THE UTAH CONSTRUCTION COMPANY

BALANCE SHEET—OCTOBER 31, 1950

ASSETS

CURRENT ASSETS:		
Cash		$ 2,167,376.33
Receivables—		
Estimates	$3,746,255.53	
Retained percentages	784,805.27	
Other	525,409.29	5,056,470.09
Unbilled costs on work in progress		509,819.43
Inventories, priced at the lower of cost or market—		
Construction materials and supplies	$ 941,292.03	
Iron ore and coal	73,506.46	1,014,798.49
TOTAL CURRENT ASSETS		$ 8,748,464.34
OTHER ASSETS:		
Investment in joint ventures	$2,587,331.23	
Buildings and facilities on construction projects, less reserve for amortization of $837,384.26	309,615.07	
Prepaid royalties	104,671.61	
Other prepaid expenses and miscellaneous	157,164.71	3,158,782.62
INVESTMENTS IN OTHER COMPANIES, at cost (which, in the aggregate, is less than estimated liquidating value):		
Capital stocks of non-controlled companies (proceeds of certain stocks pledged to secure bank loan)	$ 812,641.03	
Capital stocks and receivables of wholly-owned foreign subsidiaries	719,318.14	1,531,959.17

PROPERTY, PLANT AND EQUIPMENT:

Classification	*Cost*	*Reserves for Depreciation and Amortization*	*Net*	
Land ($33,800.00), buildings and improvements	$ 240,119.50	$ 34,610.06	$ 205,509.44	
Coal lands and leases	799,134.89	50,764.19	748,370.70	
Plant and facilities on mining projects	1,653,853.44	751,799.34	902,054.10	
Equipment	8,591,993.76	3,985,436.18	4,606,557.58	
Furniture and fixtures	112,966.22	60,234.07	52,732.15	
	$11,398,067.81	$4,882,843.84	$6,515,223.97	6,515,223.97
				$19,954,430.10

LIABILITIES

CURRENT LIABILITIES:			
Current installments of long-term notes and contracts payable—due within one year			$ 355,242.75
Accounts payable—			
Trade		$ 1,119,892.25	
Other		251,911.17	1,371,803.42
Advances received on construction contracts			740,000.00
Accrued liabilities—			
Salaries and wages		$ 310,696.90	
General taxes and miscellaneous		267,031.46	
Current portion of Federal income taxes		1,500,000.00	2,077,728.36
TOTAL CURRENT LIABILITIES			$ 4,544,774.53
LONG-TERM LIABILITIES:			
Bank loans, 3%—due December 31, 1951—			
Secured by proceeds of stocks of certain non-controlled companies		$ 725,820.00	
Unsecured		1,050,000.00	
		$ 1,775,820.00	
Non-current portion of 3½% bank loan—payable in quarterly installments of at least $45,000.00		585,000.00	
Non-current installments of note and contracts payable for coal lands		358,485.50	
Non-current portion of accrued Federal income taxes (applicable to recorded income from joint ventures not taxable until subsequent years)		227,356.63	2,946,662.13
RESERVE FOR CONTINGENCIES—PRIOR YEARS' FEDERAL INCOME TAXES			500,000.00
CAPITAL STOCK AND RETAINED EARNINGS:			
Capital stock, par value $10 per share—			
Authorized—175,510 shares			
Issued and outstanding—175,507.5 shares		$ 1,755,075.00	
Earnings retained in the business, exclusive of amounts capitalized ($7,244,925.00 not available for dividends under bank loan agreement)—			
Balance, October 31, 1949	$ 8,143,750.21		
Add—Net profit for the year	2,364,384.71		
	$10,508,134.92		
Deduct—Dividends paid in cash ($264,588.75) and property	300,216.48	10,207,918.44	11,962,993.44
			$19,954,430.10

TO THE BOARD OF DIRECTORS OF
THE UTAH CONSTRUCTION COMPANY:

We have examined the balance sheet of THE UTAH CONSTRUCTION COMPANY (a Utah corporation) as of October 31, 1950, and the related statement of profit and loss for the fiscal year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, the accompanying balance sheet presents fairly the financial position of THE UTAH CONSTRUCTION COMPANY as of October 31, 1950, and was prepared in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

San Francisco, California
December 28, 1950

ARTHUR ANDERSEN & CO.

THE UTAH CONSTRUCTION COMPANY

★

BOARD OF DIRECTORS

M. A. Browning . . . . *Ogden, Utah*
L. S. Corey . . . *San Francisco, Calif.*
A. D. Christensen *San Francisco, Calif.*
L. T. Dee . . . . . *Ogden, Utah*
George S. Eccles . . . . *Ogden, Utah*
M. S. Eccles . . . . . *Ogden, Utah*
W. H. Harris . . . . . *Ogden, Utah*
Shepard Mitchell . *Los Angeles, Calif.*
P. L. Wattis . . *San Francisco, Calif.*

★

OFFICERS

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Chairman of the Board

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President

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W. H. Harris . . . . . *Ogden, Utah*
Secretary and Treasurer

Vice-Presidents

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H. N. Stronck . . . . . *San Francisco, Calif.*
A. H. Ayers . . . . . *San Francisco, Calif.*
C. S. Davis . . . . . *San Francisco, Calif.*
G. R. Putnam . . . . . *Salt Lake City, Utah*

BALANCE SHEET

THE UTAH CONSTRUCTION COMPANY

★

OCTOBER 31, 1950

★

General Offices

OGDEN, UTAH

Salt Lake City, Utah
57 E. Fourth South

San Francisco, California
1 Montgomery Street

THE UTAH CONSTRUCTION COMPANY

BALANCE SHEET—OCTOBER 31, 1950

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CURRENT ASSETS:		
Cash		$ 2,167,376.33
Receivables—		
Estimates	$3,746,255.53	
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Classification	*Cost*	*Reserves for Depreciation and Amortization*	*Net*	
Land ($33,800.00), buildings and improvements	$ 240,119.50	$ 34,610.06	$ 205,509.44	
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	$11,398,067.81	$4,882,843.84	$6,515,223.97	6,515,223.97
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Accounts payable—			
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San Francisco, California
December 28, 1950

ARTHUR ANDERSEN & CO.

THE UTAH CONSTRUCTION COMPANY

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BALANCE SHEET

THE UTAH CONSTRUCTION COMPANY

★

OCTOBER 31, 1950

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THE UTAH CONSTRUCTION COMPANY

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BALANCE SHEET

THE UTAH CONSTRUCTION COMPANY

★

OCTOBER 31, 1950

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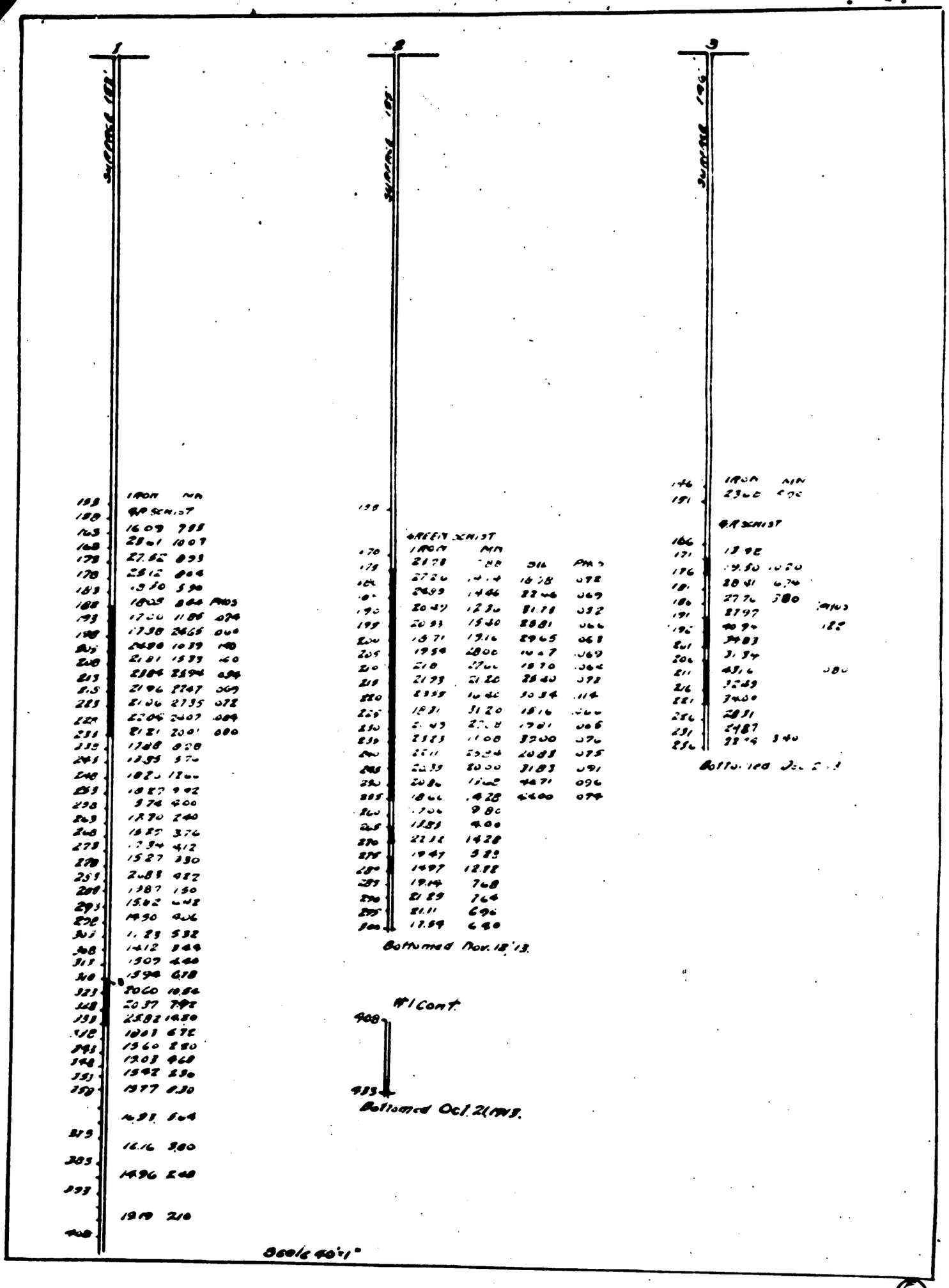
General Offices

