p(9)+...+P(11)	RR = (0..2,9..11)	α = 0.073	Reject Ho:

TEST OF CONFIDENCE INTERVALS

$(\Sigma w_{DIFF})^2$ =	5.95	$(\Sigma w_{DIFF})^2 / n$ =	0.54	SS =	0.19
$s^2 = SS/d.o.f$ =	0.02	$s = (s^2)^{½}$ =	0.14	$s / n^{½}$ =	0.04

$t(s/n^{½})\alpha = 0.100$ =	0.076	μL =	-0.298	μU =	-0.146	Reject Ho:
$t(s/n^{½})\alpha = 0.050$ =	0.094	μL =	-0.316	μU =	-0.128	Reject Ho:
$t(s/n^{½})\alpha = 0.025$ =	0.111	μL =	-0.333	μU =	-0.111	Reject Ho:

Differences

Range of differences:	Max =	0.03	Min =	-0.41
μ of differences:	μ =	-0.22		

APPENDIX 7A: CONTINUED

MgO [ACME - LORING]

Sample	MgO (%) ACME	MgO (%) LOR	Test of Differences and Confidence Intervals DIFF (D)	DEV (d)	SD (d^2)	Sign Test Sign of DIFF
9357	0.45	0.43	0.02	-0.28	0.08	+
9732	4.07	3.32	0.75	0.45	0.20	+
9756	0.55	0.41	0.14	-0.16	0.03	+
Total (Σ w)	5.07	4.16	ΣW_{DIFF} = 0.91	0.00	SS = 0.31	M = 3
Mean (μ)	1.69	1.39	d_x = 0.30		S_D^2 = 0.15	
n =	3		d.o.f = 2			

TEST OF DIFFERENCES

S_D =	0.39	t = 1.342	tα = 0.100 =	2.920	Accept Ho:
S_{d2} =	0.05		tα = 0.050 =	4.303	Accept Ho:
S_d =	0.23		tα = 0.025 =	6.205	Accept Ho:

SIGN TEST

α = p(0)+p(1)+p(2)+P(3)	RR = (0,1,2,3)	α =	0.688	Reject Ho:
α = p(0)+p(3)	RR = (0,3)	α =	0.313	Reject Ho:

TEST OF CONFIDENCE INTERVALS

$(\Sigma w_{DIFF})^2$ =	0.83	$(\Sigma w_{DIFF})^2 / n$ =	0.28	SS =	0.31	
s^2 = SS/d.o.f =	0.15	$s = (s^2)^{1/2}$ =	0.39	$s / n^{1/2}$ =	0.23	
$t(s/n^{1/2})\alpha$ = 0.100 =	0.660	μL = -0.357	μU = 0.963			Accept Ho:
$t(s/n^{1/2})\alpha$ = 0.050 =	0.972	μL = -0.669	μU = 1.276			Accept Ho:
$t(s/n^{1/2})\alpha$ = 0.025 =	1.402	μL = -1.099	μU = 1.706			Accept Ho:

Differences

Range of differences: Max = 0.75 Min = 0.02

μ of differences: μ = 0.30

APPENDIX 7A: CONTINUED

MgO [ACME - CONTINENTAL]

Sample	MgO (%)		Test of Differences and Confidence Intervals			Sign Test
	ACME	CONT	DIFF (D)	DEV (d)	SD (d^2)	Sign of DIFF
7781	1.59	1.52	0.07	-0.04	0.00	+
7782	0.90	0.88	0.02	-0.09	0.01	+
9356	0.49	0.48	0.01	-0.10	0.01	+
9357	0.45	0.44	0.01	-0.10	0.01	+
9373	0.46	0.41	0.05	-0.06	0.00	+
9732	4.07	3.54	0.53	0.42	0.18	+
9737	0.66	0.55	0.11	0.00	0.00	+
9739	0.58	0.53	0.05	-0.06	0.00	+
9752	0.57	0.49	0.08	-0.03	0.00	+
9756	0.55	0.46	0.09	-0.02	0.00	+
9757	0.94	0.78	0.16	0.05	0.00	+
Total (Σ w)	11.26	10.08	ΣW_{DIFF} = 1.18	0.00	SS = 0.22	M = 11
Mean (μ)	1.02	0.92	d_x = 0.11		S_D^2 = 0.02	
n =	11		d.o.f = 10			

TEST OF DIFFERENCES

S_D =	0.15	t =	2.415	tα = 0.100 =	1.812	Reject Ho:
S_{d2} =	0.00			tα = 0.050 =	2.228	Reject Ho:
S_d =	0.04			tα = 0.025 =	2.634	Accept Ho:

SIGN TEST

α = p(0)+...+p(4)+p(7)+...+P(11)	RR = (0..4,7..11)	α = 0.387	Reject Ho:
α = p(0)+...+p(3)+p(8)+...+P(11)	RR = (0..3,8..11)	α = 0.194	Reject Ho:
α = p(0)+...+p(2)+p(9)+...+P(11)	RR = (0..2,9..11)	α = 0.073	Reject Ho:

TEST OF CONFIDENCE INTERVALS

$(\Sigma w_{DIFF})^2$ =	1.39	$(\Sigma w_{DIFF})^2 / n$ =	0.13	SS =	0.22	
$s^2 = SS/d.o.f$ =	0.02	$s = (s^2)^{1/2}$ =	0.15	$s / n^{1/2}$ =	0.04	
$t(s/n^{1/2})\alpha = 0.100$ =	0.081	μL =	0.027	μU =	0.188	Reject Ho:
$t(s/n^{1/2})\alpha = 0.050$ =	0.099	μL =	0.008	μU =	0.206	Reject Ho:
$t(s/n^{1/2})\alpha = 0.025$ =	0.117	μL =	-0.010	μU =	0.224	Accept Ho:

Differences

Range of differences:	Max =	0.53	Min =	0.01
μ of differences:	μ =	0.11		

APPENDIX 7A: CONTINUED

SiO_2 [ACME - LORING*]

Sample	SiO_2 (%) ACME	LOR	Test of Differences and Confidence Intervals DIFF (D)	DEV (d)	SD (d^2)	Sign Test Sign of DIFF
9357	0.31	0.37	-0.06	-0.15	0.02	-
9732	2.29	2.12	0.17	0.08	0.01	+
9756	0.37	0.20	0.17	0.08	0.01	+
Total (Σ w)	2.97	2.69	ΣW_{DIFF} = 0.28	0.00	SS = 0.04	M = 2
Mean (μ)	0.99	0.90	d_x = 0.09		S_D^2 = 0.02	
n =	3		d.o.f = 2			

TEST OF DIFFERENCES

S_D =	0.13	t = 1.217	$t\alpha = 0.100$ =	2.920	Accept Ho:
S_{d2} =	0.01		$t\alpha = 0.050$ =	4.303	Accept Ho:
S_d =	0.08		$t\alpha = 0.025$ =	6.205	Accept Ho:

SIGN TEST

α = p(0)+p(1)+p(2)+P(3)	RR = (0,1,2,3)	α = 0.688	Reject Ho:
α = p(0)+p(3)	RR = (0,3)	α = 0.313	Accept Ho:

TEST OF CONFIDENCE INTERVALS

$(\Sigma w_{DIFF})^2$ =	0.08	$(\Sigma w_{DIFF})^2 / n$ =	0.03	SS =	0.04
s^2 = SS/d.o.f =	0.02	$s = (s^2)^{1/2}$ =	0.13	$s / n^{1/2}$ =	0.08

$t(s/n^{1/2})\alpha = 0.100$ =	0.224	μL =	-0.131	μU =	0.317	Accept Ho:
$t(s/n^{1/2})\alpha = 0.050$ =	0.330	μL =	-0.237	μU =	0.423	Accept Ho:
$t(s/n^{1/2})\alpha = 0.025$ =	0.476	μL =	-0.382	μU =	0.569	Accept Ho:

Differences

Range of differences:	Max =	0.17	Min =	-0.06
μ of differences:	μ =	0.09		

* Acid Insolubles (Appendix 1C)

APPENDIX 7A: CONTINUED

SiO_2 [ACME - CONTINENTAL]

Sample	SiO_2 (%)		Test of Differences and Confidence Intervals			Sign Test
	ACME	CONT	DIFF (D)	DEV (d)	SD (d^2)	Sign of DIFF
7781	0.40	0.32	0.08	0.00	0.00	+
7782	0.25	0.20	0.05	-0.03	0.00	+
9356	0.20	0.15	0.05	-0.03	0.00	+
9357	0.31	0.26	0.05	-0.03	0.00	+
9373	0.20	0.19	0.01	-0.07	0.00	+
9732	2.29	2.26	0.03	-0.05	0.00	+
9737	0.29	0.24	0.05	-0.03	0.00	+
9739	0.28	0.16	0.12	0.04	0.00	+
9752	0.47	0.31	0.16	0.08	0.01	+
9756	0.37	0.21	0.16	0.08	0.01	+
9757	0.48	0.36	0.12	0.04	0.00	+
Total (Σ w)	5.54	4.66	ΣW_{DIFF} = 0.88	0.00	SS = 0.03	M = 11
Mean (μ)	0.50	0.42	d_x = 0.08		S_D^2 = 0.00	
n =	11		d.o.f = 10			

TEST OF DIFFERENCES

S_D =	0.05	t = 5.106	tα = 0.100 =	1.812	Reject Ho:
S_{d2} =	0.00		tα = 0.050 =	2.228	Reject Ho:
S_d =	0.02		tα = 0.025 =	2.634	Reject Ho:

SIGN TEST

α = p(0)+...+p(4)+p(7)+...+P(11)	RR = (0..4,7..11)	α = 0.387	Reject Ho:
α = p(0)+...+p(3)+p(8)+...+P(11)	RR = (0..3,8..11)	α = 0.194	Reject Ho:
α = p(0)+...+p(2)+p(9)+...+P(11)	RR = (0..2,9..11)	α = 0.073	Reject Ho:

TEST OF CONFIDENCE INTERVALS

$(\Sigma w_{DIFF})^2$ =	0.77	$(\Sigma w_{DIFF})^2 / n$ =	0.07	SS =	0.03
s^2 = SS/d.o.f =	0.00	$s = (s^2)^{1/2}$ =	0.05	$s / n^{1/2}$ =	0.02

$t(s/n^{1/2})\alpha$ = 0.100 =	0.028	μL =	0.052	μU =	0.108	Reject Ho:
$t(s/n^{1/2})\alpha$ = 0.050 =	0.035	μL =	0.045	μU =	0.115	Reject Ho:
$t(s/n^{1/2})\alpha$ = 0.025 =	0.041	μL =	0.039	μU =	0.121	Reject Ho:

Differences

Range of differences:	Max =	0.16	Min =	0.01
μ of differences:	μ =	0.08		

APPENDIX 7B: TWO-TAILED STUDENTS *t*-TEST FOR DIFFERENCES, SIGN TEST, AND TEST OF CONFIDENCE INTERVALS FOR CONSTITUENT DETERMINATIONS OF SAMPLES COLLECTED IN 1995

CaO [CONTINENTAL - ACME]

Sample	CaO (%)		Test of Differences and Confidence Intervals			Sign Test
	CONT	ACME	DIFF (D)	DEV (d)	SD (d^2)	Sign of DIFF
10731	54.58	56.19	-1.61	-0.84	0.71	-
10732	54.66	55.83	-1.17	-0.40	0.16	-
10735	44.50	44.29	0.21	0.98	0.96	+
10755	54.73	55.21	-0.48	0.29	0.08	-
10769	53.76	54.91	-1.15	-0.38	0.14	-
10771	54.79	55.21	-0.42	0.35	0.12	-
Total (Σ w)	317.01	321.64	ΣW_{DIFF} =	-4.63	0.00	SS = 2.17	M = 1
Mean (μ)	52.83	53.61	d_x =	-0.77		S_D^2 = 0.43	
n =	6		d.o.f =	5			

TEST OF DIFFERENCES

S_D =	0.66	t =	-2.867	tα = 0.100 = 2.015	Reject Ho:
S_{d^2} =	0.07			tα = 0.050 = 2.571	Reject Ho:
S_d =	0.27			tα = 0.025 = 3.163	Accept Ho:

SIGN TEST

α = p(0)+...+p(2)+p(4)+...+p(6)	RR = (0 ... 2,4 ... 6)	α = 0.625	Reject Ho:
α = p(0)+p(1)+p(5)+p(6)	RR = (0, 1, 5, 6)	α = 0.469	Reject Ho:
α = p(0)+p(6)	RR = (0, 6)	α = 0.188	Accept Ho:

TEST OF CONFIDENCE INTERVALS

$(\Sigma w_{DIFF})^2$ =	21.44	$(\Sigma w_{DIFF})^2 / n$ =	3.57	SS =	2.17
s^2 = SS/d.o.f =	0.43	$s = (s^2)^{1/2}$ =	0.66	$s / n^{1/2}$ =	0.27

$t(s/n^{1/2})\alpha$ = 0.100 =	0.542	μL =	-1.314	μU =	-0.229	Reject Ho:
$t(s/n^{1/2})\alpha$ = 0.050 =	0.692	μL =	-1.464	μU =	-0.080	Reject Ho:
$t(s/n^{1/2})\alpha$ = 0.025 =	0.852	μL =	-1.623	μU =	0.080	Accept Ho:

Differences

Range of differences:	Max =	0.21	Min =	-1.61
μ of differences:	μ =	-0.77		

APPENDIX 7B: CONTINUED

Adjusted CaO [CONTINENTAL - ACME]

Sample	Adjusted CaO (%) CONT	ACME	Test of Differences and Confidence Intervals DIFF (D)	DEV (d)	SD (d^2)	Sign Test Sign of DIFF
10731	54.58	55.00	-0.42	-0.15	0.02	-
10732	54.66	55.02	-0.36	-0.08	0.01	-
10735	44.50	44.29	0.21	0.49	0.24	+
10755	54.73	55.21	-0.48	-0.20	0.04	-
10769	53.76	53.95	-0.19	0.09	0.01	-
10771	54.79	55.21	-0.42	-0.14	0.02	-
Total (Σ w)	317.01	318.68	ΣW_{DIFF} = -1.67	0.00	SS = 0.33	M = 1
Mean (μ)	52.83	53.11	d_x = -0.28		S_D^2 = 0.07	
n =	6		d.o.f = 5			

TEST OF DIFFERENCES

S_D =	0.26	t = -2.639	tα = 0.100 =	2.015	Reject Ho:
S_{d2} =	0.01		tα = 0.050 =	2.571	Reject Ho:
S_d =	0.11		tα = 0.025 =	3.163	Accept Ho:

SIGN TEST

α = p(0)+...+p(2)+p(4)+...+p(6)	RR = (0 ... 2,4 ... 6)	α = 0.625	Reject Ho:
α = p(0)+p(1)+p(5)+p(6)	RR = (0, 1, 5, 6)	α = 0.469	Reject Ho:
α = p(0)+p(6)	RR = (0, 6)	α = 0.188	Accept Ho:

TEST OF CONFIDENCE INTERVALS

$(\Sigma w_{DIFF})^2$ =	2.79	$(\Sigma w_{DIFF})^2 / n$ =	0.46	SS =	0.33
s^2 = SS/d.o.f =	0.07	$s = (s^2)^{1/2}$ =	0.26	$s / n^{1/2}$ =	0.11

$t(s/n^{1/2})\alpha$ = 0.100 =	0.212	μL =	-0.491	μU =	-0.066	Reject Ho:
$t(s/n^{1/2})\alpha$ = 0.050 =	0.271	μL =	-0.549	μU =	-0.007	Reject Ho:
$t(s/n^{1/2})\alpha$ = 0.025 =	0.334	μL =	-0.612	μU =	0.055	Accept Ho:

Differences

Range of differences:	Max =	0.21	Min =	-0.48
μ of differences:	μ =	-0.28		

APPENDIX 7B: CONTINUED

MgO [CONTINENTAL - ACME]

Sample	MgO (%)		Test of Differences and Confidence Intervals			Sign Test
	CONT	ACME	DIFF (D)	DEV (d)	SD (d^2)	Sign of DIFF
10731	0.46	0.48	-0.02	0.12	0.02	-
10732	0.47	0.48	-0.01	0.13	0.02	-
10735	8.25	9.07	-0.82	-0.68	0.47	-
10755	0.34	0.33	0.01	0.15	0.02	+
10769	1.10	1.11	-0.01	0.13	0.02	-
10771	0.44	0.43	0.01	0.15	0.02	+
Total (Σ w)	11.06	11.90	ΣW_{DIFF} =	-0.84	0.00	SS = 0.56	M = 2
Mean (μ)	1.84	1.98	d_x =	-0.14		S_D^2 = 0.11	
n =	6		d.o.f =	5			

TEST OF DIFFERENCES

S_D =	0.34	t =	-1.024	tα = 0.100 = 2.015	Accept Ho:
S_{d2} =	0.02			tα = 0.050 = 2.571	Accept Ho:
S_d =	0.14			tα = 0.025 = 3.163	Accept Ho:

SIGN TEST

α = p(0)+...+p(2)+p(4)+...+p(6)	RR = (0 ... 2,4 ... 6)	α = 0.625	Reject Ho:
α = p(0)+p(1)+p(5)+p(6)	RR = (0, 1, 5, 6)	α = 0.469	Accept Ho:
α = p(0)+p(6)	RR = (0, 6)	α = 0.188	Accept Ho:

TEST OF CONFIDENCE INTERVALS

$(\Sigma w_{DIFF})^2$ =	0.71	$(\Sigma w_{DIFF})^2 / n$ =	0.12	SS =	0.56
$s^2 = SS/d.o.f$ =	0.11	$s = (s^2)^{1/2}$ =	0.34	$s / n^{1/2}$ =	0.14

$t(s/n^{1/2})\alpha$ = 0.100 =	0.276	μL =	-0.416	μU = 0.136	Accept Ho:
$t(s/n^{1/2})\alpha$ = 0.050 =	0.352	μL =	-0.492	μU = 0.212	Accept Ho:
$t(s/n^{1/2})\alpha$ = 0.025 =	0.433	μL =	-0.573	μU = 0.293	Accept Ho:

Differences

Range of differences:	Max = 0.01	Min =	-0.82
μ of differences:	μ =	-0.14	

APPENDIX 7B: CONTINUED

SiO_2 [CONTINENTAL - ACME]

Sample	SiO_2 (%) CONT	SiO_2 (%) ACME	Test of Differences and Confidence Intervals DIFF (D)	DEV (d)	SD (d^2)	Sign Test Sign of DIFF
10731	0.11	0.12	-0.01	-0.01	0.00	-
10732	0.20	0.11	0.09	0.10	0.01	+
10735	1.10	1.32	-0.22	-0.22	0.05	-
10755	0.18	0.11	0.07	0.07	0.01	+
10769	0.64	0.68	-0.04	-0.03	0.00	-
10771	0.10	0.02	0.08	0.08	0.01	+
Total (Σ w)	2.33	2.36	ΣW_{DIFF} = -0.03	0.00	SS = 0.07	M = 3
Mean (μ)	0.39	0.39	d_x = 0.00		S_D^2 = 0.01	
n =	6		d.o.f = 5			

TEST OF DIFFERENCES

S_D =	0.12	t = -0.103	$t\alpha = 0.100$ =	2.015	Accept Ho:
S_{d2} =	0.00		$t\alpha = 0.050$ =	2.571	Accept Ho:
S_d =	0.05		$t\alpha = 0.025$ =	3.163	Accept Ho:

SIGN TEST

α = p(0)+...+p(2)+p(4)+...+p(6)	RR = (0 ... 2,4 ... 6)	α =	0.625	Accept Ho:
α = p(0)+p(1)+p(5)+p(6)	RR = (0, 1, 5, 6)	α =	0.469	Accept Ho:
α = p(0)+p(6)	RR = (0, 6)	α =	0.188	Accept Ho:

TEST OF CONFIDENCE INTERVALS

$(\Sigma w_{DIFF})^2$ =	0.00	$(\Sigma w_{DIFF})^2 / n$ =	0.00	SS =	0.07
$s^2 = SS/d.o.f$ =	0.01	$s = (s^2)^{1/2}$ =	0.12	$s / n^{1/2}$ =	0.05

$t(s/n^{1/2})\alpha = 0.100$ =	0.097	μL =	-0.102	μU =	0.092	Accept Ho:
$t(s/n^{1/2})\alpha = 0.050$ =	0.124	μL =	-0.129	μU =	0.119	Accept Ho:
$t(s/n^{1/2})\alpha = 0.025$ =	0.153	μL =	-0.158	μU =	0.148	Accept Ho:

Differences

Range of differences:	Max =	0.09	Min =	-0.22
μ of differences:	μ =	0.00		

APPENDIX 7C: TWO-TAILED STUDENTS *t*-TEST FOR DIFFERENCES, SIGN TEST, AND TEST OF CONFIDENCE INTERVALS FOR CONSTITUENT DETERMINATIONS OF SAMPLES COLLECTED IN 1997

CaO [CONTINENTAL - ACME]

Sample	CaO (%)		Test of Differences and Confidence Intervals			Sign Test
	CONT	ACME	DIFF (D)	DEV (d)	SD (d^2)	Sign of DIFF
11561	55.31	55.57	-0.26	0.03	0.00	-
11571	55.34	55.39	-0.05	0.24	0.06	-
11576	41.76	41.94	-0.18	0.11	0.01	-
RE 11576	41.76	42.02	-0.26	0.03	0.00	-
11579	55.30	55.51	-0.21	0.08	0.01	-
11584	52.71	53.49	-0.78	-0.49	0.24	-
11586	43.10	42.66	0.44	0.73	0.54	+
11600	52.15	52.94	-0.79	-0.50	0.25	-
11603	51.09	51.61	-0.52	-0.23	0.05	-
Total (Σ w)	448.51	451.13	ΣW_{DIFF} =	-2.62	0.00	SS = 1.16	M = 1
Mean (μ)	49.83	50.13	d_x =	-0.29		S_D^2 = 0.14	
n =	9		d.o.f =	8			

TEST OF DIFFERENCES

S_D =	0.38	t =	-2.296	$t\alpha$ = 0.100 = 1.860	Reject Ho:
S_{d2} =	0.02			$t\alpha$ = 0.050 = 2.306	Accept Ho:
S_d =	0.13			$t\alpha$ = 0.025 = 2.752	Accept Ho:

SIGN TEST

α = p(0)+...+p(2)+p(7)+...+p(9)	RR = (0 ... 2,7 ... 9)	α = 0.328	Reject Ho:
α = p(0)+p(1)+p(8)+p(9)	RR = (0, 1, 8, 9)	α = 0.141	Reject Ho:
α = p(0)+p(9)	RR = (0, 9)	α = 0.035	Accept Ho:

TEST OF CONFIDENCE INTERVALS

$(\Sigma w_{DIFF})^2$ =	6.85	$(\Sigma w_{DIFF})^2 / n$ =	0.76	SS =	1.16	
s^2 = SS/d.o.f =	0.14	$s = (s^2)^{1/2}$ =	0.38	$s / n^{1/2}$ =	0.13	
$t(s/n^{1/2})\alpha$ = 0.100 =	0.236	μL =	-0.527	μU =	-0.055	Reject Ho:
$t(s/n^{1/2})\alpha$ = 0.050 =	0.292	μL =	-0.583	μU =	0.001	Accept Ho:
$t(s/n^{1/2})\alpha$ = 0.025 =	0.349	μL =	-0.640	μU =	0.058	Accept Ho:

Differences

Range of differences:	Max = 0.44	Min =	-0.79
μ of differences:	μ =	-0.29	

APPENDIX 7C: CONTINUED

Adjusted CaO [CONTINENTAL - $ACME_{ADJUSTED}$]

Sample	Adjusted CaO (%)		Test of Differences and Confidence Intervals			Sign Test
	CONT	ACME	DIFF (D)	DEV (d)	SD (d^2)	Sign of DIFF
11561	55.31	55.11	0.20	0.34	0.12	+
11571	55.34	55.17	0.17	0.31	0.10	+
11576	41.76	41.94	-0.18	-0.04	0.00	-
RE 11576	41.76	41.98	-0.22	-0.08	0.01	-
11579	55.30	55.16	0.15	0.29	0.08	+
11584	52.71	53.37	-0.66	-0.51	0.26	-
11586	43.10	42.66	0.44	0.58	0.34	+
11600	52.15	52.81	-0.66	-0.52	0.27	-
11603	51.09	51.61	-0.52	-0.37	0.14	-
Total (Σ w)	448.51	449.81	ΣW_{DIFF} = -1.30	0.00	SS = 1.32	M = 4
Mean (μ)	49.83	49.98	d_x = -0.14		S_D^2 = 0.16	
n =	9		d.o.f = 8			

