

**Cadmium in Soil and Grain in the Canadian Prairie Region.**

Interim Report; February 3, 1994  
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**Experiment 1. a)**

**Objectives:**

- 1) To determine the relationship between parent material and Cd levels from different agricultural regions of Manitoba.
- 2) To determine the relationship between climate and Cd levels from different agricultural regions of Manitoba.
- 3) To determine the potential for soil sampling with a "Dutch auger".

**Procedure:**

Soil samples were collected on a genetic horizon basis from three different agricultural regions of Manitoba, representing three different Cd levels in cereal crops (low, medium, and high). Four pedons were selected from two Soil Zones, the Black and Dark Gray Soil Zones. Three different parent materials were represented from the pedons studied. A shovel and a "Dutch auger" were both used as methods of collecting soil samples.

**Pedons Sampled in Manitoba.**

Cd in Cereal Crops	Soil Order	Parent Material	Soil Series
high	Chernozem	lacustrine	Lakeland
medium	Luvisol	shale till	Nayler
medium	Luvisol	mixed till	Pembina(2)
low	Chernozem	mixed till	Ryerson

## Results:

The paired t-test statistical analysis ( $\alpha = 0.05$ ) indicates that there was no contamination of Cd when the "Dutch auger" was used as the sampling tool. These results would allow for quick soil sampling to be carried out without the fear of Cd contamination from the sampling tool.

Soil characterizations for each of the four pedon's included: texture, bulk density, %  $\text{CaCO}_3$  equivalent, % organic carbon, pH, exchangeable cations, cation exchange capacity, citrate-dithionite-bicarbonate removable oxides, total cadmium, exchangeable cadmium, total:copper, iron, nickel, and zinc.

The two pedons from the Black Soil Zone in the Chernozem order with different parent materials (lacustrine and mixed till) indicate that;

- 1) There is a slightly higher total Cd content in the surface horizon of the lacustrine parent material (Lakeland soil),  $0.516 \mu\text{g/g}$  compared to  $0.386 \mu\text{g/g}$  in the surface horizon of the mixed till parent material (Ryerson soil).
- 2) Total Cd values were highest in the Ap horizons.
- 3) The total Cd levels below the surface horizon for the Lakeland soil increased going down the profile, and the Ryerson soil decreased with depth.
- 5) Exchangeable Cd values were very low. The lacustrine parent material did have the larger exchangeable Cd values by a factor of 10.
- 6) The AC horizon from the Lakeland soil possessed the greatest amount  $3.50 \times 10^{-3} \mu\text{g/g}$  of exchangeable Cd.
- 7) Total Cd and exchangeable Cd values from the two pedon's show poor correlation with all of the soil properties in their characterization, for example percent clay content, organic matter, oxides, C.E.C., or pH.

Soil characterizations of the two pedon's from the Dark Gray Soil Zone in the Luvisol order with different parent materials (shale till and mixed till) indicated that;

- 1) There is a slightly higher total Cd content in the surface horizon of the mixed till parent material (Pembina(2) soil),  $0.490 \mu\text{g/g}$  compared to  $0.384 \mu\text{g/g}$  surface horizon of the shale till parent material (Nayler soil).

2) Total Cd values were highest in Ap horizon of the Pembina(2) soil profile. Total Cd values were higher in the Ap horizon of the Nayler soil than all other horizons except for the C horizon.

3) Very little exchangeable Cd is available from either parent material source. The Nayler soil possessed a greater amount of exchangeable Cd by a factor of 100 compared to the Pembina soil. The BC horizon of the Nayler soil had the largest amount of exchangeable Cd  $1.01 \times 10^{-2} \mu\text{g/g}$ .

4) Total Cd and exchangeable Cd values from the two pedon's show poor correlation with all of the soil properties in their characterization, for example percent clay content, organic matter, oxides, C.E.C., or pH.

Soil characterizations of the two pedon's with the same parent material(mixed till) from the Dark Gray Soil Zone in the Luvisol order, and the Black soil zone in the Chernozem order indicated that;

1) There is a slightly higher total Cd content in surface horizon of the Luvisol soil(Pembina(2) soil),  $0.490 \mu\text{g/g}$  compared to the  $0.386 \mu\text{g/g}$  in the surface horizon of the Chernozem soil(Ryerson soil).

2) Total Cd values were greatest in the Ap horizon for both soils. The total Cd levels in the Ryerson soil decreased with depth. The Pembina(2) soil total Cd levels decreased immediately below the Ap horizon and then began to increase with depth.

3) Very little exchangeable Cd is available from either of these soil orders,  $< 1.67 \times 10^{-4} \mu\text{g/g}$ .

4) Exchangeable Cd values from the two pedon's displayed the same trends as the total Cd content.

5) Total Cd and exchangeable Cd values from the two pedon's show poor correlation with all of the soil properties in their characterization, for example percent clay content, organic matter, oxides, C.E.C., or pH.

#### **Experiment 1. b)**

##### **Objectives:**

1) To determine the relationship between climate and Cd levels from different agricultural regions of Saskatchewan.

Procedure:

Soil samples were collected on a genetic horizon basis from three different agricultural regions of Saskatchewan. These three regions represent three different regions for Cd levels in cereal crops (low, medium, and high). Four pedon's were selected from four Soil Zones: Brown, Dark Brown, Black, and Dark Gray.

Pedons Sampled in Saskatchewan.

Cd in Cereal Crops	Great Group	Parent Material	Soil Series
high	Brown	mixed till	Ardill
high	Dark Brown	mixed till	Weyburn
medium	Black	mixed till	Mayfair
low	Dark Gray	mixed till	Whitewood

Results:

To date only bulk density and total: copper, iron, nickel, and zinc values are known. Soil characterizations similar as to those conducted in Experiment 1. a) have yet to be completed.

Experiment 1. c)

Objectives:

- 1) To determine the relationship between parent material and Cd levels from different agricultural regions of Alberta.
- 2) To determine the relationship between climate and Cd levels from different agricultural regions of Alberta.

Procedure:

Soil samples were collected on a genetic horizon basis from three different agricultural regions of Alberta. These three regions represent three different regions for Cd levels in cereal crops (low, medium, and high). Five pedon's were selected from four Soil Zones: Brown, Dark Brown, Black, and Dark Gray. Two different parent materials were collected from two pedon's found in the Brown Soil Zone.

