

SASKATCHEWAN INSTITUTE OF PEDOLOGY

GEOLOGY OF THE SHAUNAVON PROJECT
SASKATCHEWAN

Report 0083-001-02 December 1, 1985

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Saskatchewan Institute of Pedology
University of Saskatchewan
Saskatoon, Saskatchewan

Attention: Dr. J.L. Henry

Dear Dr. Henry:

Enclosed are six copies of:

- (a) information sheet (Drawing 0083-001-01),
- (b) cross sections AA', BB', and CC' (Drawings 0083-001-02-04),
- (c) results of carbonate (p. 2-7) and grain size analyses (p. 9) on bedrock and till,
- (d) x-ray diffraction patterns of bedrock and till (p. 11-15),
- (e) geologic logs (p. 17-21), and
- (f) five history of deglaciation phases (Figs. 1-5).

The regional cross sections (Drawings 0083-001-02,03) show three bedrock aquifers: namely; the Judith River Formation; the Eastend, Whitemud, Battle, and Frenchman Formations unit; and the Ravenscrag Formation.

The salinity project areas are underlain by the Eastend, Whitemud, Battle, and Frenchman Formations unit.

A detailed cross section (Drawing 0083-001-04) was drawn from a Ravenscrag upland through project 82-2 to Rock Creek. The Eastend, Whitemud, Battle, and Frenchman Formations unit occurs throughout the cross section and represents the most permeable path for groundwater movement.

Three tills were encountered in testhole 82-2-104. The presence of weathering zones on the top of these tills indicate they were deposited by separate glaciations. Although sands and gravels of possible inter-till origin were encountered in testhole 82-2-104, these deposits were not encountered in any of the other testholes suggesting intertill aquifers have a limited extent in the project area.

Although the finer-grained sediments in both the Eastend, Whitemud, Battle, and Frenchman Formations unit and the Bearpaw Formation have a high silt and clay content (p. 9), they differ in clay mineral content (p. 11,12). The Bearpaw Formation has a much higher montmorillonite content than the Eastend, Whitemud, Battle, and Frenchman Formations unit. This difference would account for the rapid thickening of the drilling fluid when the Bearpaw Formation was encountered during test drilling.

The history of deglaciation of the Shaunavon area and surrounding region is shown in five sketches (Figs. 1-5). This interpretation is based on Christiansen (1979, enclosed). For more detailed location of the features shown within the Shaunavon area, the reader is referred to Drawing 0083-001-01. Attention is drawn in the following to the deglaciation of this area.

During Phase 1 (Fig. 1), meltwater drained from the Conglomerate Channel into the Frenchman Channel which in turn drained into the Missouri River. During Phase 2 (Fig. 2), meltwater drained through the "sidehill" Jones Channel into the Frenchman Channel.

To explain the upper part of the Swift Current Channel, it is postulated the lobe of ice south of the Frenchman Channel re-advanced northward diverting the Frenchman Channel into the Swift Current Channel (Fig. 3). During this phase, the Bone Channel drained into the Swift Current Channel which in turn drained into the Pelletier Channel, Lake Kincaid, the Big Muddy Spillway, and the Missouri River.

During Phase 4 (Fig. 4), the glacier retreated south of the Frenchman Channel, and the Channel returned to its previous course abandoning the upper part of the Swift Current Channel. The Bone, Swift Current, and Pelletier Channels drained into Lake Kincaid which in turn drained through the Big Muddy Spillway into the Missouri River.

During Phase 5 (Fig. 5), the lobe of ice south of the Frenchman Channel retreated into Alberta, and the Milk River Spillway came into existence. A glacial lake in the vicinity of Gull Lake drained through the Reid, Swift Current, and Pelletier Spillways into Lake Kincaid which in turn drained through the Big Muddy Spillway into the Missouri River.

When you have had a opportunity to study these results, we can discuss them further at your convenience.