TEST OF DIFFERENCES

S_D =	0.41	t = -1.066	tα = 0.100 =	1.860	Accept Ho:
S_{d2} =	0.02		tα = 0.050 =	2.306	Accept Ho:
S_d =	0.14		tα = 0.025 =	2.752	Accept Ho:

SIGN TEST

α = p(0)+...+p(2)+p(7)+...+p(9)	RR = (0 ... 2,7 ... 9)	α = 0.328	Accept Ho:
α = p(0)+p(1)+p(8)+p(9)	RR = (0, 1, 8, 9)	α = 0.141	Accept Ho:
α = p(0)+p(9)	RR = (0, 9)	α = 0.035	Accept Ho:

TEST OF CONFIDENCE INTERVALS

$(\Sigma w_{DIFF})^2$ =	1.68	$(\Sigma w_{DIFF})^2 / n$ =	0.19	SS =	1.32
s^2 = SS/d.o.f =	0.16	$s = (s^2)^{1/2}$ =	0.41	$s / n^{1/2}$ =	0.14

$t(s/n^{1/2})\alpha$ = 0.100 =	0.252	μL = -0.396	μU =	0.107	Accept Ho:
$t(s/n^{1/2})\alpha$ = 0.050 =	0.312	μL = -0.456	μU =	0.168	Accept Ho:
$t(s/n^{1/2})\alpha$ = 0.025 =	0.372	μL = -0.516	μU =	0.228	Accept Ho:

Differences

Range of differences:	Max =	0.44	Min =	-0.66
μ of differences:	μ =	-0.14		

APPENDIX 7C: CONTINUED

MgO [CONTINENTAL - ACME]

Sample	MgO (%)		Test of Differences and Confidence Intervals			Sign Test
	CONT	ACME	DIFF (D)	DEV (d)	SD (d^2)	Sign of DIFF
11561	0.48	0.51	-0.03	-0.02	0.00	-
11571	0.45	0.48	-0.03	-0.02	0.00	-
11576	11.12	11.34	-0.22	-0.20	0.04	-
RE 11576	11.12	11.12	0.00	0.02	0.00	+
11579	0.44	0.46	-0.02	-0.01	0.00	-
11584	1.86	1.89	-0.03	-0.02	0.00	-
11586	7.37	7.13	0.24	0.25	0.06	+
11600	2.45	2.45	0.00	0.01	0.00	+
11603	2.94	2.96	-0.02	-0.01	0.00	-
Total (Σ w)	38.23	38.34	ΣW_{DIFF} =	-0.11	0.00	**SS =** 0.11	**M =** 3
Mean (μ)	4.25	4.26	d_x =	-0.01		S_D^2 = 0.01	
n =	9		**d.o.f =**	8			

TEST OF DIFFERENCES

S_D =	0.12	t =	-0.315	tα = 0.100 = 1.860	**Accept Ho:**
S_{d2} =	0.00			tα = 0.050 = 2.306	**Accept Ho:**
S_d =	0.04			tα = 0.025 = 2.752	**Accept Ho:**

SIGN TEST

α = p(0)+...+p(2)+p(7)+...+p(9)	RR = (0 ... 2,7 ... 9)	α = 0.328	**Accept Ho:**
α = p(0)+p(1)+p(8)+p(9)	RR = (0, 1, 8, 9)	α = 0.141	**Accept Ho:**
α = p(0)+p(9)	RR = (0, 9)	α = 0.035	**Accept Ho:**

TEST OF CONFIDENCE INTERVALS

$(\Sigma w_{DIFF})^2$ =	0.01	$(\Sigma w_{DIFF})^2 / n$ =	0.00	SS =	0.11
s^2 = SS/d.o.f =	0.01	$s = (s^2)^{1/2}$ =	0.12	$s / n^{1/2}$ =	0.04

$t(s/n^{1/2})\alpha$ = 0.100 =	0.071	μL =	-0.084	μU = 0.059	**Accept Ho:**
$t(s/n^{1/2})\alpha$ = 0.050 =	0.089	μL =	-0.101	μU = 0.077	**Accept Ho:**
$t(s/n^{1/2})\alpha$ = 0.025 =	0.106	μL =	-0.118	μU = 0.094	**Accept Ho:**

Differences

Range of differences:	Max =	0.24	Min =	-0.22
μ of differences:	μ =	-0.01		

APPENDIX 7C: CONTINUED

SiO_2 [CONTINENTAL - ACME]

Sample	SiO_2 (%)		Test of Differences and Confidence Intervals			Sign Test
	CONT	ACME	DIFF (D)	DEV (d)	SD (d^2)	Sign of DIFF
11561	0.13	0.07	0.06	0.19	0.04	+
11571	0.11	0.09	0.02	0.15	0.02	+
11576	1.34	1.30	0.04	0.18	0.03	+
RE 11576	1.34	1.21	0.13	0.27	0.07	+
11579	0.17	0.11	0.06	0.20	0.04	+
11584	0.31	0.27	0.04	0.17	0.03	+
11586	6.25	7.80	-1.55	-1.42	2.01	-
11600	0.17	0.14	0.03	0.17	0.03	+
11603	1.20	1.24	-0.04	0.09	0.01	-
Total (Σ w)	11.01	12.23	ΣW_{DIFF} = -1.22	0.00	SS = 2.28	M = 7
Mean (μ)	1.22	1.36	d_x = -0.14		S_D^2 = 0.28	
n =	9		d.o.f = 8			

TEST OF DIFFERENCES

S_D =	0.53	t = -0.764	$t\alpha = 0.100$ =	1.860	Accept Ho:
S_{d2} =	0.03		$t\alpha = 0.050$ =	2.306	Accept Ho:
S_d =	0.18		$t\alpha = 0.025$ =	2.752	Accept Ho:

SIGN TEST

α = p(0)+...+p(2)+p(7)+...+p(9)	RR = (0 ... 2,7 ... 9)	α =	0.328	Reject Ho:
α = p(0)+p(1)+p(8)+p(9)	RR = (0, 1, 8, 9)	α =	0.141	Accept Ho:
α = p(0)+p(9)	RR = (0, 9)	α =	0.035	Accept Ho:

TEST OF CONFIDENCE INTERVALS

$(\Sigma w_{DIFF})^2$ =	1.50	$(\Sigma w_{DIFF})^2 / n$ =	0.17	SS =	2.28
s^2 = SS/d.o.f =	0.28	$s = (s^2)^{1/2}$ =	0.53	$s / n^{1/2}$ =	0.18

$t(s/n^{1/2})\alpha = 0.100$ =	0.331	μL = -0.467		μU = 0.195		Accept Ho:
$t(s/n^{1/2})\alpha = 0.050$ =	0.410	μL = -0.546		μU = 0.274		Accept Ho:
$t(s/n^{1/2})\alpha = 0.025$ =	0.489	μL = -0.625		μU = 0.353		Accept Ho:

Differences

Range of differences:	Max =	0.13	Min =	-1.55
μ of differences:	μ =	-0.14		

APPENDIX 7C: CONTINUED

LOI [CONTINENTAL - ACME]

Sample	LOI (%)		Test of Differences and Confidence Intervals			Sign Test
	CONT	ACME	DIFF (D)	DEV (d)	SD (d^2)	Sign of DIFF
11561	43.76	43.60	0.16	0.30	0.09	+
11571	43.74	43.70	0.04	0.18	0.03	+
11576	44.98	45.00	-0.02	0.12	0.01	-
RE 11576	44.98	45.20	-0.22	-0.08	0.01	-
11579	43.77	43.70	0.07	0.21	0.04	+
11584	43.99	44.00	-0.01	0.13	0.02	-
11586	41.71	41.90	-0.19	-0.05	0.00	-
11600	44.37	44.20	0.17	0.31	0.09	+
11603	43.83	43.90	-0.07	0.07	0.00	-
Total (Σ w)	395.13	395.20	ΣW_{DIFF} =	-0.07	1.15	SS = 0.30	M = 4
Mean (μ)	43.90	43.91	d_x =	-0.01		S_D^2 = 0.04	
n =	9		d.o.f =	8			

TEST OF DIFFERENCES

S_D =	0.19	t =	-0.121	tα = 0.100 = 1.860	Accept Ho:
S_{d2} =	0.00			tα = 0.050 = 2.306	Accept Ho:
S_d =	0.06			tα = 0.025 = 2.752	Accept Ho:

SIGN TEST

α = p(0)+...+p(2)+p(7)+...+p(9)	RR = (0 ... 2,7 ... 9)	α = 0.328	Accept Ho:
α = p(0)+p(1)+p(8)+p(9)	RR = (0, 1, 8, 9)	α = 0.141	Accept Ho:
α = p(0)+p(9)	RR = (0, 9)	α = 0.035	Accept Ho:

TEST OF CONFIDENCE INTERVALS

$(\Sigma w_{DIFF})^2$ =	0.00	$(\Sigma w_{DIFF})^2 / n$ =	0.00	SS =	0.30
$s^2 = SS/d.o.f$ =	0.04	$s = (s^2)^{1/2}$ =	0.19	$s / n^{1/2}$ =	0.06

$t(s/n^{1/2})\alpha = 0.100$ =	0.120	μL =	-0.127	μU =	0.112	Accept Ho:
$t(s/n^{1/2})\alpha = 0.050$ =	0.148	μL =	-0.156	μU =	0.141	Accept Ho:
$t(s/n^{1/2})\alpha = 0.025$ =	0.177	μL =	-0.185	μU =	0.169	Accept Ho:

Differences

Range of differences:	Max =	0.17	Min =	-0.22
μ of differences:	μ =	-0.01		

APPENDIX 8A: DETERMINED, ADJUSTED, AND PREFERRED ANALYSES FOR CaO AND LOI IN THE 1994 SAMPLES BY ACME ANALYTICAL LABORATORIES LTD.

Det'd - determined; adjustments: LOI - LOI based, Imp - impurity based; Pref - preferred

Code			
1	LOI - CO_2 EQ ≥ 0.00	CaO(Pref) = CaO(Det'd)	LOI(Pref) = LOI(Det'd)
2	LOI - CO_2EQ < 0.00 and CaO(Det'd) < 53.00	CaO(Pref) = CaO(Det'd)	LOI(Pref) = LOI(Det'd)
3	LOI - CO_2EQ < 0.00 and CaO(Det'd) < CaO(LOI)	CaO(Pref) = CaO(Det'd)	LOI(Pref) = LOI(Det'd)
4	For repeat analyses (RE) the preferred values for that sample are the means of the CaO(Pref) and the LOI(Pref) values.		
5	LOI - CO_2EQ < 0.00 and CaO(LOI) ≤ CaO(Imp)	CaO(Pref) = CaO(LOI)	LOI(Pref) = LOI(LOI)

Criteria for codes are applied to each sample in the order listed.