Pedons Sampled in Alberta.

Cd in Cereal Crops	Great Group	Parent Material	Soil Series
high	Brown	mixed till	Maleb
high	Brown	lacustrine	Chin
high	Dark Brown	mixed till	Readymade
medium	Dark Gray	mixed till	Falun
low	Black	mixed till	Beaverhills

Results:

To date only bulk density and total: copper, iron, nickel, and zinc values are known. Soil characterizations similar as to those conducted in Experiment 1. have yet to be completed.

**Experiment 2.**

Objectives:

1) To determine the relationship between soil Cd levels and Cd levels in cereal crops over a fifty-two mile transect in southern Manitoba.

Procedure:

Soil samples were collected on a genetic horizon basis, representative of a solum from eleven agricultural fields of varying soil texture and similar parent material. Grain samples were also collected from the same location as the soils sampled. Each field was sampled along a transect consisting of three sites per field. The toe-slope, mid-slope, and crest positions represent the three sample sites per field.

Solums Sampled along a Transect in Southern Manitoba.

Solum Site Number	Soil Series	Parent Material	Soil Texture	Cereal Crop
1	Rathwell	lacustrine	clay loam	Glenlea
2	Plum Coulee	lacustrine	clay	Neepawa
3	Plum Coulee	lacustrine	clay	Neepawa
4	Graysville	lacustrine	loam	Biggar
5	Winkler loam	lacustrine	loam	Roblin
6	Reinland	lacustrine	VFSL	Sceptre
7	Neunberg	lacustrine	loam	Medora
8	Neunberg	lacustrine	loam	Sceptre
9	Gretna	lacustrine	clay	Roblin
10	Hochfeld	lacustrine	coarse loamy	Biggar
11	Blumengart	recent fluvial	clay	Roblin

Results:

To date only bulk density and the Cd in the grain are known. Soil characterizations similar as to those conducted in Experiment 1. have yet to be completed.

Cadmium values in the grain samples collected were highest in the Amber Durum wheats: Medora and Sceptre, 0.129  $\mu\text{g/g}$  and 0.170  $\mu\text{g/g}$  respectively. The Utility wheat, Glenlea also contained high levels of Cd, 0.104  $\mu\text{g/g}$ . The Hard Red Spring wheat, Roblin had high levels from one sample site 0.180  $\mu\text{g/g}$ .

Summary:

Based on the results collected so far it appears that the Cd levels are highest in the surface Ap horizon. The exception was in the Nayler Soil Series where the total Cd is highest in the C horizon. The Nayler soil Series is developed from shale till parent material. This would account for the higher total Cd level in the C horizon. Shale is known to generally possess higher background Cd levels. The decrease in total Cd between the Ap and C horizons is likely due to a combination of Soil Forming Factors (climate) and Soil Forming Processes that have occurred with time.

Climate has influenced the movement of Cd. This situation can be observed when comparing the pedon's with the same parent materials, Pembina(2) Soil Series and the Ryerson Soil Series. Under more severe influences of climate we see a redistribution of Cd through the Pembina(2) profile.

Data collected so far would suggest that the Cd levels in the surface horizons are a combination of background levels, plant re-cycling, and anthropogenic sources.

TABLE OF VALUES: Experiment 1. e)

Manitoba Pedon's

PEDON #	SOIL ORDER	PARENT MATERIAL	Total Yearly Precipitation (mm)	Mean Daily Temperature, C	Elevation, ft.	HORIZON	DEPTH,cm	%S	%SI	%C
1 Lakeland NE28-02-1E	Chernozem	lacustrine	510.6	2.8	787	Apk	0-15	32	32	36
						AC	15-32	38	29	35
						Cca	32-80	27	42	31
						Ck	80-100	5	23	81
2 Naylor W30-05-08W	Luvisol	shale till	546.6	1.8	1800	Ap	0-20	30	39	32
						Ae	20-30	31	39	30
						Bt	30-50	30	39	31
						BC	50-70	33	40	27
						C	70-100	28	40	31
3 Pembina(2) SW32-05-08W	Luvisol	mixed till	546.6	1.8	1525	Ap	0-25	45	35	21
						Ae	25-30	32	54	14
						AB	30-37	38	38	28
						Bt	37-87	60	15	26
						BC	87-95	73	23	4
						Ck	95-130	88	14	0
4 Ryerson NE27-08-28W	Chernozem	mixed till	461.7	2.0	1600	Ap	0-20	46	28	25
						Bm	20-40	45	23	31
						Ck1	40-65	58	35	7
						Ck2	65-95	56	40	3



PEDON #	SOIL ORDER	PARENT MATERIAL	HORIZON	DEPTH,cm	TEXTURE	B.D.g/cm <sup>3</sup>	%CaCO <sub>3</sub>	% ORG C(OD)	0.01M CaCl <sub>2</sub> pH	Na cmol/kg
1 Lakeland NE28-02-1E	Chernozem	lacustrine	Apk	0-15	CL	1.38	8	5.04	7.3	0.3
			AC	15-32	CL	1.63	8	4.39	7.1	0.5
			Cca	32-60	CL	1.30	32	2.76	7.2	0.4
			Ck	60-100	C	1.48	15	2.75	7.3	0.2
2 Naylor W30-05-08W	Luvisol	shale till	Ap	0-20	CL	0.93	0	5.78	5.8	0.4
			Ae	20-30	CL	1.11	0	3.80	5.0	0.7
			Bt	30-50	CL	1.14	0	3.19	4.7	0.7
			BC	50-70	L	0.98	0	2.95	4.8	0.9
			C	70-100	CL	0.90	0	2.72	4.8	0.8
3 Pembina(2) SW32-05-08W	Luvisol	mixed till	Ap	0-25	L	1.38	2	4.67	6.2	0.5
			Ae	25-30	SIL	1.45	1	4.52	6.4	0.5
			AB	30-37	L	1.43	0	3.15	6.5	0.8
			Bt	37-67	SCL	1.48	0	2.83	6.8	0.5
			BC	67-85	LS	1.47	9	1.51	6.8	0.8
			Ck	85-130	S	1.63	20	1.47	6.8	0.5
4 Fyerson NE27-09-28W	Chernozem	mixed till	Ap	0-20	L	1.28	0	3.48	6.8	0.5
			Em	20-40	CL	1.38	1	2.29	6.9	0.3
			Ck1	40-65	SL	1.55	23	1.23	7.0	0.4
			Ck2	65-85	SL	1.64	25	1.37	7.2	1.4