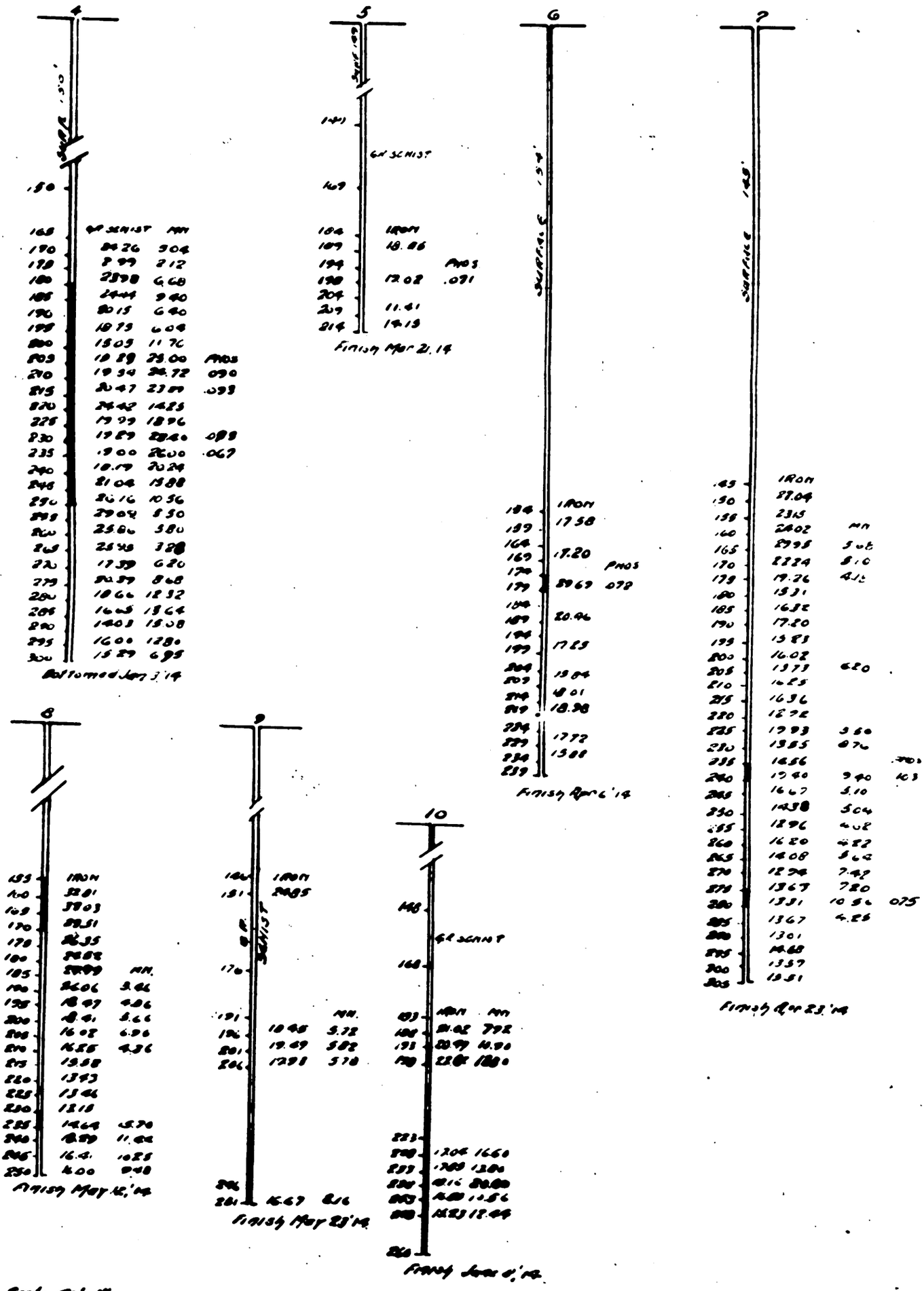
OGDEN, UTAH

Salt Lake City, Utah
57 E. Fourth South

San Francisco, California
1 Montgomery Street


1
SURFACE 102'
IRON MN
G.R. SCHIST
2
SURFACE 182'
GREEN SCHIST
IRON MN SIL PHOS
Bottomed Nov. 18 '13.
#1 Cont.
Bottomed Oct. 21, 1913.
3
SURFACE 146'
IRON MN
G.R. SCHIST
Bottomed Oct. 2 '13
S60½ 40½°

Sheet 1.


4
SURFACE 150'
150
168 GR SCHIST MN
170 8.26 3.04
175 8.99 2.12
180 28.98 6.68
185 24.44 9.40
190 20.15 6.40
195 18.75 6.04
200 15.03 11.70
205 18.89 29.00 PHOS
210 19.34 28.72 .090
215 20.47 27.00 .093
220 24.42 14.25
225 19.99 18.96
230 19.89 28.40 .088
235 19.00 26.00 .067
240 18.19 20.24
245 21.04 19.88
250 20.16 10.56
255 29.04 8.50
260 25.60 5.80
265 25.48 3.28
270 17.39 6.20
275 20.39 8.68
280 18.66 12.32
285 16.05 18.64
290 14.03 15.08
295 16.00 12.80
300 15.29 6.95
Bottomed Jan 3 '14
5
SURFACE 109'
141
GR SCHIST
169
184 IRON
189 18.86
194 PHOS
199 17.02 .071
204
209 11.41
214 14.13
Finish Mar 21 '14
6
SURFACE 154'
184 IRON
189 17.58
164
169 17.20
170 PHOS
179 29.69 .072
184
189 20.46
194
199 17.23
204
209 19.64
214 18.01
219 18.98
224
229 17.72
234 15.88
239
Finish Apr 6 '14
7
SURFACE 145'
145 IRON
150 27.04
155 23.15
160 24.02 MN
165 29.95 5.08
170 22.24 8.10
175 19.26 4.12
180 15.31
185 16.32
190 17.20
195 15.83
200 16.02
205 13.73 6.20
210 16.25
215 16.36
220 12.72
225 17.93 3.60
230 13.85 8.76
235 16.56 .700
240 17.40 9.40 .103
245 16.67 5.10
250 14.38 5.04
255 12.96 4.08
260 16.20 4.22
265 14.08 5.62
270 12.94 7.42
275 13.67 7.20
280 13.31 10.56 .075
285 13.67 4.26
290 13.01
295 14.68
300 13.57
305 19.51
Finish Apr 23 '14
8
155 IRON
160 22.01
165 27.03
170 29.51
175 26.35
180 24.82
185 27.99 MN.
190 26.06 3.46
195 18.97 4.86
200 18.41 3.66
205 16.02 6.96
210 16.55 4.36
215 19.58
220 13.93
225 13.46
230 12.18
235 14.64 5.70
240 18.29 11.42
245 16.41 10.25
250 16.00 9.48
Finish May 16 '14
9
SURFACE
186 IRON
191 24.05
GR SCHIST
176
191 MN.
196 10.48 5.72
201 19.49 5.82
206 12.91 5.78
206
211 16.67 8.16
Finish May 23 '14
10
SURFACE
148
GR SCHIST
168
173 IRON MN
178 21.02 7.92
183 20.77 10.90
188 22.02 12.80
223
228 12.04 16.60
233 13.09 12.84
238 18.16 20.80
243 14.80 11.56
248 14.23 18.44
256
Finish June 6 '14

Scale 40' = 1"

1001	Mat.	Color	Texture	Hardness
7	Sand & Clay	Yellow	Fine	Soft
20	Clay	Blue	"	"
29	Hardpan	Gray		Medium
40	Sand	Dark	Coarse	
61	"	"	Medium	
70	"	"	Coarse	
84	Sand & Gravel	"	"	
93	"	"	Fine	
99	Gravel & Boulders	"		
102	Gravel	Gray	Medium	Hard Medium
14	Sand & Gravel	"	"	Hard
117	Clay, Sand & Boulders	"		Medium
135	Hardpan Boulders	"	Coarse	Hard
152	Sand	Lt Yellow	Fine	Soft
155	Sand, Gravel & Schist	Red	Medium	"
160	20.00 Fe		5.45 Mn	SiO_2
165	21.00		4.81	
170	30.30		3.85	
115	22.20		7.10	
180	25.20	.090	10.18	31.15
185	23.70	.129	10.18	32.20
190	22.10	.156	11.96	29.75
195	16.80	.100	15.12	31.90
200	19.33		5.93	
205	21.17		7.98	
210	16.48		7.70	
215	17.33		8.25	
220	22.48		8.75	
225	15.45	.102	10.45	46.15
230	14.60		8.25	
235	19.50		6.32	
240	17.40		3.99	
245	16.80		3.49	
250	15.60		6.79	
255	15.40	.102	25.10	32.65
260	30.80		7.98	
265	15.40		1.65	
270	16.30		2.20	
275	14.80		1.18	
280	17.20		9.26	
285	19.90	.108	10.06	46.05
290	18.00		8.63	
295	16.80		5.50	
300	11.05		1.88	
305	16.76		7.00	
310	16.08		3.00	
315	15.12		9.50	
320	17.91	.098	18.00	
325	11.70	.069	4.06	
330	12.51	.078	9.30	
335	16.22	.041	14.00	
340	12.16	.079	8.52	
345	12.18		4.95	
350	13.93		7.16	
355	12.94		5.16	
360	10.35		17.00	
365	8.67		10.49	
370	16.90		6.52	
375	18.97		4.64	
380	29.01		.80	
385	18.33		1.68	
390	22.18		.64	
395	24.96		.58	
400	28.49		.86	