Sample	LOI - CO_2 EQ	Code	CaO%				LOI%				SUM %	
			Det'd	LOI	Imp	Pref	Det'd	LOI	Imp	Pref	Det'd	Adjusted
7780	-0.18	2	46.34	46.13	46.16	46.34	44.80	45.03	45.05	44.80	99.93	99.93
7781	0.18	1	53.52	53.70	53.68	53.52	43.90	44.06	44.04	43.90	99.72	99.72
7782	0.17	1	54.49	54.60	54.58	54.49	43.90	44.02	44.01	43.90	99.82	99.82
7783	0.19	1	53.07	53.18	53.17	53.07	44.10	44.20	44.19	44.10	99.81	99.81
7784	-0.63	2	30.57	29.49	29.62	30.57	47.00	46.99	47.10	47.00	100.94	100.94
7785	-0.63	2	31.49	30.41	30.54	31.49	47.00	46.99	47.09	47.00	100.86	100.86
7786	0.56	1	49.60	49.92	49.88	49.60	44.10	44.00	43.97	44.10	99.85	99.85
7787	0.90	4	50.90	51.47	51.41	50.30	44.20	43.95	43.90	44.20	99.79	99.19
RE 7787	0.69	4	49.70	50.08	50.04	-	44.20	44.02	43.98	-	99.88	100.48
7788	1.01	1	44.31	44.73	44.68	44.31	44.20	43.73	43.69	44.20	100.14	100.14
7789	1.01	1	51.64	52.13	52.07	51.64	43.30	42.87	42.83	43.30	100.04	100.04
7790	0.91	1	49.87	50.31	50.25	49.87	43.80	43.44	43.40	43.80	100.02	100.02
7791	0.69	1	46.67	46.95	46.91	46.67	44.00	43.73	43.71	44.00	100.05	100.05
7792	1.23	1	51.16	51.78	51.71	51.16	43.60	43.06	43.00	43.60	100.05	100.05
7793	1.31	1	52.25	52.90	52.82	52.25	43.10	42.50	42.44	43.10	100.09	100.09
7794	1.27	1	52.69	53.27	53.20	52.69	43.70	43.09	43.04	43.70	100.15	100.15
7795	0.96	1	52.77	53.18	53.13	52.77	43.30	42.86	42.83	43.30	100.11	100.11
7796	0.89	1	52.58	52.93	52.89	52.58	43.20	42.79	42.76	43.20	100.13	100.13
7797	0.71	1	52.68	52.89	52.86	52.68	42.70	42.35	42.33	42.70	100.19	100.19
9001	0.14	1	25.66	25.04	25.11	25.66	31.00	30.58	30.64	31.00	100.92	100.92
9351	-0.58	2	43.46	42.85	42.93	43.46	44.60	44.91	44.96	44.60	100.22	100.22
9352	-0.44	2	31.48	30.63	30.73	31.48	43.40	43.37	43.45	43.40	100.70	100.70
9353	-0.48	2	31.35	30.69	30.77	31.35	45.90	46.06	46.13	45.90	100.41	100.41
9354	-0.23	5	54.99	54.69	54.72	54.69	43.70	43.90	43.93	43.90	100.09	99.99
9355	0.65	1	49.81	49.98	49.96	49.81	40.50	40.19	40.17	40.50	100.18	100.18
9356	0.03	1	55.24	55.04	55.07	55.24	43.90	43.91	43.93	43.90	100.16	100.16
9357	-0.19	5	55.32	55.05	55.08	55.05	43.70	43.88	43.91	43.88	100.03	99.94
9358	-0.40	5	55.19	54.83	54.87	54.83	43.60	43.92	43.95	43.92	99.97	99.93

APPENDIX 8A: CONTINUED

Sample	LOI - CO_2 EQ	Code	CaO%				LOI%				SUM %	
			Det'd	LOI	Imp	Pref	Det'd	LOI	Imp	Pref	Det'd	Adjusted
9371	0.03	1	51.75	51.66	51.67	51.75	43.30	43.40	43.41	43.30	99.97	99.97
9372	0.59	1	54.47	54.73	54.70	54.47	44.10	43.92	43.89	44.10	99.98	99.98
9373	0.21	1	54.93	55.05	55.03	54.93	43.80	43.88	43.87	43.80	99.82	99.82
9374	-0.46	5	53.77	53.65	53.66	53.65	43.50	44.06	44.07	44.06	99.56	100.00
9375	0.94	1	45.44	46.33	46.22	45.44	45.10	45.05	44.97	45.10	99.35	99.35
9718	0.39	1	48.69	48.74	48.73	48.69	44.30	44.15	44.15	44.30	100.11	100.11
9719	-0.39	2	41.66	41.35	41.39	41.66	45.30	45.65	45.68	45.30	99.93	99.93
9720	-0.70	2	38.52	37.92	38.00	38.52	45.60	46.04	46.10	45.60	100.03	100.03
9721	-2.22	2	30.58	28.65	28.88	30.58	45.90	46.81	46.99	45.90	100.65	100.65
9722	-0.34	2	52.09	51.85	51.88	52.09	43.90	44.26	44.28	43.90	99.87	99.87
9723	-0.04	5	54.35	54.18	54.20	54.18	43.80	43.91	43.93	43.91	100.02	99.97
9724	-0.20	2	47.72	47.51	47.53	47.72	44.00	44.23	44.26	44.00	99.93	99.93
9725	-0.28	2	43.25	42.93	42.97	43.25	40.70	40.93	40.96	40.70	100.03	100.03
9726	-0.10	2	52.60	52.38	52.41	52.60	41.90	42.03	42.06	41.90	100.03	100.03
9727	-0.07	2	48.46	48.29	48.31	48.46	39.20	39.34	39.35	39.20	100.01	100.01
9728	-0.46	5	54.92	54.48	54.53	54.48	43.40	43.72	43.76	43.72	100.04	99.91
9729	-2.39	2	30.70	28.70	28.94	30.70	46.40	47.42	47.61	46.40	100.62	100.62
9730	-0.60	5	53.55	53.08	53.14	53.08	43.70	44.13	44.17	44.13	99.94	99.90
9731	-0.01	2	44.29	44.47	44.45	44.29	45.00	45.36	45.34	45.00	99.51	99.51
9732	-1.06	2	50.41	49.55	49.65	50.41	42.90	43.49	43.57	42.90	100.09	100.09
9733	-0.51	2	41.39	41.11	41.15	41.39	41.00	41.50	41.52	41.00	99.72	99.72
9734	-0.84	2	50.25	49.58	49.66	50.25	42.00	42.52	42.58	42.00	100.01	100.01
9735	-0.89	5	54.63	53.94	54.02	53.94	43.40	43.95	44.02	43.95	100.00	99.86
9736	-0.55	5	55.31	54.81	54.87	54.81	43.50	43.86	43.91	43.86	100.03	99.89
9737	-1.18	5	55.54	54.66	54.77	54.66	43.10	43.79	43.87	43.79	100.00	99.81
9738	-1.47	5	55.32	54.28	54.41	54.28	43.00	43.86	43.96	43.86	100.00	99.82
9739	-0.98	5	55.64	54.87	54.96	54.87	43.30	43.87	43.95	43.87	100.04	99.84
9740	-1.19	5	55.78	54.95	55.05	54.95	43.10	43.84	43.92	43.84	99.91	99.82
9741	0.32	1	54.54	54.85	54.81	54.54	43.70	43.82	43.80	43.70	99.63	99.63
9742	0.24	1	54.72	54.86	54.84	54.72	43.80	43.87	43.86	43.80	99.85	99.85
9751	0.19	1	54.74	54.94	54.92	54.74	43.70	43.87	43.85	43.70	99.67	99.67
9752	-0.01	5	54.95	54.83	54.84	54.83	43.70	43.82	43.83	43.82	99.97	99.97
9753	0.25	1	54.67	54.75	54.74	54.67	43.90	43.91	43.91	43.90	99.97	99.97
9754	0.17	1	47.63	47.59	47.60	47.63	44.60	44.61	44.61	44.60	100.02	100.02
9755	-0.02	5	55.06	54.95	54.96	54.95	43.70	43.84	43.85	43.84	99.95	99.97
9756	-0.12	4	55.10	54.95	54.97	54.94	43.70	43.90	43.92	43.90	99.91	99.95
RE 9756	-0.14	4	55.11	54.93	54.95	-	43.70	43.90	43.91	-	100.00	100.03
9757	0.00	1	54.53	54.40	54.41	54.53	43.80	43.90	43.91	43.80	100.01	100.01

APPENDIX 8B: DETERMINED, ADJUSTED, AND PREFERRED ANALYSES FOR CaO AND LOI IN THE 1995 SAMPLES BY ACME ANALYTICAL LABORATORIES LTD.

Det'd - determined; adjustments: LOI - LOI based, Imp - impurity based; Pref - preferred

Code			
1	LOI - CO_2 EQ ≥ 0.00	CaO(Pref) = CaO(Det'd)	LOI(Pref) = LOI(Det'd)
2	LOI - CO_2EQ < 0.00 and CaO(Det'd) < 52.50	CaO(Pref) = CaO(Det'd)	LOI(Pref) = LOI(Det'd)
3	LOI - CO_2EQ < 0.00 and CaO(Det'd) < CaO(LOI)	CaO(Pref) = CaO(Det'd)	LOI(Pref) = LOI(Det'd)
4	For repeat analyses (RE) the preferred values for that sample are the means of the CaO(Pref) and the LOI(Pref) values.		
5	LOI - CO_2EQ < 0.00 and CaO(LOI) ≤ CaO(Imp)	CaO(Pref) = CaO(LOI)	LOI(Pref) = LOI(LOI)

Criteria for codes are applied to each sample in the order listed.

Sample	LOI - CO_2 EQ	Code	CaO%				LOI%				SUM %	
			Det'd	LOI	Imp	Pref	Det'd	LOI	Imp	Pref	Det'd	Adjusted
10731	-1.11	5	56.19	55.00	55.14	55.00	43.50	43.88	43.99	43.88	100.51	99.70
10732	-0.73	5,4	56.00	55.07	55.18	55.02	43.70	43.90	43.99	43.87	100.48	99.75
RE 10732	-0.47	5,4	55.66	54.97	55.05	-	43.70	43.83	43.90	-	100.39	99.83
10735	0.37	1	44.29	44.32	44.32	44.29	45.00	44.86	44.86	45.00	100.11	100.11
10755	0.12	1	55.21	55.33	55.31	55.21	43.80	43.97	43.96	43.80	99.69	99.69
10769	-0.56	5	54.91	53.95	54.07	53.95	43.70	43.71	43.80	43.71	100.72	99.77
10771	0.01	1	55.21	55.27	55.26	55.21	43.80	44.03	44.03	43.80	99.69	99.69

APPENDIX 8C: DETERMINED, ADJUSTED, AND PREFERRED ANALYSES FOR CaO AND LOI IN THE 1997 SAMPLES BY ACME ANALYTICAL LABORATORIES LTD. AND THE QUALITY ASSURANCE LABORATORY OF CONTINENTAL LIME INC.

Det'd - determined; adjustments: LOI - LOI based, Imp - impurity based; Pref - preferred

Code			
1	LOI - CO_2 EQ $\geq$ 0.00	CaO(Pref) = CaO(Det'd)	LOI(Pref) = LOI(Det'd)
2	LOI - CO_2EQ < 0.00 and CaO(Det'd) < 52.50	CaO(Pref) = CaO(Det'd)	LOI(Pref) = LOI(Det'd)
3	LOI - CO_2EQ < 0.00 and CaO(Det'd) < CaO(LOI)	CaO(Pref) = CaO(Det'd)	LOI(Pref) = LOI(Det'd)
4	For repeat analyses (RE) the preferred values for that sample are the means of the CaO(Pref) and the LOI(Pref) values.		
5	LOI - CO_2EQ < 0.00 and CaO(LOI) $\leq$ CaO(Imp)	CaO(Pref) = CaO(LOI)	LOI(Pref) = LOI(Det'd)

Criteria for codes are applied to each sample in the order listed.