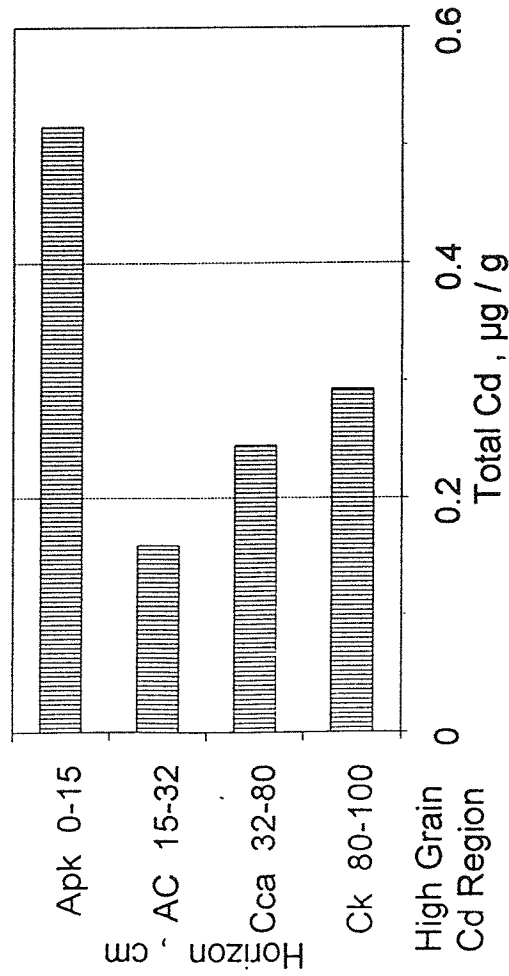
PEDON #	SOIL ORDER	PARENT MATERIAL	HORIZON	DEPTH,cm	K cmol/kg	Mg cmol/kg	EXCHANGEABLE CATIONS				CEC (sum) cmol/kg
							Ca cmol/kg	Al cmol/kg	Fe cmol/kg	sum	
1 Lakeland NE28-02-1E	Chernozem	lacustrine	Apk	0-15	1.3	11.5	14.0	0.0	0.0	0.0	26.9
			AC	15-32	1.1	14.5	10.5	0.0	0.0	0.0	26.4
			Cca	32-60	0.6	10.4	7.9	0.0	0.0	0.0	18.2
			Ck	60-100	1.3	22.2	14.8	0.0	0.0	0.0	38.5
2 Naylor W30-05-09W	Luvisol	shale till	Ap	0-20	1.1	5.3	12.3	0.0	0.0	0.0	18.1
			Ae	20-30	0.8	6.1	6.9	0.5	0.0	0.0	15.0
			Bt	30-50	0.8	7.4	7.1	0.4	0.0	0.0	16.3
			BC	50-70	0.8	7.5	7.1	0.5	0.0	0.0	16.8
			C	70-100	0.5	7.2	7.0	0.2	0.0	0.0	15.7
3 Pembina(2) SW32-05-08W	Luvisol	mixed till	Ap	0-25	0.8	3.2	6.7	0.0	0.0	0.0	12.9
			Ae	25-30	0.5	2.7	6.6	0.0	0.0	0.0	10.1
			AB	30-37	0.6	3.7	6.5	0.0	0.0	0.0	11.4
			Bt	37-67	0.7	5.3	6.1	0.0	0.0	0.0	12.5
			BC	67-85	0.7	5.0	5.9	0.0	0.0	0.0	12.1
			Ck	85-130	0.3	1.9	3.0	0.1	0.0	0.0	5.7
4 Ryerson NE27-09-28W	Chernozem	mixed till	Ap	0-20	1.3	5.4	10.7	0.0	0.0	0.0	16.8
			Bm	20-40	0.8	7.2	5.5	* ND	ND	ND	13.75
			Ck1	40-85	0.6	7.3	4.5	ND	ND	ND	12.75
			Ck2	65-95	0.6	11.9	9.0	ND	ND	ND	22.86

\* ND = Not Done

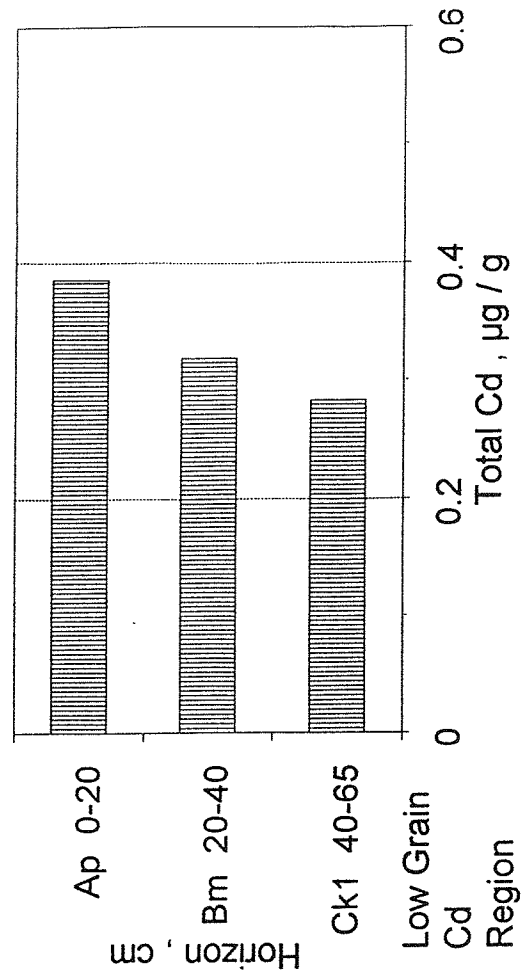
PEDON #	SOIL ORDER	PARENT MATERIAL	HORIZON	DEPTH,cm	Oxides		TOTAL Cd ugCd/g SPADE	TOTAL Cd ugCd/g AUGER	Exchangeable Cd (g/g)
					gMn/ kg soil	gFe/ kg soil			
1 Lakeland NE28-02-1E	Chernozem	lacustrine	Apk	0-15	0.36	3.08	0.518	0.421	8.73E-05
			AC	15-32	0.26	3.22	0.159	0.233	3.50E-03
			Cca	32-60	0.17	3.14	0.245	0.239	3.29E-05
			CK	60-100	0.28	5.67	0.283	0.275	4.40E-04
2 Naylor W30-05-09W	Luvisol	shale till	Ap	0-20	2.75	15.74	0.384	0.322	2.63E-03
			Ae	20-30	0.78	12.62	0.091	0.132	4.15E-03
			Bt	30-50	0.37	6.14	0.078	0.095	4.95E-03
			BC	50-70	0.29	5.55	0.058	0.172	1.01E-02
			C	70-100	0.26	5.58	0.461	0.577	4.41E-03
3 Pembina(2) SW32-05-08W	Luvisol	mixed till	Ap	0-25	0.81	6.54	0.490	0.515	1.50E-04
			Ae	25-30	0.71	6.06	0.273	0.228	3.12E-05
			AB	30-37	0.54	7.57	0.140	0.162	0.00E+00
			Bt	37-67	0.50	6.77	0.129	0.151	0.00E+00
			BC	67-85	0.64	8.05	0.314	0.174	7.46E-05
			CK	85-130	0.41	6.99	0.351	0.270	4.40E-05
4 Fyersen NE27-09-28W	Chernozem	mixed till	Ap	0-20	0.56	4.02	0.388	0.385	1.67E-04
			Bm	20-40	0.43	5.48	0.319	0.284	5.37E-05
			CK1	40-65	0.26	3.60	0.283	* ND	0.00E+00
			CK2	65-85	0.28	3.67	ND	ND	0.00E+00