Cont

1002	Mat.	Color	Texture	Hardness
7	Muskeg	Black		Soft
24	Sand & Clay	Gray		"
37	Sand, Gravel & Boulders	"		Hard
43	Sand, Gravel	"	Coarse	Medium
68	Hardpan	"		"
73	Sand, Gravel & Boulders	"	"	Hard
100	Hardpan & Gravel	Brown	Medium	"
123	Gravel & Boulders	Gray	Coarse	"
133	Hardpan Sand & Gravel	"	Medium	"
142	Sand		Fine	Soft
144	Sand & Gravel	Yellow	Medium	
150	21.70 Fe		3.88 Mn	SiO_2
155	24.10		3.00	
160	23.00		12.28	
165	24.70		4.18	
170	21.00	.069	10.83	24.40
175	23.80	.078	10.58	25.00
180	26.00		5.53	
185	19.80		7.78	
190	24.70		4.81	
195	19.40		8.08	
200	19.50		6.10	
205	24.40		3.61	
210	15.30	.060	7.60	42.84
215	1[illegible].07	.058	16.00	31.41
220	18.71	.082	12.40	43.51
225	18.46	.056	9.60	46.16
230	19.63	.063	7.20	45.16
235	18.54	.089	22.10	38.66
240	13.44	.104	14.00	
245	17.87	.178	7.10	
250	15.35	.086	16.00	
255	15.24	.077	13.94	
260	20.16	.091	2.84	
265	16.05	.080	14.06	
270	14.43	.079	15.60	
275	15.45	.111	19.96	
280	15.89	.154	12.80	
285	17.71	.117	16.00	
290	15.91	.123	10.40	
295	17.53	.116	7.80	
300	20.61	.119	10.14	
305	19.27	.096	1.82	
310	18.41		2.86	
315	17.86		1.96	
320	18.51		2.42	
325	16.36		6.91	
330	13.87		1.76	
335	16.79		1.96	
340	20.08		5.19	
345	19.63		14.08	
350	17.82		10.50	
355	16.42		11.00	
360	16.81		6.09	
365	20.[illegible]		3.80	
370	18.10		1.98	
375	19.84		1.74	
380	14.48		1.38	
385	17.13		1.40	
390	15.19		1.84	
395	15.09		2.60	
400	15.17		2.78	
405	16.30		2.12	
410	14.70		6.48	

Cont.

Sheet 2

1001 cont

	Iron	Mn
400		
405	2.66	.42
410	2.315	.34
415	15.35	.24
420	17.64	.26
425	7.37	.30
430	12.43	.32
435	11.01	.34
440	8.04	.28
445	8.04	
450	6.02	
455	8.09	
460	6.46	
465	7.45	
470	7.25	
475	7.05	
476	Slate	

Finished May 17, 1916.

(1) Slate

1002 cont

	Iron	Mn
410		
415	16.32	5.08
420	13.43	1.20
425	13.17	2.32
430	9.14	2.88
435	Slate	

Finished May 17 1916

(1) Slate

1003

	Material	Color	Text	Hardness
3	Quicksand	Gray	Fine	Soft
10	Sand	Brown	Med.	"
	Clay	Gray		Medium
32	Sand	"	Med.	Soft
40				
	"	"	Fine	"
75	"	"	Coarse	"
81				
	"	"	Fine	"
94	Gravel		"	Med.
101	"		Med	"
110	Gravel & Boulders		Coarse	Hard
116	Hardpan & Boulders	Gray	"	"
139	Hardpan	"	"	"
139	Sand	Yellow	Fine	Soft
145				

	Fe.	Mn.
150		7.46
155		9.32
160		1.30
165		16.04
170		10.44
175		6.36
180		9.18
185		6.80
190		8.96
195		5.94
200		6.60
205		3.92
210		12.49
215		14.54
220		5.84
225	14.95	12.88
230		15.60
235		5.40
240		9.00
245		10.96
250		9.28
255		1.80
260		7.20
265		5.68
270		6.48
275	19.25	5.40
280	22.46	5.92
285	22.22	5.92
290	27.18	11.28
295	24.52	19.20
300	14.08	6.82

Cont.

1004

	Mat	Color	Texture	Hardness
0	Sand	Black Gray	Fine	Soft Soft
	Boulders			
	Hardpan	"	"	Hard
26				
	Hardpan	"		"
36				
	Sand & Gravel	"		Soft
76				
82	Sand	Red		"
	Clay	"		"
91				
	Hardpan & Boulders	Gray		Hard
137				
142	Hardpan	"		"
144	Sand		Medium	Soft

	Fe.	Mn.	SiO_2	Graph.
150		.44		
155		.44		
160		.44		
165		.28		
170		.08		
175		.10		
180		.14		
185		.14		
190		.16		
195		.14		
200		.28		
205		.14		
210		.18		
215		.4		
220	6.18	.32		11.27
225	7.40			21.32
230	7.50			7.95
235	15.37	.20		
240		.16		
245		.14		
250		.20		
255		.18		
260		.16		
265		.10		
270		.14		
275		.14		
280			55.00	
285			62.10	
290			52.60	
295			62.64	
300			60.50	
305	7.60		70.75	
310			70.32	
315			74.64	
320			60.24	
325		.24	62.50	
330		.24	68.60	
335		.38		14.35
340		.28		21.85
345		.68		10.35
350		.40		34.25
355		.20		26.15
360		.34		10.40
365		.32		30.95
370		.66		33.65
375		.60		29.30
380		.20		30.80
385		.52		30.60
390		.44		24.72
395		.58		29.83

Cont.

1003 cont

	Iron	Mn.
300		
305	21.CP	15.94
310	16.46	2.52
315	13.87	1.28
320	19.36	6.44
325	12.48	3.68
330	16.71	8.14
335	20.21	14.08
340	25.14	11.14
345	21.32	12.92
350	20.53	7.06
355	16.46	8.08
360	14.08	4.00
365	18.13	5.02
370	17.46	1.94
375	11.34	.56
380	16.67	2.90
385	9.84	.54

Bottomed in Slate
Finished June 14 '16

1004 cont

	Mn.	Graph.
395	.60	28.45
400	.42	26.15
405	.32	29.00
410	.46	30.80
415	.44	27.85
420	.34	25.80
425	.34	25.00
430	.34	24.85
435	.40	25.50
440	.36	23.30
445		23.97
448		20.45
450		20.35
455		

Finished June 14 '16
Bottomed in Graphitic Slate & Quartz

1005

	Material	Color	Texture	Hardness
2	Muck	Black	Fine	Soft
10	Sand & Clay	Yellow	Medium	Medium
33	Clay	Grey	"	Hard
42	Gravel & Sand	"	Coarse	Med.
47	Clay & "	Red	Fine	Soft
62	Clay	Grey	Coarse	Hard
74	Sand	"	"	"
94	Clay	"	Medium	"
105	Clay & Rock	"	Coarse	"
115	Sand & Grit	"	Med	Soft
122	Gravel	"	Coarse	Med
135	Hardpan	Brown	"	Hard
142	Clay Boulders	Grey	Med	"
149	" & Sand	"	"	Med.

	Fe	Phos	Mn	SiO_2	Graph
155			10.20		
160			11.50		
165			12.32		
170			6.96		
175			5.96		
180			3.80		
185			4.64		
190			7.78		
195			6.68		
200			7.44		
205			5.12		
210			5.94		
215			2.18		
220			6.94		
225			7.44		
230	19.26	.104	14.42		
235	18.45	.097	11.60		
240		.103	12.20		
245		.180	13.76		
250		.119	10.06		
255		.125	7.20		
260		.124	14.54		
265		.099	12.24		
270		.111	8.96		
275		.087	8.60		
280		.066	10.76		
285		.063	13.76		
290		.090	21.36		
295		.179	6.52		
300		.097	12.46		
305		.081	14.90		
310		.088	1.36		
315		.130	17.60		
320		.090	12.60		
325		.108	16.64		
330		.095	11.98		
335			3.84		
340			1.70		

Bottomed in Slate July 12. 1916

1006

Ft.	Material	Color	Texture	Hardness
	Muskeg	Black		
9.	Sand	Gray	Fine	Soft
18.	Clay	"	"	Medium
30.	"	"	"	Soft
40.	Sand & Gravel	"	Coarse	"
65.	Sand	"	Fine	"
85.	Clay	"	"	"
100.	Clay & Sand	"	"	"
115.	Hardpan	"	Med	Hard
	"	"	"	"

	Fe	Mn
145.		
150.		92
155.		88
160.		108
165.		112
170.		96
175.		156
180.		54
185.		68
190.		64

Graphitic Slate & Quartz

215.

260.

Quartz & Schist

285.

Graphitic Slate & Quartz.

320.		
325.	1373	24
330.	2327	28
335.	2770	32
340.	13.65	36
345.		
350.	Graphitic Slate.	
355.		