Samples	LOI-CO_2EQ	Code	CaO				LOI				SUM	
			Det'd	LOI	IMP	Pref.	Det'd	LOI	IMP	Pref.	Det'd	Adjusted
						ACME ANALYSES						
11561	-0.58	5	55.57	55.11	55.17	55.11	43.60	44.00	44.05	43.60	99.96	99.50
11571	-0.30	5	55.39	55.17	55.20	55.17	43.70	44.02	44.04	43.70	99.85	99.63
11576	-0.28	2	41.94	41.66	41.69	41.94	45.00	45.25	45.28	45.00	99.98	99.98
RE 11576	0.09	4	42.02	42.00	42.00	41.98	45.20	45.29	45.29	45.10	99.93	99.79
11579	-0.37	5	55.51	55.16	55.20	55.16	43.70	43.98	44.02	43.70	99.98	99.63
11584	-0.05	5	53.49	53.37	53.38	53.37	44.00	44.14	44.15	44.00	99.94	99.82
11586	0.73	1	42.66	43.04	42.99	42.66	41.90	41.66	41.63	41.90	99.97	99.97
11600	-0.03	5	52.94	52.81	52.83	52.81	44.20	44.31	44.33	44.20	99.97	99.84
11603	0.19	1	51.61	51.62	51.62	51.61	43.90	43.91	43.91	43.90	99.98	99.98
						CONTINENTAL ANALYSES						
11551	-0.26	2	48.91	48.88	48.88	48.91	43.03	44.45	44.45	43.03	99.87	99.87
11552	-0.41	5	54.86	54.80	54.81	54.80	43.46	44.01	44.02	44.01	99.91	100.40
11553	-0.14	5	55.23	55.13	55.14	55.13	43.72	43.96	43.97	43.96	99.95	100.10
11554	-0.18	5	55.10	55.03	55.04	55.03	43.55	43.87	43.87	43.87	99.93	100.18
11555	-0.12	5	55.18	55.08	55.09	55.08	43.73	43.95	43.96	43.95	99.98	100.10
11556	0.07	1	48.05	48.32	48.28	48.05	44.62	44.95	44.93	44.62	99.41	99.41
11557	-0.05	2	45.65	45.68	45.67	45.65	44.88	45.15	45.15	44.88	99.76	99.76
11558	0.16	1	49.08	49.37	49.33	49.08	44.45	44.70	44.68	44.45	99.37	99.37
11559	0.29	1	54.58	54.91	54.87	54.58	43.80	43.95	43.92	43.80	99.31	99.31
11560	-0.06	5	55.09	55.02	55.03	55.02	43.79	43.97	43.98	43.97	99.95	100.06
11561	-0.18	5	55.31	55.19	55.20	55.19	43.76	44.03	44.04	44.03	99.99	100.14
11562	0.07	1	55.02	55.29	55.26	55.02	43.76	44.09	44.07	43.76	99.39	99.39
11563	-0.04	3	55.19	55.19	55.19	55.19	43.82	44.05	44.05	43.82	99.81	99.81
11564	-0.01	5	55.19	55.13	55.14	55.13	43.84	43.99	44.00	43.99	99.91	100.01
11565	-0.01	5	55.10	55.04	55.05	55.04	43.85	43.99	44.00	43.99	99.91	99.99
11566	-0.31	5	54.68	54.59	54.61	54.59	43.40	43.83	43.84	43.83	99.96	100.30
11567	-0.17	5	55.25	55.16	55.17	55.16	43.75	44.03	44.04	44.03	99.97	100.16
11568	-0.16	5	55.23	55.23	55.23	55.23	43.69	44.03	44.03	44.03	99.82	100.16
11569	-0.29	5	55.22	55.13	55.14	55.13	43.56	43.97	43.98	43.97	99.93	100.25
11570	0.09	1	54.98	55.15	55.13	54.98	43.79	44.02	44.01	43.79	99.54	99.54
11571	-0.19	5	55.34	55.23	55.25	55.23	43.74	44.03	44.04	44.03	99.99	100.17
11572	0.04	1	55.09	55.01	55.02	55.09	43.96	44.04	44.05	43.96	99.95	99.95
11573	0.36	1	54.90	55.12	55.09	54.90	44.04	44.03	44.01	44.04	99.48	99.48
11574	0.13	1	53.60	53.61	53.61	53.60	44.01	44.08	44.08	44.01	99.83	99.83
11575	0.12	1	54.84	54.76	54.77	54.84	44.02	44.03	44.04	44.02	99.97	99.97
11576	0.08	1	41.76	42.01	41.98	41.76	44.98	45.29	45.27	44.98	99.44	99.44

APPENDIX 8C: CONTINUED

Samples	LOI-CO_2EQ	Code	CaO				LOI				SUM	
			Det'd	LOI	IMP	Pref.	Det'd	LOI	IMP	Pref.	Det'd	Adjusted
11577	0.36	1	52.58	52.65	52.64	52.58	44.35	44.24	44.23	44.35	99.70	99.70
11578	-0.17	5	55.21	55.17	55.18	55.17	43.67	44.00	44.00	44.00	99.87	100.16
11579	-0.12	5	55.30	55.23	55.24	55.23	43.77	44.02	44.03	44.02	99.92	100.10
11580	-0.40	5	53.87	53.83	53.83	53.83	42.72	43.27	43.27	43.27	99.90	100.41
11581	-0.07	3	55.13	55.15	55.15	55.13	43.68	43.95	43.95	43.68	99.78	99.78
11582	0.01	1	46.84	47.21	47.17	46.84	44.39	44.86	44.83	44.39	99.23	99.23
11583	0.27	1	50.64	50.97	50.93	50.64	44.22	44.40	44.37	44.22	99.31	99.31
11584	0.58	1	52.71	53.56	53.46	52.71	43.99	44.26	44.18	43.99	98.47	98.47
11585	0.41	1	54.51	54.92	54.87	54.51	43.96	44.06	44.02	43.96	99.19	99.19
11586	-0.16	2	43.10	43.70	43.62	43.10	41.71	42.53	42.47	41.71	98.88	98.88
11587	-0.22	5	55.19	55.12	55.13	55.12	43.66	44.01	44.01	44.01	99.92	100.20
11588	0.07	1	54.81	54.98	54.96	54.81	43.70	43.95	43.94	43.70	99.57	99.57
11589	0.05	1	47.62	47.84	47.81	47.62	44.65	44.96	44.94	44.65	99.48	99.48
11590	0.39	1	53.05	53.62	53.55	53.05	43.97	44.21	44.16	43.97	98.93	98.93
11591	0.26	1	54.95	55.19	55.16	54.95	43.96	44.07	44.05	43.96	99.44	99.44
11592	0.20	1	54.94	55.22	55.18	54.94	43.89	44.09	44.07	43.89	99.39	99.39
11593	0.09	1	54.86	55.01	54.99	54.86	43.79	44.00	43.99	43.79	99.58	99.58
11594	0.11	1	54.97	55.07	55.06	54.97	43.86	44.01	44.00	43.86	99.65	99.65
11595	0.16	1	44.94	45.17	45.14	44.94	45.15	45.36	45.34	45.15	99.44	99.44
11596	0.23	1	54.90	55.15	55.12	54.90	43.88	44.03	44.01	43.88	99.43	99.43
11597	0.40	1	46.75	47.38	47.30	46.75	44.68	44.97	44.91	44.68	98.84	98.84
11598	-0.01	5	53.87	53.79	53.80	53.79	43.96	44.09	44.10	44.09	99.95	100.00
11599	0.49	1	51.44	52.09	52.01	51.44	44.24	44.44	44.38	44.24	98.78	98.78
11600	0.76	1	52.15	52.97	52.87	52.15	44.37	44.44	44.36	44.37	98.52	98.52
11601	0.21	1	54.88	55.07	55.05	54.88	43.88	44.01	43.99	43.88	99.52	99.52
11602	0.15	1	54.74	54.95	54.93	54.74	43.76	43.96	43.94	43.76	99.49	99.49
11603	0.53	1	51.09	51.78	51.69	51.09	43.83	44.02	43.96	43.83	98.75	98.75
11604	0.08	1	45.94	46.07	46.05	45.94	44.95	45.16	45.15	44.95	99.61	99.61
11605	0.43	1	48.42	48.89	48.83	48.42	44.15	44.27	44.23	44.15	99.08	99.08
11606	0.25	1	53.41	53.40	53.40	53.41	43.34	43.27	43.27	43.34	99.82	99.82
11607	0.04	1	52.31	52.23	52.24	52.31	42.94	43.02	43.03	42.94	99.95	99.95
11608	0.13	1	53.87	53.77	53.78	53.87	43.21	43.19	43.20	43.21	99.96	99.96
11609	0.18	1	53.41	53.32	53.33	53.41	43.17	43.10	43.11	43.17	99.95	99.95
11651	0.36	1	46.71	47.08	47.03	46.71	43.75	43.87	43.83	43.75	99.23	99.23
11652	0.19	1	51.19	51.17	51.17	51.19	43.42	43.40	43.40	43.42	99.87	99.87

APPENDIX 9A: DETERMINED AND PREFERRED CONCENTRATIONS OF CHEMICAL CONSTITUENTS IN SAMPLES COLLECTED IN 1994

All values are as determined except for CaO, LOI, and SUM which have been adjusted, where required, to the preferred values in Appendix 8A.

At each location samples are listed in order from stratigraphic top to bottom with covered or other unsampled intervals omitted. See Appendix 2A for sample descriptions.

Sample	Formation	Strat. Thick. (m)	CaO %	MgO %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	Na_2O %	K_2O %	TiO_2 %	P_2O_5 %	MnO %	Cr_2O_3 %	Ba ppm	Sr ppm	Others* ppm	LOI %	LOI-CO_2EQ	SUM %
94-1 North Knob (Fig. 7.1)																			
9754	Livingstone	2½	47.63	6.48	0.86	0.19	<0.05	<0.01	0.21	0.01	0.02	<0.01	0.004	<5	197	<42	44.60	0.17	100.02
9753	Livingstone	5¼	54.67	0.70	0.43	0.13	<0.05	0.02	0.05	0.01	0.02	<0.01	0.003	<5	264	<45	43.90	0.25	99.97
9752	Livingstone	5¾	54.83	0.57	0.47	0.15	<0.05	0.01	0.05	0.04	0.03	<0.01	0.008	<5	309	<63	43.82	-0.01	100.01
9751	Livingstone	4¼	54.74	0.53	0.37	0.12	<0.05	<0.01	0.13	0.01	0.03	<0.01	<0.002	<5	293	<46	43.70	0.19	99.67
94-2 Little Shunda Mountain (Fig. 7.1)																			
9742	Livingstone	1	54.72	0.60	0.42	0.15	<0.05	0.02	<0.05	0.03	0.04	<0.01	0.004	5	275	<45	43.80	0.24	99.85
9741	Livingstone	3¼	54.54	0.55	0.41	0.18	<0.05	0.04	0.15	<0.01	0.02	<0.01	0.003	<5	269	<56	43.70	0.32	99.63
9740	Livingstone	8½	54.95	0.49	0.29	0.17	<0.05	0.02	<0.05	<0.01	0.02	<0.01	0.006	<5	256	<43	43.84	-1.19	99.81
94-3 Shunda Mountain Road (Fig. 7.1)																			
9757	Livingstone	3¼	54.53	0.94	0.48	0.16	<0.05	0.02	<0.05	0.02	0.02	<0.01	0.003	8	246	<51	43.80	0.00	100.01
9756	Livingstone	4	54.94	0.55	0.37	0.14	<0.05	0.02	<0.05	0.01	0.01	<0.01	0.003	5	256	<50	43.90	-0.13	99.97
9755	Livingstone	5 1/3	54.95	0.50	0.36	0.12	<0.05	0.02	0.08	0.04	0.03	<0.01	0.006	7	261	<43	43.84	-0.02	99.97
7797	Banff	1	52.68	0.61	2.92	0.75	0.29	0.04	0.08	0.03	0.02	0.02	0.003	36	287	<42	42.70	0.71	100.19
7796	Banff	1½	52.58	0.99	2.28	0.50	0.22	0.04	0.20	0.03	0.03	0.02	<0.002	36	295	<48	43.20	0.89	100.13
7795	Banff	1½	52.77	0.86	2.12	0.58	0.25	0.03	0.13	0.01	0.01	0.01	<0.002	12	297	<52	43.30	0.96	100.11
7794	Banff	1½	52.69	1.00	1.85	0.43	0.18	0.05	0.16	0.02	0.01	0.01	0.009	10	293	<58	43.70	1.27	100.15
7793	Banff	~3	52.25	0.73	2.79	0.66	0.28	0.04	0.15	0.02	0.01	0.02	<0.002	10	288	<48	43.10	1.31	100.09

*Sum of Nb, Ni, Sc, Y, and Zr (Appendix 3A).