Sincerely yours,

E.A. Christiansen

CARBONATE ANALYSES

SAMPLE 1014 0-5
CALCIUM(WT%)= 2.05
MAGNESIUM(WT%)= 0.94
DOLOMITE(WT%) 7.13
CALCITE(WT%)= 1.25
CO₂ EQUIVALENTS(S.T.P.)(MLS/GM)= 20.12

SAMPLE 5-10
CALCIUM(WT%)= 2.21
MAGNESIUM(WT%)= 1.02
DOLOMITE(WT%) 7.74
CALCITE(WT%)= 1.32
CO₂ EQUIVALENTS(S.T.P.)(MLS/GM)= 21.75

SAMPLE 10-15
CALCIUM(WT%)= 2.51
MAGNESIUM(WT%)= 0.97
DOLOMITE(WT%) 7.36
CALCITE(WT%)= 2.27
CO₂ EQUIVALENTS(S.T.P.)(MLS/GM)= 22.97

SAMPLE 15-20
CALCIUM(WT%)= 2.31
MAGNESIUM(WT%)= 0.91
DOLOMITE(WT%) 6.90
CALCITE(WT%)= 2.02
CO₂ EQUIVALENTS(S.T.P.)(MLS/GM)= 21.29

SAMPLE 20-25
CALCIUM(WT%)= 2.35
MAGNESIUM(WT%)= 0.90
DOLOMITE(WT%) 6.83
CALCITE(WT%)= 2.16
CO₂ EQUIVALENTS(S.T.P.)(MLS/GM)= 21.43

SAMPLE 25-30
CALCIUM(WT%)= 2.41
MAGNESIUM(WT%)= 0.94
DOLOMITE(WT%) 7.13
CALCITE(WT%)= 2.15
CO₂ EQUIVALENTS(S.T.P.)(MLS/GM)= 22.13

SAMPLE 30-35
CALCIUM(WT%)= 2.76
MAGNESIUM(WT%)= 1.06
DOLOMITE(WT%) 6.04
CALCITE(WT%)= 2.03
CO₂ EQUIVALENTS(S.T.P.)(MLS/GM)= 25.19

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SAMPLE 103: 0-5
CALCIUM(WT%)= 2.72
MAGNESIUM(WT%)= 1.01
DOLOMITE(WT%) 7.66
CALCITE(WT%)= 2.63
CO₂ EQUIVALENTS(S.T.P.)(MLS/GM)= 24.51

SAMPLE 5-10
CALCIUM(WT%)= 2.04
MAGNESIUM(WT%)= 0.92
DOLOMITE(WT%) 6.98
CALCITE(WT%)= 1.31
CO₂ EQUIVALENTS(S.T.P.)(MLS/GM)= 19.88

SAMPLE 10-15
CALCIUM(WT%)= 2.06
MAGNESIUM(WT%)= 0.86
DOLOMITE(WT%) 7.28
CALCITE(WT%)= 1.24
CO₂ EQUIVALENTS(S.T.P.)(MLS/GM)= 20.47

SAMPLE 15-20
CALCIUM(WT%)= 2.07
MAGNESIUM(WT%)= 0.87
DOLOMITE(WT%) 6.60
CALCITE(WT%)= 1.59
CO₂ EQUIVALENTS(S.T.P.)(MLS/GM)= 19.58

SAMPLE 25-30
CALCIUM(WT%)= 2.49
MAGNESIUM(WT%)= 1.16
DOLOMITE(WT%) 8.80
CALCITE(WT%)= 1.44
CO₂ EQUIVALENTS(S.T.P.)(MLS/GM)= 24.60

SAMPLE 35-40
CALCIUM(WT%)= 2.47
MAGNESIUM(WT%)= 1.11
DOLOMITE(WT%) 8.42
CALCITE(WT%)= 1.60
CO₂ EQUIVALENTS(S.T.P.)(MLS/GM)= 24.03

SAMPLE 45-50
CALCIUM(WT%)= 2.91
MAGNESIUM(WT%)= 1.25
DOLOMITE(WT%) 9.48
CALCITE(WT%)= 2.12
CO₂ EQUIVALENTS(S.T.P.)(MLS/GM)= 27.78