PEDON #	SOIL ORDER	PARENT MATERIAL	HORIZON	DEPTH,cm	Total ugCu/ g soil	Total mgFe/ g soil	Total ugNi/ g soil	Total ugZn/ g soil
1 Lakeland NE28-02-1E	Chernozem	lacustrine	Apk	0-15	31.49	54.56	42.17	66.42
			AC	15-32	21.78	36.11	36.70	64.24
			Cca	32-80	26.27	31.24	41.41	47.68
			Ck	80-100	38.70	52.54	57.45	61.19
2 Naylor W30-05-09W	Luvisol	shale till	Ap	0-20	24.06	48.32	33.47	66.64
			Ae	20-30	15.43	35.99	31.77	78.74
			Bt	30-50	11.20	36.77	33.36	149.03
			BC	50-70	14.01	40.42	30.07	108.96
			C	70-100	13.31	35.82	32.81	141.04
3 Pembina(2) SW32-05-08W	Luvisol	mixed till	Ap	0-25	15.63	36.82	26.23	60.79
			Ae	25-30	11.17	28.23	21.81	87.48
			AB	30-37	10.61	43.89	28.09	187.50
			Bt	37-67	11.52	36.73	24.56	55.63
			BC	67-95	16.62	35.14	43.47	56.66
			Ck	85-130	6.19	22.04	25.34	35.45
4 Ryerson	Chernozem	mixed till	Ap	0-20	15.16	28.15	19.99	63.81
			Bm	20-40	16.68	35.19	31.63	65.47

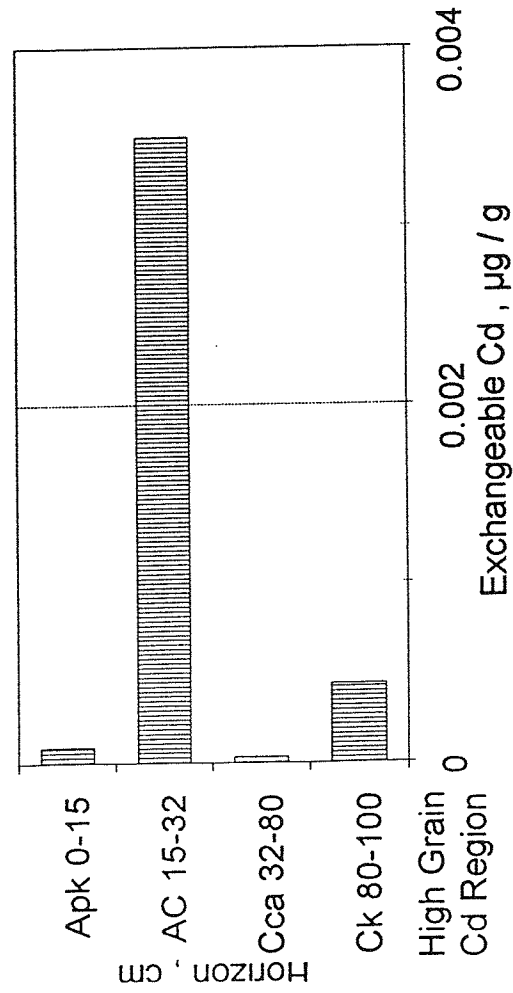
**Total Cd as a function of Horizon**  
Lakeland Soil Series, CA. BL



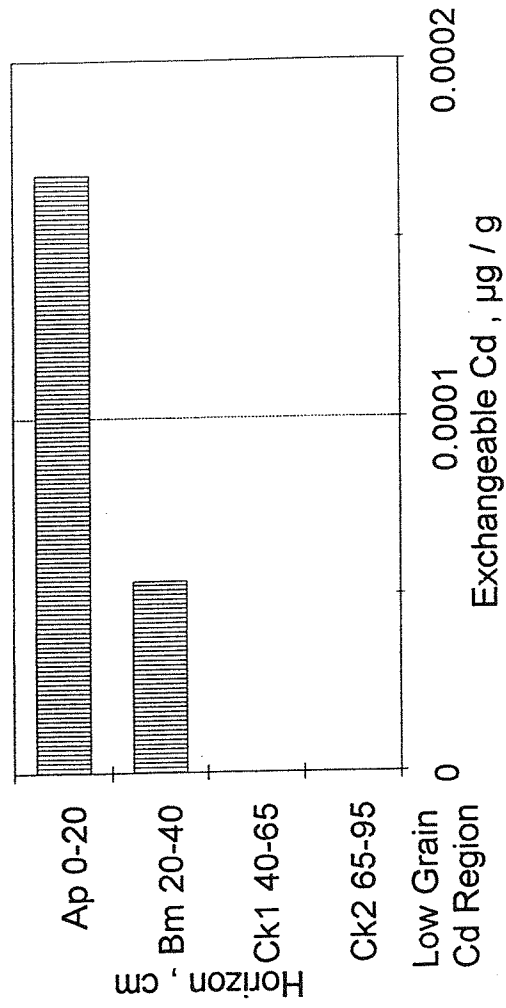
**Total Cd as a function of Horizon**  
Ryerson Soil Series, O. BL