APPENDIX 9A: CONTINUED

Sample	Formation	Strat. Thick. (m)	CaO %	MgO %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	Na_2O %	K_2O %	TiO_2 %	P_2O_5 %	MnO %	Cr_2O_3 %	Ba ppm	Sr ppm	Others* ppm	LOI %	LOI-CO_2EQ	SUM %
97-4 Coliseum Mountain - North (Fig. 7.1)																			
9724	Livingstone	¾	47.72	6.22	1.70	0.19	<0.05	<0.01	<0.05	0.03	0.04	<0.01	0.005	5	174	<43	44.00	-0.20	99.93
9723	Livingstone	1¾	54.18	1.09	0.41	0.13	0.10	0.01	0.09	<0.01	<0.01	<0.01	0.002	5	230	<49	43.91	-0.04	99.95
9722	Livingstone	2	52.09	3.13	0.43	0.15	<0.05	0.02	<0.05	0.02	0.05	<0.01	0.007	5	233	<58	43.90	-0.34	99.87
9720	Livingstone	2½	38.52	14.79	0.70	0.19	<0.05	<0.01	0.12	0.01	0.07	<0.01	0.005	5	118	<55	45.60	-0.70	100.03
9721	Livingstone	¼	30.58	22.17	1.37	0.35	<0.05	<0.01	0.11	0.02	0.08	<0.01	0.005	7	88	<42	45.90	-2.22	100.65
9718	Livingstone	2¾	48.69	5.27	1.08	0.17	0.43	<0.01	0.07	<0.01	0.05	<0.01	0.014	<5	200	<70	44.30	0.39	100.11
9719	Livingstone	8	41.66	11.99	0.63	0.18	<0.05	<0.01	<0.05	<0.01	0.09	<0.01	0.004	<5	119	<54	45.30	-0.39	99.93
7783	Livingstone	6	53.07	2.09	0.25	0.18	<0.05	0.06	<0.05	<0.01	0.02	<0.01	0.005	<5	253	<52	44.10	0.19	99.81
7782	Livingstone	4	54.49	0.90	0.25	0.17	<0.05	0.04	<0.05	<0.01	0.01	<0.01	<0.002	<5	282	<42	43.90	0.17	99.82
97-5 Coliseum Mountain - South (Fig. 7.1)																			
7781	Livingstone	4	53.52	1.59	0.40	0.19	<0.05	0.04	<0.05	<0.01	0.02	<0.01	0.002	<5	264	<55	43.90	0.18	99.72
7780	Livingstone	10½	46.34	7.95	0.50	0.19	<0.05	0.05	<0.05	0.01	0.06	<0.01	0.002	<5	206	<59	44.80	-0.18	99.93
9375	Livingstone	7¾	45.44	7.81	0.63	0.27	<0.05	0.03	<0.05	0.01	0.03	<0.01	0.004	5	175	<42	45.10	0.94	99.35
9374	Livingstone	5¾	53.65	1.62	0.25	0.21	0.12	0.02	<0.05	<0.01	0.01	<0.01	0.003	<5	219	<59	44.06	-0.46	99.96
9373	Livingstone	5¾	54.93	0.46	0.20	0.22	<0.05	0.02	0.13	0.01	0.02	<0.01	0.002	<5	241	<42	43.80	0.21	99.82
9372	Livingstone	1	54.47	0.71	0.32	0.21	<0.05	0.01	0.09	0.01	0.01	<0.01	0.003	5	304	<44	44.10	0.59	99.98
94-6 Isolated Sample ON Coliseum Mountain (Fig. 7.1)																			
9371	Palliser	7	51.75	2.45	1.58	0.48	0.19	0.02	0.10	0.03	0.02	0.01	<0.002	10	254	<42	43.30	#NAME?	99.97
94-7 Mountain East of Martin Creek - Location 1 (Fig. 7.4)																			
7790	Livingstone	4¼	49.87	3.48	1.88	0.50	0.22	0.04	0.09	0.04	0.04	0.02	0.002	7	253	<51	43.80	0.91	100.02
7789	Livingstone	1¼	51.64	1.65	2.32	0.58	0.23	0.04	0.16	0.03	0.04	0.01	0.004	10	279	<50	43.30	1.01	100.04
7788	Livingstone	2½	44.31	7.76	2.59	0.55	0.25	0.04	0.30	0.03	0.05	0.02	0.005	13	217	<64	44.20	1.01	100.14
7787	Livingstone	1½	50.90	3.10	1.01	0.32	0.10	0.04	<0.05	0.04	0.03	0.01	0.005	<5	298	<52	44.20	0.80	99.79
7786	Livingstone	1	49.65	4.21	1.37	0.19	0.11	0.04	0.08	<0.01	0.03	0.01	0.004	<5	192	<59	44.15	0.56	99.87
7784	Banff	1	30.57	21.76	1.06	0.25	<0.05	0.06	<0.05	0.01	0.11	<0.01	0.004	6	83	<122	47.00	-0.63	100.94
7785	Palliser	~2	31.49	21.07	0.83	0.24	<0.05	0.06	0.06	0.01	0.08	<0.01	0.003	12	86	<50	47.00	-0.63	100.86

*Sum of Nb, Ni, Sc, Y, and Zr (Appendix 3A).

APPENDIX 9A: CONTINUED

Sample	Formation	Strat. Thick. (m)	CaO %	MgO %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	Na_2O %	K_2O %	TiO_2 %	P_2O_5 %	MnO %	Cr_2O_3 %	Ba ppm	Sr ppm	Others* ppm	LOI %	LOI-CO_2EQ	SUM %
94-8 Mountain East of Martin Creek - Location 2 (Fig. 7.4)																			
7792	Livingstone	9¼	51.16	2.05	2.19	0.50	0.23	0.04	0.18	0.02	0.02	0.02	0.006	12	259	<53	43.60	1.23	100.05
7791	Livingstone	5	46.67	6.17	2.26	0.50	0.20	0.04	0.07	0.03	0.05	0.02	0.004	12	254	<47	44.00	0.69	100.05
94-9 Storm Mountain - South Ridge (Fig. 7.4)																			
9734	Livingstone	2½	50.25	3.14	4.36	0.17	<0.05	0.02	<0.05	<0.01	0.02	<0.01	0.009	<5	269	<68	42.00	-0.84	100.01
9733	Livingstone	3	41.39	8.31	8.27	0.16	0.41	0.01	<0.05	<0.01	0.04	<0.01	0.085	5	189	<164	41.00	-0.51	99.72
9732	Livingstone	1½	50.41	4.07	2.29	0.15	<0.05	0.01	0.16	<0.01	0.04	<0.01	0.009	<5	321	<66	42.90	-1.06	100.09
9731	Livingstone	1	44.29	9.44	0.46	0.16	<0.05	<0.01	0.06	0.01	0.05	<0.01	0.005	6	172	<62	45.00	-0.01	99.51
9730	Livingstone	2¼	53.08	2.09	0.39	0.14	<0.05	0.01	<0.05	0.01	0.01	<0.01	0.006	<5	242	<60	44.13	-0.60	99.89
9729	Livingstone	1	30.70	22.68	0.52	0.17	<0.05	<0.01	<0.05	<0.01	0.06	<0.01	0.004	<5	70	<62	46.40	-2.39	100.62
9728	Livingstone	2¼	54.48	0.70	0.75	0.21	<0.05	0.01	<0.05	<0.01	0.01	<0.01	0.003	7	275	<42	43.72	-0.46	99.91
9727	Banff	¾	48.46	1.21	7.81	1.67	0.59	0.03	0.79	0.05	0.08	0.02	0.007	251	396	<75	39.20	-0.07	100.01
9726	Banff	½	52.60	0.71	3.53	0.72	0.19	0.02	0.20	0.05	0.05	0.01	0.008	19	326	<55	41.90	-0.10	100.03
9725	Banff	¾	43.25	6.49	6.81	1.32	0.70	0.01	0.54	0.09	0.05	0.01	0.006	80	290	<60	40.70	-0.28	100.03
94-10 Dipslope Mountain (Fig. 7.4)																			
9739	Livingstone	7	54.87	0.58	0.28	0.15	<0.05	0.02	<0.05	<0.01	0.02	<0.01	0.005	<5	286	<54	43.87	-0.98	99.82
9737	Livingstone	8¼	54.66	0.66	0.29	0.19	<0.05	0.02	0.12	<0.01	0.03	<0.01	0.008	<5	277	<67	43.79	-1.18	99.80
9736	Livingstone	4	54.81	0.62	0.34	0.16	<0.05	0.02	<0.05	0.01	0.03	<0.01	0.007	<5	238	<50	43.86	-0.55	99.88
9738	Livingstone	1	54.28	0.98	0.41	0.18	<0.05	0.02	<0.05	<0.01	0.01	<0.01	0.006	<5	211	<42	43.86	-1.47	99.77
9735	Livingstone	2¾	53.94	1.30	0.42	0.16	<0.05	0.02	<0.05	0.01	<0.01	<0.01	0.005	<5	296	<60	43.95	-0.89	99.83
94-11 Gap on North Saskatchewan River (Fig. 7.4)																			
9351	Livingstone	3¾	43.46	10.19	1.40	0.24	0.10	0.05	<0.05	0.04	0.05	<0.01	0.007	<5	207	<49	44.60	-0.58	100.22
9352	Livingstone	3	31.48	17.60	7.54	0.31	0.12	0.05	0.08	<0.01	0.08	<0.01	0.004	6	160	<93	43.40	-0.44	100.70
9353	Livingstone	2	31.35	20.04	2.54	0.28	0.08	0.03	<0.05	0.01	0.10	<0.01	0.006	7	134	<45	45.90	-0.48	100.41
9354	Livingstone	~7¼	54.69	0.75	0.29	0.18	<0.05	0.04	<0.05	<0.01	0.04	<0.01	0.003	<5	332	<44	43.90	-0.23	99.93
9355	Livingstone	~4½	49.81	0.71	8.89	0.18	<0.05	0.04	<0.05	<0.01	0.01	<0.01	<0.002	<5	250	<46	40.50	0.65	100.18
9356	Livingstone	4½	55.24	0.49	0.20	0.20	<0.05	0.05	<0.05	<0.01	0.02	<0.01	0.002	<5	276	<61	43.90	0.03	100.16
9357	Livingstone	6¾	55.05	0.45	0.31	0.16	<0.05	0.04	<0.05	<0.01	0.01	<0.01	0.002	<5	270	<57	43.88	-0.19	99.93
9358	Livingstone	~6	54.83	0.63	0.24	0.20	<0.05	0.05	<0.05	0.01	<0.01	<0.01	0.003	<5	308	<53	43.92	-0.40	99.91
9001	Banff	¼	25.66	9.89	27.95	3.26	1.13	0.15	1.53	0.19	0.07	0.03	0.005	132	145	<123	31.00	0.14	100.92

*Sum of Nb, Ni, Sc, Y, and Zr (Appendix 3A).

APPENDIX 9B: DETERMINED CONCENTRATIONS OF CHEMICAL CONSTITUENTS IN SAMPLES COLLECTED IN 1995

All values are as determined by Central Laboratory of Continental Lime Inc. LOI, LOI-CO2 EQ and SUM are the adjusted values of Acme analyses from Appendix 8B.
At each location samples are listed in order from stratigraphic top to bottom with covered or other unsampled intervals omitted. See Appendix 2B for sample descriptions.

Sample	Formation	Strat. Thick. (m)	CaO %	MgO %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	Na_2O ppm	K_2O ppm	TiO_2 ppm	P_2O_5 ppm	MnO ppm	Cr_2O_3 %	Ba ppm	Sr ppm	Others* ppm	LOI %	LOI-CO_2EQ	SUM %
95-1 South End of Ridge Trending Southerly from Little Shunda Mountain (Fig. 7.1)																			
10773	Livingstone	~2¼	49.42	4.78	0.38	0.058	0.087	191	292	26	<70	32	-	6	365	-	-	-	98.83
10772	Livingstone	1	54.54	0.47	0.10	0.020	0.020	95	83	8	<70	19	-	4	485	-	-	-	98.55
10771	Livingstone	~3⅛	54.79	0.44	0.10	0.017	0.034	134	68	9	<70	16	0.004	5	521	-	43.8	0.01	98.93
10770	Livingstone	2½	54.96	0.39	0.12	0.019	0.026	128	73	10	<70	17	-	4	502	-	-	-	99.16
95-2 Along Cut Line South of Little Shunda Mountain (Fig. 7.1)																			
10769	Livingstone	~6½	53.76	1.1	0.64	0.04	0.029	174	170	22	<70	12	0.001	7	481	-	43.71	-5.56	99.06
95-3 Creek Gorge about 2¾ km West of Shunda Mountain Road (Fig. 7.1)																			
10728	Livingstone	1	54.28	0.61	0.27	0.034	0.034	164	154	15	75	14	-	4	486	-	-	-	98.59
10727	Livingstone	4½	54.32	0.57	0.21	0.022	0.027	145	87	7	73	17	-	5	451	-	-	-	98.48
10726	Livingstone	2⅛	54.53	0.64	0.13	0.023	0.033	163	78	8	<70	17	-	6	470	-	-	-	98.92
10775	Livingstone	3	53.69	1.09	0.3	0.03	0.035	174	142	12	<70	20	-	6	445	-	-	-	98.54
10774	Livingstone	3	53.94	0.86	0.24	0.052	0.05	174	224	27	<70	22	-	5	431	-	-	-	98.50
95-4 Creek Valley about 2 km West of Shunda Mountain (Fig. 7.1)																			
10734	Livingstone	2	54.81	0.51	0.65	0.02	0.037	161	86	9	<70	19	-	5	509	-	-	-	99.69
10733	Livingstone	1¾	54.56	0.45	0.14	0.028	0.034	168	104	12	<70	18	-	6	518	-	-	-	98.61
10732	Livingstone	½	54.66	0.47	0.2	0.03	0.044	172	124	14	<70	18	0.002	5	562	-	43.87	-0.73	98.89
10731	Livingstone	1¼	54.58	0.46	0.11	0.017	0.025	186	78	7	<70	17	<0.001	5	468	-	43.88	-1.11	98.60
10730	Livingstone	1½	54.94	0.42	0.11	0.019	0.028	167	58	7	<70	19	-	4	497	-	-	-	99.19
10729	Livingstone	¼	54.85	0.38	0.09	0.016	0.025	113	60	7	<70	18	-	6	580	-	-	-	98.91
95-5 Shallow Creek Bed on Southwest Flank of Shunda Mountain (Fig. 7.1)																			
10736	Livingstone	1⅔	46.79	7.00	0.51	0.038	0.029	173	166	24	<70	20	-	6	322	-	-	-	98.81
10735	Livingstone	1⅓	44.50	8.25	1.10	0.101	0.048	206	447	66	<70	28	0.001	10	304	-	45.00	0.37	98.02
10762	Livingstone	4	53.47	1.24	0.45	0.030	0.018	179	134	13	<70	23	-	7	433	-	-	-	98.61
10761	Livingstone	2	54.34	0.54	0.28	0.028	0.021	158	127	14	<70	25	-	7	416	-	-	-	98.52
10760	Livingstone	~1	55.03	0.35	0.13	0.023	0.018	139	86	9	<70	24	-	7	459	-	-	-	99.19

*Sum of Nb, Ni, Sc, Y, and Zr (Appendix 4B).