SAMPLE 55-60
CALCIUM(WT%)= 2.17
MAGNESIUM(WT%)= 0.98
DOLOMITE(WT%) 7.43
CALCITE(WT%)= 1.38
CO₂ EQUIVALENTS(S.T.P.)(MLS/GM)= 21.16

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SAMPLE 65-70

CALCIUM(WT%)=	1.64
MAGNESIUM(WT%)=	0.77
DOLOMITE(WT%)	5.84
CALCITE(WT%)=	0.93
CO ₂ EQUIVALENTS(S.T.P.)(MLS/GM)=	16.26

SAMPLE 70-75

CALCIUM(WT%)=	2.43
MAGNESIUM(WT%)=	0.95
DOLOMITE(WT%)	7.21
CALCITE(WT%)=	2.16
CO ₂ EQUIVALENTS(S.T.P.)(MLS/GM)=	22.33

SAMPLE 80-85

CALCIUM(WT%)=	1.89
MAGNESIUM(WT%)=	0.95
DOLOMITE(WT%)	7.21
CALCITE(WT%)=	0.81
CO ₂ EQUIVALENTS(S.T.P.)(MLS/GM)=	19.32

SAMPLE 85-90

CALCIUM(WT%)=	1.61
MAGNESIUM(WT%)=	0.85
DOLOMITE(WT%)	5.45
CALCITE(WT%)=	0.52
CO ₂ EQUIVALENTS(S.T.P.)(MLS/GM)=	16.83

SAMPLE 95-100

CALCIUM(WT%)=	1.64
MAGNESIUM(WT%)=	0.98
DOLOMITE(WT%)	7.43
CALCITE(WT%)=	0.56
CO ₂ EQUIVALENTS(S.T.P.)(MLS/GM)=	19.31

SAMPLE 105-110

CALCIUM(WT%)=	1.77
MAGNESIUM(WT%)=	1.03
DOLOMITE(WT%)	7.81
CALCITE(WT%)=	0.18
CO ₂ EQUIVALENTS(S.T.P.)(MLS/GM)=	19.38

SAMPLE 110-115

CALCIUM(WT%)=	2.26
MAGNESIUM(WT%)=	1.30
DOLOMITE(WT%)	9.86
CALCITE(WT%)=	0.29
CO ₂ EQUIVALENTS(S.T.P.)(MLS/GM)=	24.61

SAMPLE 115-120

CALCIUM(WT%)=	1.45
MAGNESIUM(WT%)=	0.88
DOLOMITE(WT%)	6.67
CALCITE(WT%)=	0.00
CO ₂ EQUIVALENTS(S.T.P.)(MLS/GM)=	16.21

E2-Z-1C:3

Fig. 3

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SAMPLE 125-130

CALCIUM(WT%)=	1.31
MAGNESIUM(WT%)=	0.76
DOLOMITE(WT%)	5.76
CALCITE(WT%)=	0.14
CO ₂ EQUIVALENTS(S.T.P.)(MLS/GM)=	14.32

SAMPLE 135-140

CALCIUM(WT%)=	1.88
MAGNESIUM(WT%)=	0.89
DOLOMITE(WT%)	6.75
CALCITE(WT%)=	1.03
CO ₂ EQUIVALENTS(S.T.P.)(MLS/GM)=	18.71

SAMPLE 145-150

CALCIUM(WT%)=	2.62
MAGNESIUM(WT%)=	0.86
DOLOMITE(WT%)	6.52
CALCITE(WT%)=	3.00
CO ₂ EQUIVALENTS(S.T.P.)(MLS/GM)=	22.57

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SAMPLE 104: 0-5
CALCIUM(WT%)= 4.21
MAGNESIUM(WT%)= 1.35
DOLOMITE(WT%) 10.24
CALCITE(WT%)= 4.96
CO₂ EQUIVALENTS(S,T,P.)(MLS/GM)= 35.97

SAMPLE 5-10
CALCIUM(WT%)= 3.20
MAGNESIUM(WT%)= 1.10
DOLOMITE(WT%) 8.34
CALCITE(WT%)= 3.46
CO₂ EQUIVALENTS(S,T,P.)(MLS/GM)= 28.02