**Exchangeable Cd by Horizon**  
**Lakeland Soil Series, CA BL**



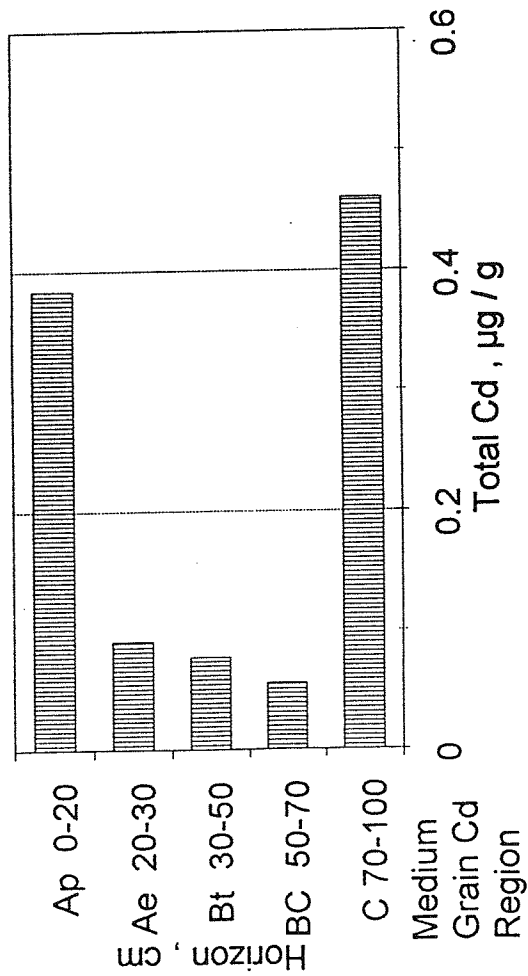
**Exchangeable Cd by Horizon**  
**Ryerson Soil Series, O. BL**



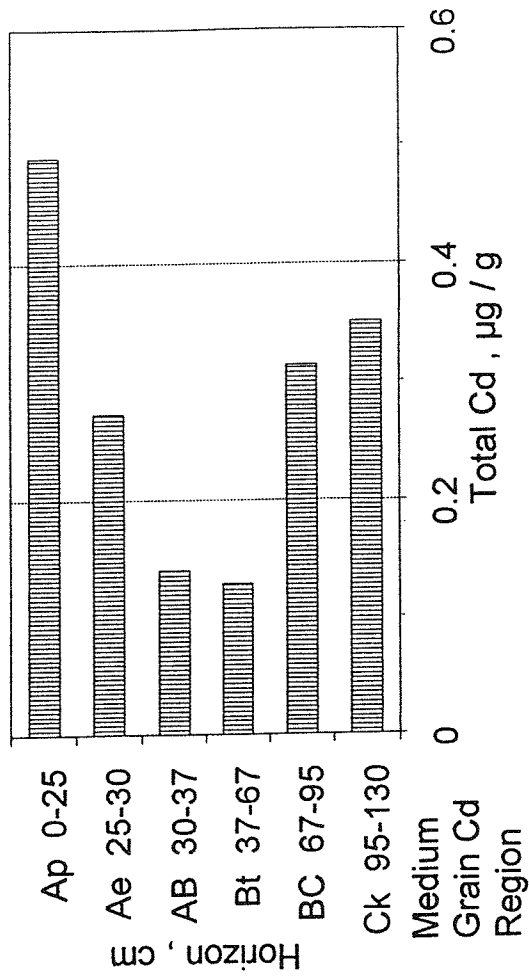
High Grain Cd Region

Low Grain Cd Region

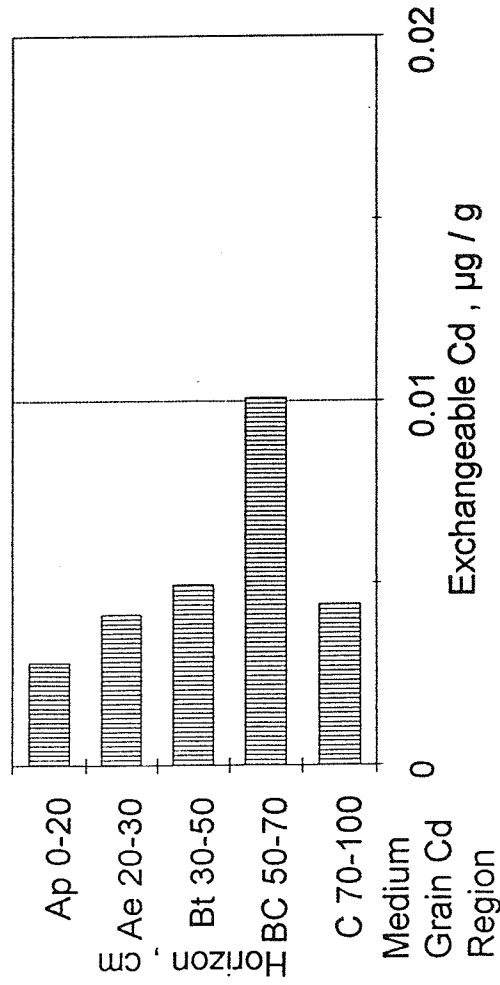
**Total Cd as a function of Horizon**  
**Naylor Soil Series, D. GL**