Bottomed in Graphitic Slate July 1 1916

1007

Ft.	Material	Color	Texture	Hardness
9.	Sand	Yellow	Fine	Soft
30.	Clay	Gray	"	Medium
40.	Hardpan	"	Coarse	Hard
55.	Sand	Yellow	Fine	Soft
64.	Sand & Boulders	Brown	"	"
68.	Hardpan	Gray	Coarse	Med
80.	Sand	Brown	Med	Soft
88.	Clay	Gray	Fine	"
93.	Sand	"	Med	"
110.	Hardpan	"	Coarse	Hard
120.	Clay & Boulders	"	"	"
146.	Hardpan & Boulders	"	"	"
152.	Hardpan	"	"	"
161.	Sand	"	Med	Soft
165.	Gray Shist		Fine	"
170.	Sandstone		"	Hard
195.	Schist	Red & Gray		
200.		Mn.		
205.		450		
		516		
	Red Schist			
230.				

Bottomed in Chert July 26 1916

1008

	Material	Color	Texture	Hardness
8.	Muskeg	Black	Fine	Soft
	Clay	Gray	"	"
23.				
	Clay • Boulders	"	Medium	Medium
45.				
55.	Hardpan	-	-	-
	Gravel • Sand.	Red	-	Soft
195.				
	Sand	Gray	Fine	Soft
150.				
153.	Clay	"	Med	Med
160.	Sand	-	Fine	Soft
165.		Mn 56		
	Gray Schist			
215.				
	Red Schist			
235.				
240.		44		
265.				
	Red Schist + Quartz			
300.	Iron			
305.	1922	.92		
	Red Schist + Quartz & Ore			
330.	Iron	Mn		
335.	9961	24		
	Schist & Ore			
360.				
370.	Graphitic Slate & Schist			

Finished Aug. 4. 1916
Bottomed in Graphitic Slate.

1009

	Material	Color	Texture	Hardness
0	Sand	Yellow	Medium	Soft.
15.	Clay	Coarse	"	Med.
20.	"	"	"	Hard.
27.	Sand	Yellow	"	Soft
35.	Hardpan	Gray	Coarse	Hard
40.	Sand • Boulders	-	-	Med.
	Gravel • Boulders	-	-	"
50.				
70.	Gravel • Boulders	"	"	Hard
75.	Hardpan	-	-	"
	Gravel	•	"	"
92.				
	Hardpan + Boulders	"	"	"
120.				
	Hardpan	-	"	"
139.				
	Clay	Blue	Med	-
157.				
162.	Sand	White	Fine	Soft.
165.		Mn 44		
	Graphitic Slate & Quartz	Black	"	"
205.				
210.	Graphitic Slate	-	•	"

Finished Aug 5 1916
Bottomed in Graphitic Slate.

1010

	Material	Color	Texture	Hardness
7	Muskeg	Black	Medium	Soft
10	Sand	Yellow	Fine	"
	Clay	Gray	Med.	Med.
30				
36	Gravel & Boulders	"	"	"
	Sand & Boulders	"	"	"
65				
	Sand, Gravel Clay & Boulders	"	"	"
85				
	Gravel, Sand & Boulders	"	"	"
100				
	Sand	"	Fine	Soft
135				
	Gravel, Sand & Boulders	"	Med	Med
150				
	Boulders & Gravel	"	Coarse	Hard
165				
	Quartz & Schist	"		
	Iron	Mn		
190	1966	68		
195	1899	70		
200				
	Schist & Pointrock seams	"		
240				
	Red & Gray Schist, Mixed			
260				

Finished Aug 24 1916
Bottomed in Schist

1011

	Material	Color	Texture	Hardness
0	Sand & Clay	Yellow	Med	Med
18	Hardpan	Gray	Coarse	Hard
	Hardpan & Boulders	"	"	"
36	Clay & Gravel	"	"	"
48				
	Gravel & Boulders	"	"	"
60				
	" " "	"	"	Med
90				
	Clay, Gravel & Boulders	"	"	Hard
125				
	Clay & Sand	"	Med	Med.
160				
169	Dark Gray Schist	Iron 784	Mn .22	
175	Gray & Brown Schist			

Finished Aug. 24 1916
Bottomed in Schist.

1012

	Material	Color	Texture	Hardness
5	Sand	Yellow	Fine	Soft
	Hardpan	Gray	Coarse	Hard
35				
	Sand & Boulders	Brown	Med.	Med.
90				
95	Gravel & Boulders	Gray	Coarse	"
	Hardpan & Boulders	"	"	"
115				
120	Clay & Boulders	"	"	"
	Hardpan & Boulders	"	"	"
175				
180	Sand & Gravel	"	"	"
	Hardpan & Boulders	"	"	"
215				
	Gravel Sand & Boulders	"	"	"
235	Schist & Quartz	"	"	"
245				
250		Green	"	Hard

Bottomed in Schist & Quartz
Finished Sept 21 16

1014

	Material	Color	Texture	Hardness
7	Muskeg	Black	Med	Soft
15	Sand	Yellow	"	Med.
	Hardpan	Gray	Coarse	Hard
35				
40	Sand	"	Med	Med.
	Hardpan & Boulders	"	Coarse	Hard
70				
80	Gravel	"	Med	Med.
	Hardpan	"	Coarse	Hard.
120				
	Hardpan & Boulders	Gray	Med	Hard
150				
	Sand	"	Fine	Soft.
165				
170	Sand & Gravel	"	Med	"
175	Black Clay	Black	"	"
180	Schist	Gray	"	Med.
	Quartz	White	Coarse	"
200				
210	Schist	Geen	"	"

Bottomed in Green Schist.
Finished Oct. 9 1916

1013 Δ Hole 60° NW

	Material	Color	Texture	Hardness
	Muskeg			
20	Clay	Gray	Med	Soft
25	Quicksand	"	Med	Med
35	Clay-Sand	"	"	"
45	Clay-Gravel	"	"	"
52	Boulder-Gravel	"	"	"
112	Gravel-Clay Boulders	"	Coarse	"
15	Gravel	"	"	"
87	Gravel-Sand	"	"	"
98	Sand	Red	Med	"
103	Sand	"	"	"
115	Sand-Gravel	Gray	Coarse	Soft
122	Clay-Gravel	Blue	"	Med
139	Gravel-Sand	Gray	Med	"
153	Hardpan Boulders	"	"	"
170	Hardpan Solid Seams	"	"	Hard
180	Clay-Sand Seams	Green	Fine	Med
185	Sub-Lignite	Black	Med	Soft
245	Schist	Gray-Brown	"	Med
260	Green & Brown Schist			
265				
270				
275				
280				
285				
290				
295				
300				

Iron	Mn
1008	326
2045	360
1503	940
1138	340
1642	340
1452	376
1740	412
1108	340
1448	346

Bottomed in Schist & Point Rock
Finished Oct 7. 1916.

1015 Commenced Oct. 9. 1916

	Material	Color	Texture	Hardness
20.	Muskeg	Black	Fine	Soft
	Clay & Sand	Gray	"	Med
22.				
	Boulder & Sand	Yellow	Med.	Soft
70.				
75.	Sand	"	Fine	Med
	Gravel & Sand	Green	Coarse	"
91.				
96.	Gravel	Gray	"	"
100.	Boulders & Clay	"	Med.	"
112.	Hardpan	"	"	Hard
115.	Gravel & Boulders	"	Coarse	Med
	Hardpan	"	Med.	Hard
130.				
	Sand & Gravel with Clo. Seams	Yellow	"	Med

	Iron	Ph	Mn
143.			
145.			
150.	2819	.071	360
155.	2104	.085	1950
160.	1924	.121	1394
165.	1667	.020	814
170.	1444	.045	1210
175.	1916	.034	678
180.	1665	.06	848
185.	2036	.038	926
190.	1986	.045	842
195.	2282	.054	840
200.	1905	.064	480
205.	1632	.064	230
210.	1746	.071	[illegible]
215.	1165	.083	[illegible]
220.	1088	.089	754
225.	1906	.118	796
230.	1201	.069	826
235.	1590	.182	1390
240.	1363	.128	1092
245.	1278	.029	1072
250.	1329	.069	1880
255.	1387	.101	1300
260.	1432	.069	1314
265.	1424	.078	2070
270.	1588	.120	792
275.		.118	674
280.		.081	658
285.		.091	850
290.		.100	252
295.		.169	1.90
300.		.150	5.80
305.		.135	556
310.		.110	254
315.		.146	.370
320.		.101	566
325.		.094	.58
330.		109	.44
335.		.096	.38
340.		.127	.36
345.		.079	.26
350.		.078	1.66
355.			1.60
360.			126
365.			192
370.			328
375.			140
380.			4.00
385.			5.80
390.			2.64
395.			2.52
400.			.82

Bottomed in Slate
Finished Nov. 2 1916

1016 Commenced Oct. 10. 1916

	Material	Color	Texture	Hardness
3.	Sand	Yellow	Fine	Soft
	Clay	Gray	Med.	"
50.				
	Gravel & Boulders	"	"	"
90.				
	Hardpan	"	Med.	Med.
102.				
	Hardpan & Boulders	"	Coarse	"
140.				
145.	Hardpan	"	Med.	"
155.				
	Sand	"	Fine	Soft
165.				
170.	Clay & Sublignite	Black	Med.	Med
	Schist	Gray	Fine	Soft
185.				
	Quartz	"	Coarse	"
235.				