APPENDIX 9B: CONTINUED

Sample	Formation	Strat. Thick. (m)	CaO %	MgO %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	Na_2O ppm	K_2O ppm	TiO_2 ppm	P_2O_5 ppm	MnO %	Cr_2O_3 %	Ba ppm	Sr ppm	Others* ppm	LOI %	LOI-CO_2EQ	SUM %
95-6 Dip Slope 2 km South of Shunda Mountain (Fig. 7.1)																			
10763	Livingstone	~1¼	54.45	0.64	0.44	0.056	0.033	206	199	28	<70	19	-	6	428	-	-	-	99.15
95-7 Approximate Dipslope on Southwest Flank of Colliseum Mountain (Fig. 7.1)																			
10759	Livingstone	3¼	54.34	0.82	0.35	0.035	0.028	159	158	18	<70	14	-	7	424	-	-	-	99.18
10758	Livingstone	¾	51.57	2.58	0.49	0.044	0.035	165	183	24	<70	17	-	6	423	-	-	-	98.09
10757	Livingstone	3	54.69	0.47	0.25	0.033	0.023	182	142	12	<70	14	-	5	421	-	-	-	99.00
10756	Livingstone	3⅛	54.51	0.41	0.09	0.017	0.015	136	74	6	<70	12	-	5	485	-	-	-	98.34
10755	Livingstone	~1½	54.73	0.34	0.18	0.016	0.016	126	79	5	<70	17	<0.001	5	408	-	43.80	0.12	98.67
95-8 North Side of Highway 11 about ½ to $^2/_3$ km East of Nordegg Turnoff (Fig. 7.1)																			
10767	Livingstone	6	48.14	5.79	0.47	0.063	0.050	218	332	32	95	17	-	8	342	-	-	-	98.72
10768	Livingstone	~2	43.12	9.96	0.73	0.105	0.063	258	502	55	175	31	-	12	237	-	-	-	98.82
10766	Livingstone	1¾	50.41	3.82	0.58	0.075	0.045	262	378	38	76	19	-	8	365	-	-	-	98.76
10765	Livingstone	1	54.62	0.54	0.23	0.030	0.022	286	138	15	92	17	-	7	418	-	-	-	99.00
10764	Livingstone	4	53.64	1.05	0.24	0.054	0.043	261	225	27	84	23	-	17	426	-	-	-	98.36

*Sum of Nb, Ni, Sc, Y, and Zr (Appendix 4B).

APPENDIX 9C: DETERMINED AND PREFERRED CONCENTRATIONS OF CHEMICAL CONSTITUENTS IN SAMPLES COLLECTED IN 1997

Major constituents are as determined by the Quality Assurance Laboratory of Continental Lime Inc. except for CaO, LOI, and SUM which have been adjusted, where required, to the preferred values in Appendix 8C. Concentrations of Cr_2O_3 and other minor constituents are as determined by Acme Analytical Laboratory Ltd. At each location samples are listed in order from stratigraphic top to bottom with covered or other unsampled intervals omitted. See Appendix 2C for sample descriptions.

Sample	Formation	Strat. Thick. (m)	CaO %	MgO %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	Na_2O %	K_2O %	TiO_2 %	P_2O_5 %	MnO %	Cr_2O_3 %	BaO ppm	$SrCO_3$ ppm	Others* ppm	LOI %	LOI-CO_2EQ	SUM %
97-1 NW Shore of Coyote Lake (Fig. 7.1)																			
11576	Livingstone	¼	41.76	11.12	1.34	0.087	0.093	199	388	113	157	37	0.002	15	293	30	44.98	0.08	99.44
11577	Livingstone	5½	52.58	2.50	0.43	0.053	0.050	158	269	35	122	27	-	17	422	-	44.35	0.36	99.7
11578	Livingstone	5¼	55.17	0.46	0.23	0.032	0.038	140	106	9	<70	28	-	6	468	-	43.67	-0.17	99.83
97-2 Ridge Trending Southeast from Coyote Lake (Fig. 7.1)																			
11579	Livingstone	5	55.23	0.44	0.17	0.028	0.032	133	103	9	<70	29	0.001	6	467	30	43.77	-0.12	99.85
97-3 Easterly Trending Ridge Top North of North Knob (Fig. 7.1)																			
11580	Banff	2	53.83	0.77	1.17	0.184	0.569	106	1061	219	148	45	-	22	549	-	42.72	-0.4	99.86
97-4 Tributary Creek Northeast of North Knob (Fig. 7.1)																			
11581	Livingstone	4	55.13	0.43	0.3	0.038	0.052	145	140	17	<70	28	-	10	660	-	43.68	-0.07	99.78
97-5 North Flank of Coliseum Mountain (Fig. 7.1)																			
11609	Upper Palliser	10	53.41	0.98	1.90	0.286	0.176	83	1458	128	78	105	-	14	469	-	43.17	0.18	99.95
11608	Upper Palliser	6	53.87	0.73	1.72	0.251	0.122	81	1272	106	<70	61	-	20	490	-	43.21	0.13	99.96
11607	Upper Palliser	7½	52.31	1.69	2.17	0.369	0.224	117	1897	178	122	95	-	14	449	-	42.94	0.04	99.95
11606	Upper Palliser	6	53.41	1.07	1.69	0.233	0.157	113	1110	128	<70	57	-	17	459	-	43.34	0.25	99.82
11605	Upper Palliser	1½	48.42	5.23	1.25	0.178	0.141	121	767	75	<70	84	-	54	363	-	44.15	0.43	99.08

*Sum of Nb, Ni, Sc, Y, and Zr (Appendix 5C).

APPENDIX 9C CONTINUED

Sample	Formation	Strat. Thick. (m)	CaO %	MgO %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	Na_2O %	K_2O %	TiO_2 %	P_2O_5 %	MnO %	Cr_2O_3 %	Ba ppm	Sr ppm	Others* ppm	LOI %	LOI-CO_2EQ	SUM %
97-6 Creek on Southwest Flank of Coliseum Mountain (Fig. 7.1)																			
11558	Livingstone	2¼	49.08	5.29	0.46	0.072	0.076	150	254	43	157	19	-	17	377	-	44.45	0.16	99.37
11557	Livingstone	2¼	45.65	8.34	0.55	0.094	0.100	184	416	88	<70	25	-	18	309	-	44.88	-0.05	99.76
11556	Livingstone	1½	48.05	6.27	0.29	0.057	0.090	178	216	43	91	33	-	23	304	-	44.62	0.07	99.41
11555	Livingstone	2	55.08	0.49	0.29	0.051	0.038	142	190	28	85	18	-	15	468	-	43.73	-0.12	99.88
11554	Livingstone	2	55.03	0.44	0.39	0.098	0.067	128	330	88	<70	23	-	25	432	-	43.55	-0.18	99.86
11553	Livingstone	2½	55.13	0.46	0.23	0.059	0.059	140	209	21	<70	27	-	16	440	-	43.72	-0.14	99.85
11552	Livingstone	2½	54.80	0.74	0.27	0.042	0.044	131	135	122	<70	27	-	16	482	-	43.46	-0.41	99.85
97-7 Cliff Outcrop at Western Bank of Martin Creek (Fig. 7.4)																			
12214	Livingstone	7	55.07	0.49	0.49	0.039	0.043	118	113	14	<70	14	-	13	517	-	43.91	0.15	99.96
12217	Livingstone	7	55.09	0.56	0.29	0.044	0.034	135	103	12	<70	16	-	14	529	-	44.08	0.23	99.94
12213	Livingstone	5	54.18	1.29	0.37	0.044	0.043	168	153	18	<70	19	-	12	438	-	44.15	0.21	99.94
12212	Livingstone	1	35.22	17.29	0.58	0.110	0.099	218	458	58	198	45	-	17	156	-	46.21	-0.29	99.94
12216	Livingstone	5	39.96	13.23	0.60	0.111	0.097	200	446	64	339	43	-	40	231	-	45.53	-0.24	99.94
12215	Livingstone	4	53.56	1.88	0.29	0.053	0.047	133	184	21	74	20	-	10	388	-	44.16	0.07	99.99
97-8 Northern Flank of Mountain East of Martin Creek and South of Highway 11 (Fig. 7.4)																			
11652	Upper Palliser	8	51.19	2.80	1.88	0.324	0.174	121	1564	138	164	188	-	13	449	-	43.42	0.19	99.87
11651	Upper Palliser	7	46.71	6.16	2.16	0.373	0.188	149	1697	180	<70	169	-	14	383	-	43.75	0.36	99.23
97-9 Southwest Side of Ridge at North End of Dipslope Mountain (Fig. 7.4)																			
11587	Livingstone	7½	55.12	0.51	0.20	0.029	0.032	121	66	185	88	16	-	10	528	-	43.66	-0.22	99.85
11586	Livingstone	1½	43.10	7.37	6.25	0.058	0.148	143	164	91	84	38	0.004	15	327	174	41.71	-0.16	98.88
11585	Livingstone	6¼	54.51	0.71	0.15	0.037	0.118	141	106	147	166	18	-	12	498	-	43.96	0.41	99.19
11584	Livingstone	4¾	52.71	1.86	0.31	0.051	0.046	140	218	183	<70	25	0.003	47	402	30	43.99	0.58	98.47
11583	Livingstone	3¼	50.64	3.85	0.58	0.091	0.079	153	439	35	78	42	-	15	411	-	44.22	0.27	99.31
11582	Livingstone	¼	46.84	6.98	0.70	0.116	0.105	139	490	50	73	48	-	16	353	-	44.39	0.01	99.23

*Sum of Nb, Ni, Sc, Y, and Zr (Appendix 5C).