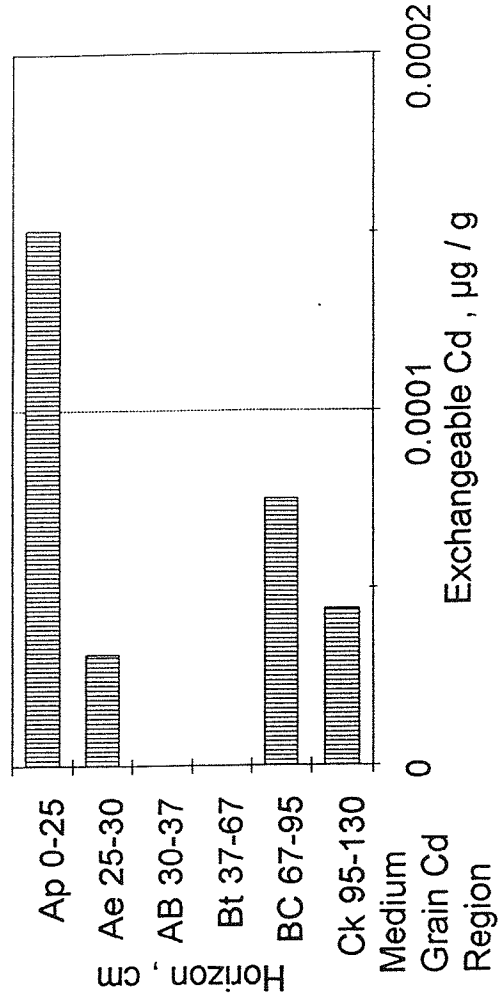
**Total Cd as a function of Horizon**  
**Pembina ( 2 ) Soil Series, D. GL**



**Exchangeable Cd by Horizon**  
**Naylor Soil Series, D. GL**

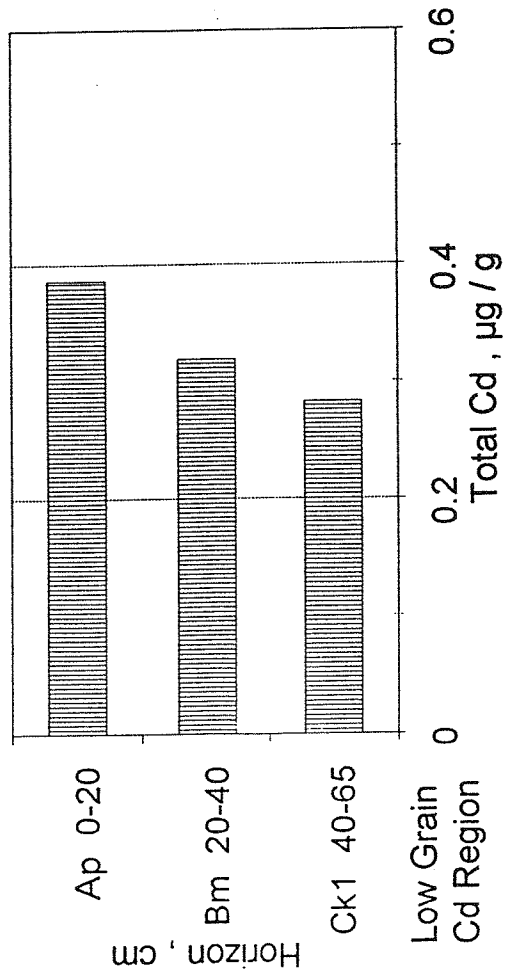


**Exchangeable Cd by Horizon**  
**Pembina(2) Soil Series, D. GL**

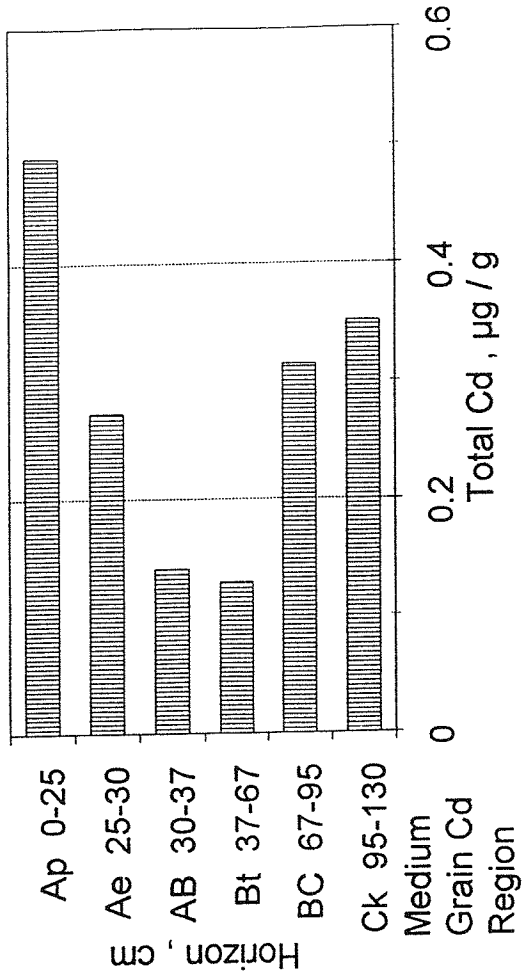




**Total Cd as a function of Horizon**  
**Ryerson Soil Series , O. BL**



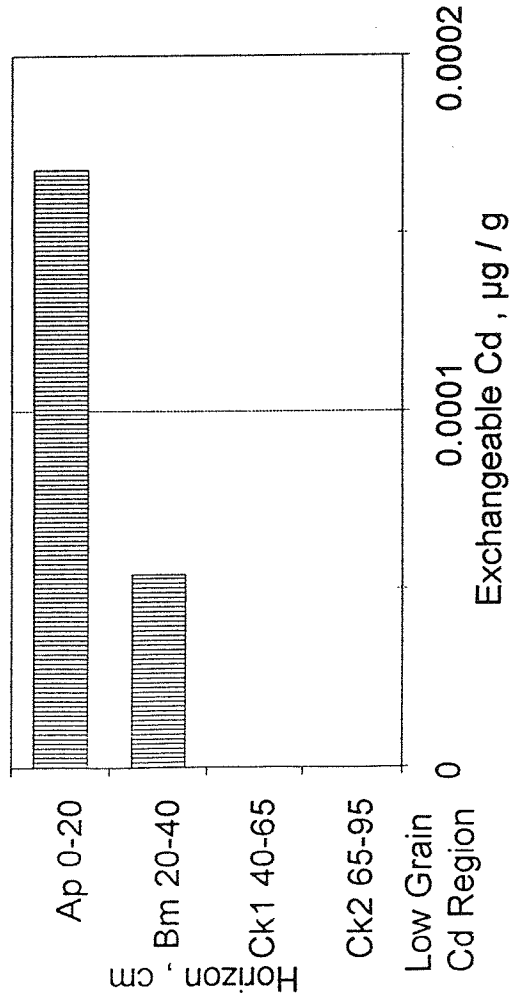
**Total Cd as a function of Horizon**  
**Pembina(2) Soil series , D. GL**