Bottomed in gray Quartz.
Finished Oct. 19. 1916

1017 Commenced Oct 20. 1916

	Material	Color	Texture	Hardness
5	Muskeg	Black	Fine	Soft
	Clay	Gray	"	"
20				
30	Sand	Yellow	Coarse	"
40	Clay	Red	Med	Med
50	Hardpan + Boulders	Gray	"	
60	Sand	"	Coarse	Soft
70	Gravel	"	"	"
80	Sand	"	"	"
	Sand + Clay Seams	"	Med	"
130				
140	Gravel + Boulders	"	Coarse	Med
146	Clay	"	Med	"
150	Boulders	"	Coarse	Hard
160	Sand	Gray	Fine	Soft
170	Sub-lignite	Black	Med	"
	Talc	Gray	Fine	"
190				
	Quartz	"	"	Hard
210	Quartz + part Rock	Red	Med	Med.
215		Mn.		
220		1.24		
225		.92		
230		1.12		
235	15.05	1.24		
240	19.71 .075 .099	1.56		
245		.76		
252	Mountrock + Schist	Red	Med	Hard
260	Slate + Schist	Black	Fine	"
	Slate	"	Med	"

Bottomed in Slate
Finished Nov 16. 1916.

1018

	Material	Color	Texture	Hardness
15	Clay-Sand	Gray	Med.	Med
32	Hardpan	"	"	Hard
38	Sand	Red	Fine	Soft
69	Sand, Gravel + Boulders	Gray	Coarse	Med.
85	Sand	"	Fine	Med.
93	Gravel + Boulders	"	Coarse	"
	Hardpan	"	Med.	Hard
132	Gravel	"		Med.
137	Sand	"	Fine	Soft
143	25.84			
145			9.24	
150			2.14	
155			.84	
160			.58	
165			6.34	
170			3.66	
175			2.24	
180			1.32	
185			4.30	
190			.342	
195	16.16		6.36	
200			3.40	
205			3.34	
210			1.52	
215			2.08	
220			1.00	
225			.62	
230			.24	
235	16.00		.22	
	Ore + Schist			
260				
268	Chert + Slate			

Bottomed in Chert + Slate
Finished Nov. 28. 1916

1019

	Material	Color	Texture	Hardness
	Muskeg	Black	Med	Soft
5	Sand	Gray	Fine	"
	Clay	"	Med	"
30				
	Sand	"	Fine	"
39	Boulders	"	Coarse	Hard
40				
48	Clay	Red	Med.	Med.
	Gravel & Boulders	Gray	Coarse	Hard
80				
87	Sand	"	Fine	Soft
88	Hardpan	"	Med	Med.
	Hardpan Boulders	"	Med.	Hard
120				
	Hardpan & Sand	"	"	"
152	Sand &			
160	Boulders	"	"	"
165	Clay	"	"	Med
	Schist	"	"	"
185				
	Schist & Quartz	"	"	"
200				

Bottomed in Schist & Quartz
Finished Nov. 28, 1916

1020

	Material	Color	Texture	Hardness
8	Muskeg	Black	Med.	Soft.
	Clay	Red & Gray	"	"
57				
60	Hardpan	Gray	"	Hard
	Gravel-Boulders	"	Coarse	"
70				
	Clay & Sand	"	Med	Med.
80				
	Sand. Clay & Boulders	Gray	Med.	Soft.
105				
	Sand	"	"	"
120				
130	Gravel & Boulders	"	Coarse	Med.
	Gravel & Sand	"	Med	"
145				
	Boulders Gravel & Sand	"	Coarse	"
158				
	Gravel & Sand	"	Med	"
168				
175	Gray Schist	"	"	Hard
185	Sub. lignite	Black	Fine	Soft.
190	Schist	Gray	Med	Hard
195	2.39 Mn. .34			
200	Schist	"	"	"

Bottomed in Schist
Finished Dec. 5, 1916

1021

	Material	Color	Texture	Hardness
	Mucky Clay	Gray	Fine	Soft
48				
56	Hardpan	"	Med	Med
68	Gravel, Sand & Boulders	"	"	"
	Sand & Gravel	Green	Coarse	Soft
90				
94	Clay & Gravel Seams	Gray	Med	Med
98	Quicksand	"	Fine	Soft
102	Gravel & Boulders	"	Coarse	Hard
107	Boulders & Gravel	"	Med	"
	Hardpan & Gravel Seams	"	"	Med
132				
136	Sand	Yellow	Fine	Soft

	Iron	Phos.	Mn
145	4742	165	498
150	3969	102	674
155	2546	131	476
160	2349	102	830
166	2416	061	594
170	1551	081	248
175	2542	065	164
180	2527	053	362
185	1604	147	294
190	1701	059	242
195	1954	077	530
200	2375	127	144
205	2782	139	100
210	2497	123	128
215	1477	056	540
220	1750	054	1012
225	2185	147	984
230	2396	190	1240
235	2446	178	266
240	1750	127	1274
248	2185	185	836
250	1474	139	996
255	2230	486	516
260	1750	076	276
265	1847	121	116
270	1931	075	1274
275			1266
280			
285			512
290			1164
295			162

Bottomed in Schist
Finished 12-20-16

1022

	Material	Color	Texture	Hardness
	Muskeg	Gray	Fine	Soft
5	Sand	Yellow	"	Med
	Clay	Gray	"	"
25				
	Sand Boulders	"	"	"
60				
	Hardpan	"	Med	Hard
70				
74	Sand & Gravel	"	"	Med
	Boulders & Sand	"	"	Hard
90				
	Boulders & Hardpan	"	"	"
160				
	Clay	"	Fine	Soft
172				
180	Schist	"	Coarse	"
	Quartz	"	Med	Med
210				

Bottomed in Quartz
Finished 1/13/17

1023

	Material	Color	Texture	Hardness
	Sand Clay	Gray	Fine	Soft
20				
	Clay	"	"	"
35				
	Clay & Sandseams	"	"	Med
51				
	Boulders & Hardpan	"	Coarse	"
62				
66				
72	Sand	-	Med	Soft
	Sand & Gravel	Green	Med	Med
95				
101	Gravel & Boulders	"	Coarse	"
	Hardpan & Boulders	Gray	Med	Hard
118				
	Hardpan	.	"	Med
134				
141	Sand & Gravel	Yellow	"	Soft

	Iron	Phos.	Mn
145	21.01		1.80
150	24.20		.60
155	22.51		.58
160	25.90		.82
165	25.75		2.10
170			4.54
175			4.21
180			4.76
185			2.61
190			1.14
195			1.33
200			2.43
205			2.24
210			2.04
215		.127	17.38
220		.120	12.50
225		.144	12.45
230		.252	9.86
235	29.82	.164	8.13
240		.171	15.70
245		.107	8.92
250		.090	8.97
255		.068	3.60
260		.119	8.22
265			5.09
270			4.43
275			3.14
280			3.78
285		.088	10.55
290			1.38
295			.92
300			2.68
305		.034	11.64
310			8.60
315		.068	11.55
320		.100	11.97
325			4.44
330			2.89
335			2.22
340			2.44
345			3.44
350			3.26
355			5.83
358	32.91	.121	20.82

Bottomed in Chert
Finished 2/24/17

1024

	Material	Color	Texture	Hardness
5	Muskeg	Gray	Fine	Soft
	Clay	"	Med	"
61				
	Sand	-	-	Med
86				
	Gravel & Boulders	.	"	Hard
100				
	Boulders & Hardpan	"	"	"
140				
145	Sand & Gravel	"	"	Med
150				
154	Sand			"

	Iron	Phos	Mn
160	21.52	.112	7.54
165	19.45	.075	3.00
170	21.55	.101	9.08
175			3.30
180			1.74
185			2.70
190			1.88
195			1.37
200			1.88
205			2.28
210			.82
215			.50
220			.68
225			4.94
230			6.77
235			4.85
240			2.70
245			6.65
250			4.72
255		.080	14.05
260			8.22
265			7.03
270			8.77
275			3.70
280			1.34
285			1.85
290			2.26
295			2.53
300			5.06
305			3.98
310			2.84
315			2.19
320			2.76
325			3.89
330			2.68
335			3.82
340			3.75
345			2.11
350			1.95
355	18.60		1.23
360			2.44
365			3.01

Bottomed in Slate
Finished 2/23/17

1025

	Material	Color	Texture	Hardness			
4		Gray	Fine	Soft			
13	Sand	"	"	"			
	Clay	"	"	"			
62							
	Sand, Gravel, & Boulders	"	Med	Hard			
91							
105	Gravel & Boulders	"	Coarse	"			
110	Hardpan		Med	Med			
125	Hardpan & Boulders	"	"	"			
130	Clay & Sand	"	Fine	Soft			
138	Sand		Med	"			
142	Clay & Sand	Mos.	Mn.	Med			
145		.089	6.37				
150		.049	9.45				
155	22.83	.072	5.42				
160			3.98				
165		.041	6.42				
170			4.08				
175			2.98				
180			4.12				
185			4.13				
190			1.94				
195			1.62				
200			1.45				
205			7.28				
210			1.94				
215		.074	2.35				
220		.102	18.02				
225		.072	4.60				
230		.056	14.80				
235		.080	17.61				
240	22.46	.108	19.64				
245		.083	11.09				
250	18.98	.051	16.64				
255		.052	23.09				
260		.046	5.70				
265		.065	6.52				
270		.068	18.02				
275		.196	1.70				
280		.187	1.09				
285	33.24	.154	9.20				
290		.134	4.68				
295		.101	19.15				
300		.081	7.37				
305		.092	9.19				
310		.113	11.31				
315		.100	14.60				
320			7.72				
325			4.91				
330			6.87				
335	19.13		2.79				
340	18.53		1.05				
345			5.32				
350			2.02				
355			3.08				
360	16.22	.105	2.38				
362	12.52	.107	2.93				

Bottomed in Quartz
April 14 1917.