SAMPLE 10-15
CALCIUM(WT%)= 2.58
MAGNESIUM(WT%)= 1.13
DOLOMITE(WT%) 8.95
CALCITE(WT%)= 1.53
CO₂ EQUIVALENTS(S,T,P.)(MLS/GM)= 25.29

SAMPLE 15-20
CALCIUM(WT%)= 2.92
MAGNESIUM(WT%)= 1.33
DOLOMITE(WT%) 10.09
CALCITE(WT%)= 1.82
CO₂ EQUIVALENTS(S,T,P.)(MLS/GM)= 26.57

SAMPLE 20-25
CALCIUM(WT%)= 2.68
MAGNESIUM(WT%)= 1.09
DOLOMITE(WT%) 8.27
CALCITE(WT%)= 2.21
CO₂ EQUIVALENTS(S,T,P.)(MLS/GM)= 25.02

SAMPLE 50-55
CALCIUM(WT%)= 3.62
MAGNESIUM(WT%)= 0.89
DOLOMITE(WT%) 6.75
CALCITE(WT%)= 5.38
CO₂ EQUIVALENTS(S,T,P.)(MLS/GM)= 28.43

SAMPLE 55-60
CALCIUM(WT%)= 3.79
MAGNESIUM(WT%)= 1.03
DOLOMITE(WT%) 7.81
CALCITE(WT%)= 5.22
CO₂ EQUIVALENTS(S,T,P.)(MLS/GM)= 30.67

SAMPLE 80-85
CALCIUM(WT%)= 2.19
MAGNESIUM(WT%)= 0.98
DOLOMITE(WT%) 7.43
CALCITE(WT%)= 1.43
CO₂ EQUIVALENTS(S,T,P.)(MLS/GM)= 21.27

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SAMPLE 90-95

CALCIUM(WT%)=	2.10
MAGNESIUM(WT%)=	1.00
DOLOMITE(WT%)	7.59
CALCITE(WT%)=	1.13
CO ₂ EQUIVALENTS+S,T,P,(MLS/GM)=	20.95

SAMPLE 100-105

CALCIUM(WT%)=	1.63
MAGNESIUM(WT%)=	0.81
DOLOMITE(WT%)	6.14
CALCITE(WT%)=	0.74
CO ₂ EQUIVALENTS+S,T,P,(MLS/GM)=	16.57

SAMPLE 110-115

CALCIUM(WT%)=	1.74
MAGNESIUM(WT%)=	0.97
DOLOMITE(WT%)	7.36
CALCITE(WT%)=	0.35
CO ₂ EQUIVALENTS+S,T,P,(MLS/GM)=	18.66

SAMPLE 130-135

CALCIUM(WT%)=	3.11
MAGNESIUM(WT%)=	1.17
DOLOMITE(WT%)	6.87
CALCITE(WT%)=	2.95
CO ₂ EQUIVALENTS+S,T,P,(MLS/GM)=	28.16

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GRAIN SIZE ANALYSES

SASKATCHEWAN RESEARCH COUNCIL

GRAIN SIZE ANALYSES *

Sample	Depth Feet	Wt.% Sand 2.0-.05mm	Wt.% Silt .05-.002mm	Wt.% Clay <.002mm	Geological Unit
82-2-101	70-75	4.5	55.1	40.4	Eastend Fm. etc.
	125-130	12.9	44.3	42.8	Bearpaw Fm.
82-2-103	190-200	15.5	46.9	37.5	Eastend Fm. etc.
	250-255	25.0	42.6	32.4	Bearpaw Fm.
82-2-104	5-10	37.7	25.7	36.6	Upper Till
	15-20	39.3	28.8	31.9	Middle Till
	50-55	38.7	31.1	30.2	Lower Till
	90-95	40.4	33.5	26.1	Lower Till
	120-125	47.1	29.2	23.7	Lower Till

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X-RAY DIFFRACTION PATTERNS



