Low Grain  
 Cd Region

Medium  
 Grain Cd  
 Region

### Exchangeable Cd by Horizon Ryerson Soil Series, O. BL



### Exchangeable Cd by Horizon Pembina(2) Soil Series, D. GL

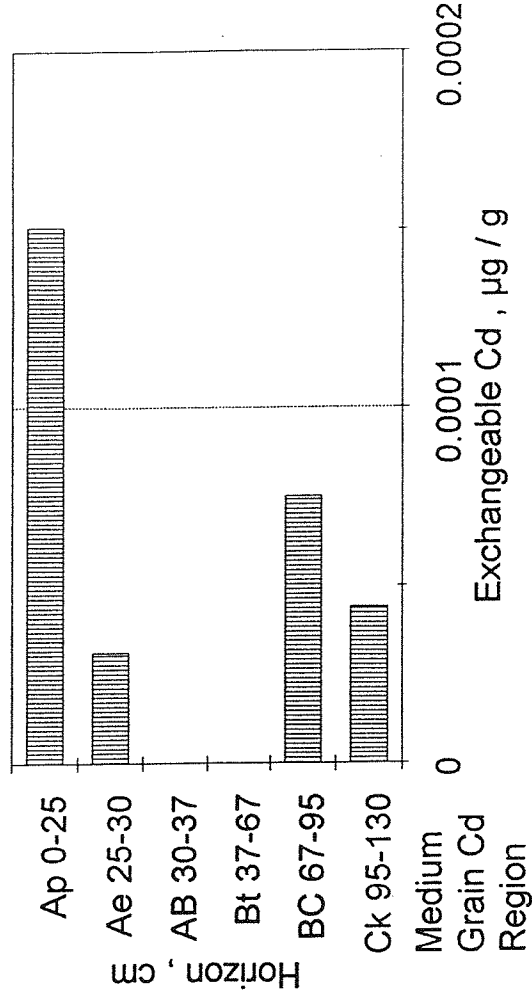


TABLE OF VALUES: Experiment 1. b)

Saskatchewan Pedon's												
PEDON #	GREAT GROUP	PARENT MATERIAL	HORIZON	DEPTH,cm	B.D.g/cm <sup>3</sup>	% < 2.0mm	% > 2.0mm	%CaCO <sub>3</sub>	Total g Cu/ g soil	Total mg Fe/ g soil	Total g Ni/ g soil	Total g Zn/ g soil
10 Whitewood SE6-52-23W	Dark Grey	mixed till	Ap	0-10	1.26	97.6	2.4	ND	15.21	12.21	18.09	43.94
			Bt1	10-27	1.60	95.5	4.5	ND	26.67	22.53	36.07	54.89
			Bt2	27-47	1.63	95.7	4.3	ND	23.76	21.87	33.02	37.73
			CK1	47-72	1.41	93.9	6.2	ND	24.23	18.11	29.61	41.34
			CK2	72-100	1.40	96.0	4.0	ND	27.14	20.81	30.94	35.11
11 Mayfair SW6-49-27W	Black	mixed till	Ap	0-10	1.29	97.0	3.1	ND	35.93	19.35	23.90	48.50
			Btj	10-28	1.48	97.3	2.7	ND	20.90	26.54	30.48	43.09
			Bm	28-37	1.60	97.1	2.9	ND	20.40	22.19	34.78	40.34
			CK1	37-80	1.53	96.9	3.1	ND	17.14	18.43	35.90	38.39
			CK2	60-88	1.56	96.3	3.7	ND	15.03	17.70	26.82	83.32
CK3	88-112	1.65	97.3	2.7	ND	27.58	16.73	24.85	47.38			
12 Weyburn NE16-33-26W	Dark Brown	mixed till	Ap	0-13	1.94	93.7	6.3	0.0	9.78	16.50	16.72	62.43
			Bm	13-26	1.45	96.7	3.3	0.3	17.71	20.16	20.23	45.76
			Cca	26-56	1.52	95.3	4.7	15.3	21.82	17.03	25.27	50.21
			CK1	56-86	1.62	95.2	4.9	16.3	8.77	16.97	20.88	44.16
			CK2	86-110	1.55	93.8	6.2	13.5	13.77	17.35	20.01	45.47
13 Ardill SE32-28-27W	Brown	mixed till	Ap	0-10	1.39	96.0	4.0	ND	5.46	24.32	15.14	44.10
			Bm	10-30	1.56	91.0	8.0	ND	7.28	18.49	20.74	42.48
			Bmk	30-45	1.49	94.0	6.0	ND	3.10	15.68	18.14	34.14
			Cca	45-60	1.63	87.8	12.2	ND	13.17	19.23	24.41	51.53
			l1CK	60-82	1.49	100.0	0.0	ND	15.90	18.78	41.54	76.17
l1l1CK	82-115	1.41	98.4	0.6	ND	20.35	18.56	37.70	80.21			

TABLE OF VALUES: Experiment 1. c)