1026

	Material	Color	Texture	Hardness			
	Muskeg	Blue	Fine	Soft			
8	Sand & Clay	"	"	"			
20							
30	" " "		"	"			
	Clay	Gray	"	"			
50							
	Sand & Clay	"	"	"			
63							
	Sand & Gravel & Clay	"	"	"			
80							
88	Sand		Med	"			
94	Gravel & Boulders	"	"	Med			
102	Hardpan	"	"	Hard			
	Sand-Gravel Hardpan & Boulders	"	"	"			
117							
125	Hardpan	"	"	"			
134	Gravel & Hardpan	"	"	Med			
137	Gravel	"	Mn	"			
140			1.54				
145			1.90				
150			1.18				
156			3.48				
160			2.31				
165			2.84				
170			2.54				
175			1.45				
180			.46				
185			.54				
190			2.49				
195			2.36				
200			1.58				
205			1.49				
210	Iron	Phos	1.40				
215			.68				
220	19.43	.081	13.92				
225		.061	9.08				
230			4.05				
235			6.08				
240			3.58				
245			5.88				
250			6.75				
255			2.26				
260			1.38				
265			2.09				
270			.82				
275			2.21				
280			.73				
285			.18				
290			4.69				
295			3.60				
300			2.66				
305			1.24				
310			1.28				
315	21.55		.92				
320			1.74				
325			1.56				
330			1.74				
335			1.00				
340	24.19		.82				
344			1.82				
345			.88				
350			.78				
355			.36				
360			.82				
365			2.02				
370			1.56				
375	20.41	.200	1.33				
376	24.88	.141	4.37				

Bottomed in Schist
April 17. 1917.

Sheet 16

1027

	Material	Color	Texture	Hardness
5	Muskeg	Black	Fine	Soft
	Clay	Gray	"	"
44				
59	Clay & Hardpan	"	Med	Med.
73	Hardpan & Gravel	"	"	"
	Gravel & Boulders		"	"
100				
	Hardpan & Boulders			
130				
	Hardpan & Sand			

	Iron	Phos	Mn
142			
145	21.33	04.2	.28
150	11.83	068	1.55
155	22.62	082	1.56
160	27.21	072	3.86
165	17.27	054	2.38
170	20.21	064	4.76
175	19.00	075	3.02
180	14.80	065	2.10
185	13.89	055	3.20
190	17.64	119	3.24
195	8.25	.068	3.83
200	15.85	030	2.28
205			.39
210			6.59
215			2.28
220			4.75
225			4.43
230			1.77
235			6.35
240			1.18
245			.89
250	00 29		.32
255	00 30		.38
260			1.8
265			9.55
270			16.02
275			12.38
280			6.49
285			3.83

Finished May 3 1917

1028

	Material	Color	Texture	Hardness
20	Muskeg & Clay	Black	Fine	Soft
38	Clay & Sand	Gray	Med.	"
80	Boulders & Hardpan		"	Med
89	Gravel & Sand		Coarse	"
	Boulders Hardpan	"	"	"
129	Boulders			
137	Gravel & Hardpan	"	Med	"

	Iron	Phos	Mn
137			
140	24.39		1.64
145	19.73		2.19
150	21.99		2.28
155			2.37
160			1.77
165			4.06
170			3.05
175			2.47
180			2.46
185			.45
190			.36
195			.40
200			.27
205			.81
210			4.39
215			9.05
220			10.03
225			7.68
230			6.21
235			6.12
240			1.46
245			6.75
250			1.09
255	18.02	.126	1.97
260	17.65	.053	11.12
262	17.65	[illegible]	[illegible]

Finished May 10, 1917

1029

	Material	Color	Texture	Hardness
5	Muskeg	Black	Fine	Soft
	Clay	Gray	Fine	Soft
47				
	Clay + Gravel	"	Coarse	Medium
63				
	Sand	"	Medium	Soft
78				
	Gravel + Boulders	"	Coarse	Hard
87				
	Gravel, Sand, + Boulders	"	Medium	
96				
	Hardpan + Boulders	"	Medium	Hard
134				
	Clay, Gravel, + Boulders	"	Medium	Soft
143				
149			.45 Mn	
150	Fe	P	.40	
155			.36	
160			.90	
165			1.74	
170			1.91	
175			.90	
180	17.05	.064	2.47	
185	22.08	.109	1.74	
190	15.85	.085	3.07	
195	16.90	.082	4.48	
200	14.72	.066	1.88	
205	14.64	.075	2.01	
210	14.42	.079	.78	
215	12.69	.061	1.10	
220	12.77	.037	3.66	
225	9.61	.052	3.93	
230	9.96	.041	2.33	
235	16.82	.059	8.33	
240	12.24	.050	3.66	

Finished May 9, 1917

1030

	Material	Color	Texture	Hardness
5	Muskeg	Black		
10	Sand	Yellow		
	Clay	Gray		
45				
	Hardpan	"		
60				
	Gravel, Sand, + Boulders	"		
90				
96	Clay	Red		
	Hardpan + Boulders	Gray		
143	Fe	P	Mn	
150	29.14	.040	8.10	
155	24.97	.050	5.08	
160	20.13	.043	3.07	Fine Soft
165	20.81	.126	3.80	
170	25.83	.084	5.58	

Finished May 14, 1917

Sheet P

1031

	Material	Color	Texture	Hardness
	Sand + Clay	Gray	Fine	Soft
M 22	Gravel + boulders	"	"	Medium
	Hardpan, gravel, + boulders	"	Medium	"
40				
	Gravel + Sand	Mixed Gray	"	"
80				
	Gravel, Sand, + Hardpan		"	"
101				
	Hardpan, Gravel + Boulders	Gray	"	"
121				
	Clay	Blue	Fine	"
150				
159	Sand + Gravel	Gray	Coarse + Fine	Medium + Soft
165	Fe 27.49 Mn .54			
170	24.27 .63		Fine	Soft
180				
	Schist + Quartz	Black + white	Coarse + Fine	Soft
200				
225				
230	22.11 .05			
	Schist	Variety	Coarse + Fine	Hard to soft
280				
285	20.45 .13			
290	31.16 .18			

Finished May 7, 1917

1032

	Material	Color	Texture	Hardness
5	Muskeg			
	Clay	Gray	Fine	Soft
35				
	Clay	Red	Medium	Medium
57				
	Clay + Gravel	Gray	Coarse + Medium	"
84				
	Sand + Gravel	"	Coarse	Soft
120				
	Sand	"	Medium	Soft
136				
144	Gravel	"	Course	
	Hardpan	"	Medium	Hard
176				
180	Sand	"	Fine	
	Schist + Sub lignite	Variety	Coarse to Fine	Soft
195				
203	Quartz	Gray	Fine	Hard

Finished May 23, 1917

Sheet P

1033

	Material	Color	Texture	Hardness
2	Muskeg			
	Sand	Yellow		
12				
	Clay	Gray		
31				
	Sand, Gravel + Boulders	Brown + Gray		
101				
	Hardpan + Boulders	Gray		
121				
	Hardpan	"		
139	Hardpan, Gravel + Boulders	"	Coarse + Medium	Hard + Medium
141	Hardpan, Gravel + Sand	"	Medium + Fine	Medium
146	12.93 Fe .13 Mn			
150	29.27 1.99	Variety	" + "	Soft
155	27.71 1.89			
160	13.38 .45	Red, Gray, Green	" + "	Medium + Soft
165	29.51 2.93			
170	18.72 1.68	Gray + Brown	" + "	Soft
175	13.93 .45			
180	16.98 .18	" + Red	" + "	Medium + Soft
185	18.75 .09			
190				
	Schist + Graphite	Variety	" + "	" + "
220				
225				
230	17.68 .05	"	" + "	Hard + Medium
235				

Finished May 31, 1917.

1034

	Material	Color	Texture	Hardness
	Clay + Sand	Gray	Fine	Soft
18				
	Clay	"	"	Medium + Soft
38				
	Water, Sand + Gravel	"	Medium + Fine	Soft
90				
97	Gravel + Boulders	Mixed	Coarse + Medium	Hard
	Hardpan	Gray	Medium	Medium
139				
	Hardpan, Sand + Gravel	"	Coarse To Fine	"
152				
	Fe Mn			
165				
170	10.91 .09			
	Schist	Variety	Medium + Fine	Medium + Soft
210				
215	7.91 .14			
225				
230				
235	5.38 .14			
240				
245	5.38 .14	"	" + "	Soft
250				
255	5.98 .14			
260				
265				
	Schist + Point R.	"	" + "	"
285				
290				
295	5.83 .05	"	" + "	"
300				

Finished June 18, 1917.