APPENDIX 9C CONTINUED

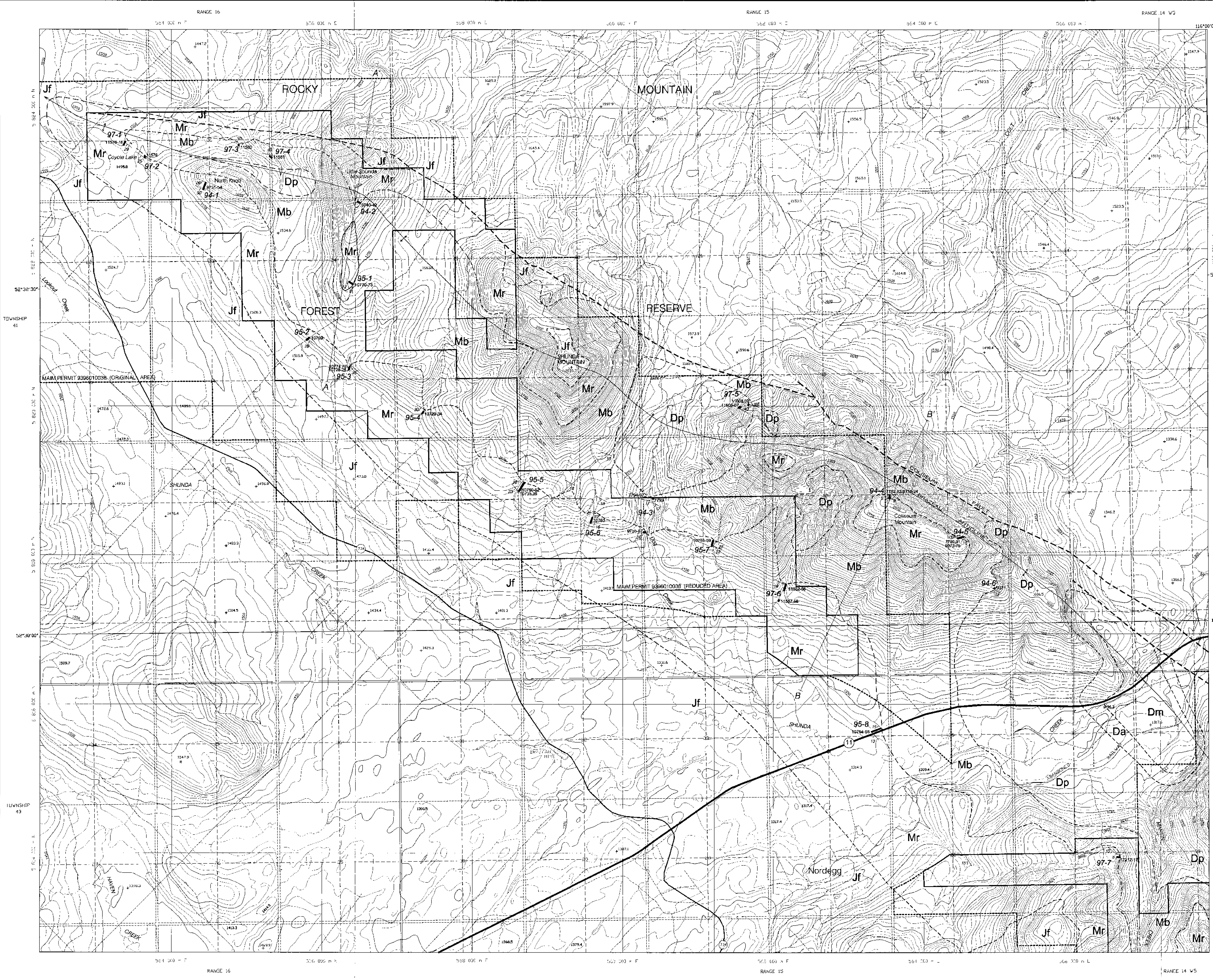
Sample	Formation	Strat. Thick. (m)	CaO %	MgO %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	Na_2O %	K_2O %	TiO_2 %	P_2O_5 %	MnO %	Cr_2O_3 %	Ba ppm	Sr ppm	Others* ppm	LOI %	LOI-CO_2EQ	SUM %
97-10 Southwest Side of Ridge near North End of Dipslope Mountain (Fig. 7.4)																			
11592	Livingstone	2	54.94	0.52	0.10	0.022	0.039	132	62	12	71	19	-	10	514	-	43.89	0.2	99.39
11591	Livingstone	2½	54.95	0.52	0.14	0.027	0.033	136	76	23	77	19	-	12	494	-	43.96	0.26	99.44
11590	Livingstone	2¾	53.05	1.78	0.32	0.049	0.062	130	198	69	128	28	-	20	420	-	43.97	0.39	98.93
11589	Livingstone	4½	47.62	6.62	0.30	0.136	0.112	155	196	46	109	48	-	14	386	-	44.65	0.05	99.48
11588	Livingstone	¼	54.81	0.56	0.34	0.031	0.092	89	110	34	103	43	-	16	570	-	43.70	0.07	99.57
97-11 Southwest Flank of Dipslope Mountain 200 m Down Ridge (Fig. 7.4)																			
11596	Livingstone	5½	54.90	0.52	0.21	0.029	0.035	150	86	12	152	20	-	8	482	-	43.88	0.23	99.43
11595	Livingstone	3	44.94	8.90	0.36	0.065	0.110	183	256	84	<70	52	-	10	262	-	45.15	0.16	99.44
11594	Livingstone	2	54.97	0.55	0.21	0.029	0.072	137	87	30	75	29	-	15	546	-	43.86	0.11	99.65
11593	Livingstone	1/3	54.86	0.58	0.24	0.033	0.087	123	113	41	<70	42	-	18	594	-	43.79	0.09	99.58
97-12 Low Point in Saddle on Dipslope Mountain (Fig. 7.4)																			
11597	Livingstone	6	46.75	6.96	0.61	0.071	0.064	130	246	36	137	27	-	20	347	-	44.68	0.4	98.84
11604	Livingstone	2	45.94	8.07	0.49	0.064	0.093	159	250	75	<70	30	-	8	341	-	44.95	0.08	99.61
11598	Livingstone	7	53.79	1.54	0.38	0.054	0.048	127	206	26	<70	18	-	11	497	-	43.96	-0.01	99.87
11599	Livingstone	5½	51.44	3.09	0.32	0.052	0.064	137	141	15	97	29	-	17	492	-	44.24	0.49	98.78
11600	Livingstone	5	52.15	2.45	0.17	0.036	0.043	154	116	19	<70	26	0.003	16	458	30	44.37	0.76	98.52
97-13 Cliff section at Top of East Side of Ridge Between Second and Third Peaks from Southeast End of Dipslope Mountain (Fig. 7.4)																			
11603	Livingstone	½	51.09	2.94	1.20	0.057	0.061	121	217	27	204	23	0.002	18	401	44	43.83	0.53	98.75
11602	Livingstone	2	54.74	0.59	0.40	0.028	0.047	120	92	21	75	20	-	15	447	-	43.76	0.15	99.49
11601	Livingstone	3½	54.88	0.55	0.27	0.029	0.042	148	86	30	106	21	-	9	419	-	43.88	0.21	99.52
11575	Livingstone	3	54.84	0.81	0.22	0.033	0.045	131	115	41	289	21	-	11	407	-	44.02	0.12	99.97
11574	Livingstone	2	53.60	1.69	0.39	0.048	0.077	154	219	68	364	21	-	20	388	-	44.01	0.13	99.83
11573	Livingstone	2¾	54.90	0.54	0.19	0.032	0.051	134	97	40	129	20	-	14	568	-	44.04	0.36	99.48
11572	Livingstone	3	55.09	0.62	0.16	0.031	0.054	150	85	30	70	20	-	16	539	-	43.96	0.04	99.95
11571	Livingstone	3	55.23	0.45	0.11	0.031	0.055	131	65	46	96	22	0.002	13	458	41	43.74	-0.19	99.88
11570	Livingstone	4	54.98	0.50	0.12	0.037	0.119	129	95	233	<70	24	-	10	455	-	43.79	0.09	99.54
11569	Livingstone	4	55.13	0.46	0.25	0.034	0.063	126	130	36	<70	29	-	12	533	-	43.56	-0.29	99.84

*Sum of Nb, Ni, Sc, Y, and Zr (Appendix 5C).

APPENDIX 9C CONTINUED

Sample	Formation	Strat. Thick. (m)	CaO %	MgO %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	Na_2O %	K_2O %	TiO_2 %	P_2O_5 %	MnO %	Cr_2O_3 %	Ba ppm	Sr ppm	Others* ppm	LOI %	LOI-CO_2EQ	SUM %
97-14 South of Second Peak from Southeast End of Dipslope Mountain (Fig. 7.4)																			
11568	Livingstone	3	55.23	0.45	0.13	0.026	0.065	129	62	50	<70	23	-	16	524	-	43.69	-0.16	99.82
11567	Livingstone	3	55.16	0.50	0.13	0.030	0.063	113	101	51	<70	27	-	15	520	-	43.75	-0.17	99.88
11566	Livingstone	1¾	54.59	0.72	0.56	0.067	0.115	103	326	63	<70	41	-	16	558	-	43.40	-0.31	99.87
97-15 Near Southeastern most Peak of Dipslope Mountain Overlooking the Gap on the North Saskatchewan River (Fig. 7.4)																			
11565	Livingstone	3¼	55.04	0.56	0.21	0.036	0.067	143	127	29	109	22	-	21	542	-	43.85	-0.01	99.85
11564	Livingstone	1½	55.13	0.49	0.22	0.026	0.050	174	84	28	98	25	-	11	470	-	43.84	-0.01	99.85
11563	Livingstone	3	55.19	0.49	0.13	0.031	0.046	145	84	37	<70	19	-	20	463	-	43.82	-0.04	99.81
11562	Livingstone	1¼	55.02	0.46	0.09	0.024	0.041	141	61	22	<70	18	-	11	453	-	43.76	0.07	99.39
11561	Livingstone	3½	55.19	0.48	0.13	0.021	0.059	144	61	13	<70	21	0.002	12	498	30	43.76	-0.18	99.87
11560	Livingstone	2¼	55.02	0.55	0.25	0.044	0.071	145	178	31	<70	23	-	10	540	-	43.79	-0.06	99.88
11559	Livingstone	2½	54.58	0.61	0.36	0.056	0.092	141	258	65	82	34	-	16	517	-	43.8	0.29	99.31

*Sum of Nb, Ni, Sc, Y, and Zr (Appendix 5C).



LEGEND AND SYMBOLS

JURASSIC

Jf	Fernie Formation: shale, sandstone, carbonates

MISSISSIPPIAN

Mr	Rundle Group: finely crystalline dolomite, finely to coarsely crystalline limestone, shale
Mb	Banff Formation: argillaceous and cherty limestone, fissile and calcareous shale

DEVONIAN

Dp	Palliser Formation: massive mottled limestone and dolomite, porous and vuggy dolomite, argillaceous limestone
Da	Alexo Formation: silty dolomite, sandstone, dolomite breccia
Dm	Mount Hawk Formation: brown cherty dolomite, dark grey argillaceous limestone

Geological boundary

Bedding (inclined, vertical, overturned, horizontal) — 30, 75

Fault (approximate)

Synclinal axis (arrow indicates plunge)

Anticlinal axis (arrow indicates plunge)

Sample section with sample numbers — 97-4 9755-57

Isolated sample with sample number — 11551

Location of cross-section — B B'

Elevation contour (interval: 10 m) — 1450

Highway with number — 11

Trail or cut line

MAIM Permit boundary (reduced area)

MAIM Permit boundary (original area)

NOTES

1) Map compiled from 1 : 20 000 scale digital base maps 83C/8NE and 83C/9SE supplied by Spatial Data Warehouse Ltd., Calgary, Alberta.
2) Geology modified after Erdman (1950), Douglas (1956, 1958), and Holter (1976).
3) UTM grid is based on North American Datum, 1983 (NAD83); UTM grid zone: 11U.

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EDMONTON, ALBERTA

Fig. 7.1

Geology and Sample Locations, North Part of MAIM Permit 9396010038

WEST-CENTRAL ALBERTA

0 1 2 km
Scale

W.M. 1998.05

LEGEND AND SYMBOLS

JURASSIC

Jf — Fernie Formation: shale, sandstone, carbonates

MISSISSIPPIAN

Mr — Rundle Group: finely crystalline dolomite, finely to coarsely crystalline limestone, shale

Mb — Banff Formation: argillaceous and cherty limestone, fissile and calcareous shale

DEVONIAN

Dp — Palliser Formation: massive mottled limestone and dolomite, porous and vuggy dolomite, argillaceous limestone

Da — Alexo Formation: silty dolomite, sandstone, dolomite breccia

Dm — Mount Hawk Formation: brown cherty dolomite, dark grey argillaceous limestone

- Geological boundary
- Bedding (inclined, vertical, overturned, horizontal)
- Fault
- Synclinal axis (arrow indicates plunge)
- Anticlinal axis (arrow indicates plunge)
- Sample section with sample numbers (e.g. 97-12)
- Isolated sample with sample number (e.g. 11561)
- Location of cross-section (B – B')
- Elevation contour (interval: 10 m)
- Highway with number
- Trail or cut line
- MAIM Permit boundary (reduced area)
- MAIM Permit boundary (original area)

NOTES

1) Map compiled from 1 : 20 000 scale digital base maps 83B/2NW and 83C/8NE supplied by Spatial Data Warehouse Ltd., Calgary, Alberta.
2) Geology modified after Erdman (1950), Douglas (1958, 1959), and Hoefer (1976).
3) UTM grid is based on North American Datum, 1983 (NAD83); UTM grid zone: 11U.

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Fig. 7.4

Geology and Sample Locations,
South Part of MAIM Permit 9396010038

WEST-CENTRAL ALBERTA

0 1 2 km
Scale

W.M. 1998.05