Alberta Pedon's		GREAT GROUP	PARENT MATERIAL	HORIZON	DEPTH, cm	B.D.g/cm <sup>3</sup>	% < 2.0mm	% > 2.0mm	%CaCO <sub>3</sub>	Total g Cu/ g soil	Total mg Fe/ g soil	Total g Ni/ g soil	Total g Pb/ g soil	Total g Zn/ g soil
5	Maleb NE10-12-08W	Brown	mixed till	Ap	0-20	1.15	99.9	0.1	0.3	13.40	15.97	19.94	10.40	66.20
				Ahe	20-30	1.05	100.0	0.0	0.0	8.22	14.82	14.78	11.57	65.90
				Bm	30-48	1.31	99.8	0.5	5.6	12.57	19.65	26.77	17.56	48.65
				Cca	48-57	1.37	98.0	2.0	13.3	11.56	18.49	41.47	23.07	64.55
				Ck	57-100	1.48	98.4	1.6	5.6	11.74	25.00	27.22	18.51	66.92
6	Chin NE31-11-10W	Brown	lacustrine	Ap	0-15	1.39	99.9	0.1	0.3	15.50	16.66	16.31	17.53	86.18
				Ae	15-24	1.50	99.9	0.1	0.1	11.72	22.47	18.17	10.44	66.67
				Btj	24-42	1.41	99.9	0.1	0.1	15.03	12.81	18.64	12.34	77.52
				Bck	42-57	1.50	100.0	0.1	0.1	11.32	17.75	21.74	22.89	81.90
				Ck1	57-70	1.58	100.0	0.0	14.5	34.95	18.60	28.45	21.08	58.60
Ck2	70-100	1.38	100.0	0.0	25.1	11.33	15.71	30.77	24.83	42.08				
7	Reaymade SE28-17-21W	Dark Brown	mixed till	Ap	0-10	1.01	83.4	6.6	0.0	21.75	21.37	17.09	9.39	67.05
				Bm	10-30	1.27	92.3	7.7	0.0	22.81	24.28	27.15	12.87	54.99
				Ck1	30-70	1.57	88.4	10.8	11.9	18.09	10.60	24.32	13.76	30.95
				Ck2	70-100	1.83	92.3	7.7	13.7	19.19	18.30	28.34	18.32	37.15
8	Falun NW5-55-09W	Dark Grey	mixed till	Ap	0-20	1.29	97.0	3.0	0.0	9.14	12.62	17.50	11.78	244.34
				AB	20-25	1.65	94.9	5.1	0.1	15.51	21.87	21.71	10.04	40.55
				Bt1	25-49	1.71	94.3	5.7	0.0	23.45	27.14	20.01	15.24	43.63
				Bt2	49-76	1.77	95.5	4.5	0.0	19.90	28.07	23.32	5.48	37.05
				BC	78-100	1.81	93.3	6.7	0.9	21.01	25.64	27.82	8.58	36.20
Ck	> 100	1.23	95.8	4.2	8.4	15.73	23.14	23.55	13.71	38.98				
9	Beaverhills NW7-50-03W	Black	mixed till	Ap	0-14	1.03	98.7	1.3	0.0	14.48	17.97	18.48	13.20	59.50
				AB	14-21	1.39	99.8	0.2	0.0	16.40	20.98	18.66	10.55	65.73
				Bm	21-40	1.44	96.4	3.8	0.0	8.89	23.23	20.75	10.61	38.42
				Bt	40-82	1.63	94.5	5.5	0.4	25.31	27.02	33.91	9.93	47.37
Ck	62-110	1.49	92.7	7.3	6.5	24.20	23.54	37.38	18.30	47.74				

TABLE OF VALUES: Experiment 2.

Manitoba Pedon's									
PROFILE ID.	SITE NO.	SOIL SERIES	PARENT MATERIAL	TEXTURE	HORIZON	DEPTH,cm	CROP	Cd ppm	Cd ppm
14	10-1	Rathwell	lacustrine	clay loam	Ap	0-15	Glenlea	0.103	0.104
SW32-1-1E					AC	>15			
15	10-2				Ap	0-18		0.067	0.073
					AC	18-51			
16	10-3				Ap	0-14		0.053	0.049
					Ck	>14			
17	12-1	Plum Coulee	lacustrine	clay	Ap	0-15	Neepawa	0.066	0.063
NE35-1-1W					AC	>15			
18	12-2				Ap	0-18		0.070	0.074
					Ah	18-36			
19	12-3				Ap	0-13		0.049	0.047
					AC	13-20			
20	15-1	Plum Coulee	lacustrine	clay	Apk	0-12	Neepawa	0.026	0.025
SE17-2-1W					Ck	>12			
21	15-2				Ap	0-11			
					Bmk	11-24			
22	15-3				Ap	0-15		0.208	0.201
					Bmk	15-21			
23	23-1	Graysville	lacustrine	loam	Apk	0-12	Biggar	0.020	0.017
SW1-3-3W					Bmk	12-39			
24	23-2				Apk	0-12		0.022	0.019
					Bmk	12-26			
25	23-3				Apk	0-21		0.031	0.024
					Bmk	21-34			
26	27-1	Winkler loam	lacustrine	loam	Ap	0-16	Roblin	0.024	0.023
NE12-3-4W					Bm	16-34			
27	27-2				Ap	0-15		0.037	0.034
					Ap	15-30			
					Ap	30-45			
28	27-3				Ap	0-18		0.029	0.034
					Bmk	18-42			
29	29-1	Reinland	lacustrine	VFSL	Apk	0-17	Sceptre	0.090	0.092
NW15-3-4W					AC	>17			
30	29-2				Apk	0-17		0.080	0.079
					AC	17-29			
31	29-3				Apk	0-18		0.134	0.170
					AC	18-46			

PROFILE ID.	SITE NO.	SOIL SERIES	PARENT MATERIAL	TEXTURE	HORIZON	DEPTH,cm	CROP	Cd ppm	Cd ppm
32 NE9-4-5W	36-1	Nuenberg	lacustrine	loam	Ap	0-41	Medora	0.090	0.076
					AB	41-48			
					Bm	48-58			
33	36-2				Apk AC	0-18 18-26		0.129 0.128	
34	36-3				Apk	0-20		0.058	0.540
					AC	20-46			
					ND				
					ND				
	36-5				ND			0.066	0.076
	36-6				ND			0.065	0.078
35 SE16-4-5	37-1	Nuenberg	lacustrine	loam	Ap	0-64	Sceptre	0.053	0.058
					AB	64-81			
					Bm	81-100			
36	37-2				Apk	0-25		0.118	0.119
					AC	25-62			
37	37-3				Apk	0-23		0.063	0.064
					AC	23-61			
					ND				
					ND				
	37-5				ND			0.041	0.051
	37-6				ND			0.094	0.094
38 NW7-4-5W	39-1	Gretna	lacustrine	clay	Apk	0-24	Roblin	0.040	0.036
					Ahk	24-39			
39	39-2				Apk Bntj	0-15 15-26		0.033 0.033	
40	39-3				Apk Bntj	0-13 13-29		0.070 0.070	
41 NE10-4-6W	40-1	Hochfeld	lacustrine	coarse loamy	Apk	0-10	Biggar	0.059	0.069
					Ahk	10-20			
42	40-2				Ap Bm	0-12 12-26		0.028 0.024	
43	40-3				Ap	0-12		0.094	0.095
					Bm	12-42			
44 NE7-4-6W	41-1	Blumengart	recent fluvial	clay	Apk	0-6	Roblin	0.180	0.176
					Ahk	6-21			
45	41-2				Apk AC	0-10 10-26		0.107 0.107	
46	41-3				Ap Ck	0-17 >17		0.055 0.053	