Sheet P

Aitkin County
Sec Ref 1072

Serial No. 42
Hole No. 1
Collar Elevation:
Depth of Hole: 332'
Location: Sec. 23, T43N - R27W

Date completed: 5/13/50
Drilled by: U. S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond Drill-Core

Depth From	Depth To	Material	Material and Analyses Iron	Mang.	Core
0	150	Sand gravel, boulders	Surface		
150	162	Green sand			
162	167	Soft iron formation			
167	172	Red mud			8.2
172	177	No core			
177	182		18.92	1.88	36.8
182	187				31.6
187	192	Red mud and lump	18.76	7.81	58.5
192	197	of red slate	17.16	4.64	48.4
197	202		13.79	6.71	40.0
202	207				26.6
207	210		16.36	20.17	
210	213				33.3
213	218	Mud and red slate			21.6
218	222	and black slate	13.79	6.87	50.0
222	227		15.79	6.05	53.4
227	232				
232	237				50.0
237	242		12.67	2.27	20.0
242	247				3.4
247	250.5	No core			
250.5	253				21.3
253	257	Red slatey	7.86	0.75	18.8
257	260				83.5
260	263		10.42	2.74	83.5
263	266				94.4
266	269.5	Clayey light decomb.	11.39	5.97	62.0
269.5	273	slate. Lump of black			90.4
273	277	slate & manganese at	9.30	0.32	85.6
277	281	260', 263'4", 269',	11.47	1.49	100.0
281	283.5	296'7", 300', 300½'			100.0
283.5	287	to 302'.	7.94	0.95	95.4
287	291.5				50.0
291.5	295		8.58	3.06	105.1
295	298				116.5
298	300.5		11.45	7.69	90.0
300.5	302				44.6
302	304		8.90	7.50	100.0
304	307	Similar but			86.0
307	309	red	11.79	3.02	87.5
309	312.5				90.8
312.5	314		15.31	2.82	66.7
314	318	Similar to above but			66.5
318	320	red. Few small black	7.70	4.33	54.0
320	324.7	manga. nodules. Large	10.42	1.38	94.0
324.7	327.7	at 319'.	8.18	1.42	100.0
327	332		14.51	0.13	93.0
116	332		11.79	3.60	

No unaltered formation.
Bands show dips 45°±

Serial No. 43
Hole No. 2
Collar Elevation: 1218.5'
Depth of Hole: 467'
Location: N.E. - [illegible]

[illegible]: 10/6/50
[illegible]: [illegible] miles
[illegible]: [illegible]
[illegible]: Diamond Drill-Core

Depth From	Depth To	Material	Core Iron	Core [illegible]	Core [illegible]	Sludge Iron	Sludge [illegible]	Sludge [illegible]	Average Iron	Average [illegible]	Average SiO_2
0	144	Surface									
144	150	material	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	44.99
150	155	Dk.red clay	20.[illegible]6	1.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	40.44
155	160	No core				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	47.92
160	164	Dk.red clay; a few soft pieces of mn. oxide	23.77	2.29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.11	45.40
164	169	Dk.red clay; a few streaks of red ore	19.73	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Average									[illegible]	[illegible]	[illegible]
169	174	Dk.red clay & broken soft slate	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
174	179	No core				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	48.10
179	184	Soft red sl. & clay; a few black mn.-bearing bands in sl.; bedding 45°	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	39.06
184	187	No core				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	50.27
187	191	Red clay & soft [illegible] few [illegible] of sl. with [illegible] bands	14.65	[illegible]	[illegible]				14.65	[illegible]	[illegible]
Average									[illegible]	[illegible]	[illegible]
191	196	Soft red [illegible] [illegible]	[illegible]	[illegible]	[illegible]				[illegible]	[illegible]	[illegible]
196	[illegible]	Soft red sl. or narrow band black sl.	[illegible]	[illegible]	[illegible]				[illegible]	[illegible]	[illegible]
201	206	Soft red sl.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
206	211	Soft red sl.; bedding [illegible]	[illegible]	[illegible]	[illegible]				[illegible]	[illegible]	[illegible]
211	216	Soft red sl.	[illegible]	[illegible]	[illegible]				[illegible]	[illegible]	[illegible]
216	[illegible]	Soft red sl.; [illegible] band of black slate	[illegible]						[illegible]	[illegible]	[illegible]

Aitkin County
Sec Ref 1072

Serial No. 43
Hole No. 2 (Cont'd.)
Collar Elevation: 1213.5'
Depth of Hole: 467'
Location: N.E.- S.W.

Date completed: 10/9/[illegible]
Drilled by: U.S. Bureau of Mines
Logged by: W. A. Gross
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Analyses: Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Iron	Adjusted Mang.	Adjusted SiO_2
220	225	Soft red sl. & clay; bedding 45°; cleavage 31° about right angles to bedding	7.60	1.22	75.79				7.60	1.22	75.79
Average									9.93	1.07	72.05
225	230	Soft red sl.	7.11	4.73	78.90				7.11	4.73	78.90
230	235	Soft red sl.; a few bands of black slate	8.08	3.23	74.01				8.08	3.23	74.01
235	238.5	Black sl. with some pale red slate	13.42	7.60	59.43	10.74	4.71	65.71	11.72	5.76	63.41
Average									9.36	4.44	73.07
238.5	243.5	Soft pale red slate	8.08	1.45	68.32				8.08	1.45	68.32
243.5	248.5	Soft pale red sl. with bands of harder red slate	7.92	.39	68.19	6.51	.89	76.76	7.25	.63	72.25
248.5	254	Pale red sl.; cleavage 52° at 249.5'; vertical fracture plane at 249'	7.27	1.49	69.22	11.56	3.88	65.03	9.92	2.97	66.63
254	259	Soft red & light gray sl.; vertical banding at 255'; cleavage 15°	6.47	.47	71.71				6.47	.47	71.71
259	264	Soft red sl. to 261'; harder red sl. 261 to 264'; cleavage 28° to 33°; mn. filling along cleavage planes	5.17	.66	75.34				5.17	.66	75.34
264	269	Red sl. band of chert & mn.(?) at 269'; bedding 53°	13.42	.59	34.27	13.86	1.44	62.93	15.44	1.17	63.36
Average									8.74	1.25	69.55

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 43
Hole No. 2 (Cont'd.)
Collar Elevation: 1213.5'
Depth of Hole: 467'
Location: N.E.- S.W.

Date completed: 10/9/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Analyses Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
269	274	Red to dk. red clay with highly fractured sl.; a few bands of harder slate	13.90	.66	60.17				13.90	.66	60.17
274	279	Black sl. 274' to 275'; red sl. 275' to 279'	7.60	.51	69.87				7.60	.51	69.87
279	284	Red sl.(soft) to 282'; soft gray sl. 282' to 284'	6.79	.28	71.30				6.79	.28	71.30
284	289	Soft red and light gray sl.	10.99	.78	64.73	11.72	.59	67.04	11.42	.67	66.09
289	294	Soft red sl.; mn. filling in fractures and/or bedding planes	9.94	.98	65.91	11.88	1.89	65.20	10.70	1.34	65.63
294	299	Soft red sl.	8.73	.36	66.56				8.73	.36	66.56
299	303.5	Soft light gray sl.;cleavage 25° at 299' to 300'; soft red sl. at 300' to 302'; hard black sl. at 302 to 303.5' (manganiferous?)	10.51	2.44	63.30				10.51	2.44	63.30
303.5	308	Soft red clay & sl. to 306'; Light red sl. to 306 to 308', soft bedding 35°; hard black sl. at 308'	8.81	.32	67.91				8.81	.32	67.91
308	313	Red sl.; cleavage 35°; mn.band at 309';fractured pieces of mn. 312' to 313'	7.68	1.65	67.18				7.68	1.65	67.18
Average									9.57	.90	66.46

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 43
Hole No. 2 (Cont'd.)
Collar Elevation: 1213.5'
Depth of Hole: 467'
Location: N.E.- S.W.

Date completed: 10/9/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Green
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Core Iron	Core Meng.	Core SiO_2	Sludge Iron	Sludge Meng.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Meng.	Adjusted Average SiO_2
313	318	Band of hard mn. ± 2' or more; dk. sl. at 318'	12.69	14.58	44.96	15.30	16.29	39.84	14.81	15.97	40.81
318	323	Red sl. and hard bands of mn. to 320'; softer red sl. 320 to 323'; rumpled bedding at 322'	9.40	1.73	65.64				9.40	1.73	65.64
323	327.5	Soft red sl.	11.03	5.00	59.74				11.03	5.00	59.74
327.5	333	Soft red sl. with ± 1' of hard mn.	22.54	10.64	40.33	14.98	5.91	57.17	16.74	7.01	53.25
Average									13.14	7.48	54.70
333	338	Soft red sl. and clay	8.60	.23	69.22				8.60	.23	69.22
338	343	Soft red sl.; bedding 30°; cleavage 55°; angle of cleavage & bedding ± 90°	6.81	.27	70.27				6.81	.27	70.27
343	347	Light red sl.; cleavage and bedding vertical	10.70	.86	65.60				10.70	.86	65.60
347	351.5	Red clay and sl.; bedding 27°; some wad	9.73	.19	68.21				9.73	.19	68.21
351.5	356.5	Red sl.; dk. gray sl. only slightly altered at 354'; bedding 35°; cleavage 20°	11.35	.15	67.60				11.35	.15	67.60
Average									9.38	.31	68.29
356.5	360.5	Soft dark gray slate	9.57	.55	69.07	11.07	2.21	65.21	10.33	1.40	67.10
360.5	366	Hard banded slate, dk. gray to light red; bedding 37°; cleavage 70°	7.30	.82	69.97				7.30	.82	69.97

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 43
Hole No. 2 (Cont'd.)
Collar Elevation: 1213.5'
Depth of Hole: 467'
Location: N.E.- S.W.

Date completed: 10/9/50
Drilled by: U. S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Core Analyses Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
366	371	Hard, dk.gray sl. with streaks of iron stain; cleavage 27°	8.11	1.68	64.31				8.11	1.68	64.31
Average									8.42	1.28	67.23
371	373	Hard, dk.gray slate;rumpled bedding	5.35	4.98	53.95				5.35	4.98	53.95
373	378	Hard,reddish iron stained slate	7.19	2.29	47.57				7.19	2.29	47.57
378	383	Hard,dk.gray slate;some iron stain;cleavage 30°	8.92	.04	69.45				8.92	.04	69.45
383	388	Bedding 15°; tends to cleave on bedding planes;dk.gray slate;2' light gray slate with thin iron seams	9.40	.63	68.53				9.40	.63	68.53
388	392	Dk.gray to moderately light gray sl.; some iron stain	7.95	1.97	64.55				7.95	1.97	64.55
392	397	Light gray slate	9.40	1.61	65.16	11.23	1.95	63.70	10.24	1.77	64.49
397	402	Light gray slate	12.16	2.13	63.04				12.16	2.13	63.04
402	407	Gray slate; some iron stain	9.57	2.49	65.03				9.57	2.49	65.03
407	412	Dk.gray slate; some iron stain; uneven fracture; rumpled bedding	8.11	1.53	67.17				8.11	1.53	67.17
412	417	Moderate gray slate;some iron stained bands	7.60	2.76	65.73				7.60	2.76	65.73
417	422	Gray slate; some iron stain; bedding 35°	7.27	1.06	69.08				7.27	1.06	69.08
422	427	Gray slate; some iron stain; bedding 35°	6.63	1.81	69.98				6.63	1.81	69.98
Average									8.03	1.89	64.58

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 43
Hole No. 2 (Cont'd.)
Collar Elevation: 1213.5'
Depth of Hole: 467'
Location: N.E. - S.W.

Date completed: 10/9/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Analyses Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
427	432	Gray slate; ± 1' badly fractured iron stained slate	8.57	.20	69.64				8.57	.20	69.64
432	437	Gray slete & red iron-stained slate	7.92	.12	71.43				7.92	.12	71.43
437	442	Dk.gray slate; bedding 40°	7.03	.12	72.82				7.03	.12	72.82
442	447	Dk. to light gray slates; some iron stain	8.08	.12	68.76				8.08	.12	68.76
447	452	Medium gray slate; several iron stained bands	8.65	.12	68.97				8.65	.12	68.97
Average									8.05	.14	70.32
452	457	Light gray slate; iron stained bands	6.95	1.18	66.44				6.95	1.18	66.44
457	462	Light gray slate; iron stained bands	8.08	2.72	62.07				8.08	2.72	62.07
462	467	Light gray slate; iron stained bands	6.47	1.57	65.27				6.47	1.57	65.27
Average									7.17	1.82	64.59
144	467	Average for hole							10.88	1.82	64.03

Serial No. 44
Hole No. 3
Collar Elevation: 1213.1'
Depth of Hole: 340'
Location: N.E.- S.W.

Aitkin County
Sec Ref 1072

Date completed: 10/6/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Analyses: Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
0	175	Surface									
175	181					13.05	2.25	62.54	13.05	2.25	62.54
181	185	Light gray clay & soft slate	12.13	3.90	57.80				12.13	3.90	57.80
185	188	Red, light red soft slate; bedding vertical	10.91	1.08	63.54				10.91	1.08	63.54
188	191	Soft red sl.; bedding vertical	10.99	2.32	63.84				10.99	2.32	63.84
191	194	Soft red sl.; bedding at 45°; rock breaks along bedding easily at 198'	12.21	2.60	56.90				12.21	2.60	56.90
Average									12.06	2.48	61.01
194	197	Light gray, closely folded slate; cleavage 15° (axis of folds) at 194 to 195'. Red sl.; bedding vertical; cleavage 70° at 196'	10.02	1.85	64.30				10.02	1.85	64.30
197	200	Red slate; bedding 43°	8.89	.59	65.78				8.89	.59	65.78
200	205	Soft red sl. & clay; bedding 15°	10.99	.95	62.22				10.99	.95	62.22
205	210	Light red sl.; bedding 50°; cleavage vertical (?)	11.24	1.28	62.77	14.34	1.77	61.95	13.67	1.66	62.13
Average									11.25	1.27	63.25
210	215	Light red, soft slate; some mang.	11.32	6.23	58.07	14.18	1.57	61.23	13.82	2.16	60.83
215	218.5	Dk. red clay; pale red slate; some mang.	12.94	3.31	61.50	14.50	1.68	59.92	13.85	2.36	60.58
218.5	221	Pale red slate; ± 3' mang.									
221	224	Red & pale red slate; cleavage 20°	11.16	1.69	63.04	11.28	1.93	66.25	11.25	1.87	65.41

(Continued)

Serial No. 44
Hole No. 3 (Cont'd.)
Collar Elevation: 1213.1'
Depth of Hole: 340'
Location: N.E.- S.W.

Aitkin County
Sec Ref 1072

Date completed: 10/6/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Core Analyses: Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
224	230	Some good mang. at 224'; pale red sl.; bedding 45°	14.15	3.27	55.70	14.34 11.03	4.18 1.12	52.01 64.03	13.20	2.94	60.98
230	233	Some mang. at 230'; red sl.; bedding 22°; cleavage 50°	14.96	3.84	58.16	10.87	1.33	65.34	12.34	2.23	62.76
Average									12.86	2.33	62.17
233	235	Soft, pale red slate									
235	237	No core	19.40	4.49	51.74	14.42	4.43	58.84	14.74	4.43	58.39
237	240	Pale red sl.; cleavage 52°	10.19	2.96	63.84				10.19	2.96	63.84
240	242.7	Pale, red sl.; little core; mostly mang.									
242.7	244	Clay, most of core good mang.; bedding 30°	16.49	9.00	46.80	12.24	3.43	64.01	13.59	5.20	58.55
244	247	Soft clay	15.20	5.14	55.87				15.20	5.14	55.87
247	250	Pale red sl.; some mang.									
250	253	Red slate; cleavage 47°; bedding ± horizontal; some mang.(?)	11.24	3.43	61.53	11.84	3.11	63.31	11.65	3.21	62.76
253	256	Little core; all mang.	11.48	20.23	42.10	9.70	2.64	74.42	9.87	4.29	71.38
Average									12.57	4.13	61.63
256	258	Soft red sl. or clay									
258	262	Dk. red clay; some mang.	13.10	3.51	62.35	12.08	1.77	65.60	12.34	2.21	64.78
262	265	Soft red sl.; bedding 10°; cleavage 10° in opposite directions									
265	268	No core	9.65	2.34	66.15	12.81	2.17	64.15	12.14	2.21	64.58
268	271	Red clay	13.42	1.71	63.15				13.42	1.71	63.15
Average									12.48	2.11	64.37

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 44
Hole No. 3 (Cont'd.)
Collar Elevation: 1213.1'
Depth of Hole: 340'
Location: N.E. - S.W.

Date completed: 10/6/50
Drilled by: U.S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Analyses: Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
271	274	Soft, pale red to red slate	12.29	.95	67.69	9.99	.63	67.56	10.87	.87	66.58
274	277	Red clay	10.51	.95	65.54						
277	280	Soft, pale red slate	9.54	.89	65.06	10.51	1.10	67.02	9.84	1.34	65.51
280	283	Red slate	9.54	1.77	62.98						
283	286	Soft, pale red slate	9.86	.79	67.33	12.13	1.32	67.00	12.10	.82	65.18
286	289	Red slate, rather hard; bedding 30°; cleavage 30°	12.61	.24	62.44						
Average									10.94	1.01	65.76
289	295	Red slate; 2 good bands of mang.	10.51	4.83	63.10	10.91	2.82	69.11	10.80	3.36	67.49
295	298	Red slate; 1 good band of mang.									
298	301	Red slate; some mang.	10.19	1.40	68.67	11.96	2.44	69.36	11.49	2.16	69.17
301	304	Red slate; bedding 70°									
304	307	Pale red sl.	10.35	.77	64.63	11.88	1.64	65.55	11.25	1.28	65.17
307	310	Red slate; 2 bands mang.; cleavage vertical (?)									
310	313	Pale red sl.; some mang.	12.29	7.46	54.32	13.42	2.44	62.91	12.99	4.35	59.65
313	316	Pale red sl.; some mang.									
316	319	Red slate; some mang.	13.10	5.48	58.23	64.88	3.55	61.20	14.39	4.09	60.37
319	322	Pale red sl.; some ochre; bedding 70°; cleavage 15°									
322	325	Red slate	10.02	1.30	65.33	11.16	3.51	60.02	10.35	2.53	65.71
325	328	Darker red sl.									
328	331	Some mang.; red slate; bedding 30°; cleavage vertical (?)	12.29	1.41	62.33	13.98	2.25	64.25	13.52	2.02	63.72

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 44
Hole No. 3 (Cont'd.)
Collar Elevetion: 1213.1'
Depth of Hole: 340'
Location: N.E.- S.W.

Date completed: 10/6/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Core Analyses Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
331	333	Dk.red slate									
333	337	Dk.red slate; bedding 35°	6.30	4.45	62.97	14.71	3.80	60.00	12.39	3.98	60.82
337	340	Gray slate; some good mang.	11.48	1.50	62.24	14.63	3.64	60.30	13.81	3.08	60.80
340		Bottom of hole									
Average									12.28	2.98	63.82
175	340	Average for hole							12.15	2.53	63.17

Aitkin County
Sec Ref 1072

Serial No. 45
Hole No. 4
Collar Elevation: 1213.3'
Depth of Hole: 370'
Location: N.E.- S.W.

Date completed: 10/26/50
Drilled by: U. S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Analyses: Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
0	143	Surface material									
143	148	Iron form.; drilled with chopping bit				8.94	.39	48.30	8.94	.39	48.30
148	151	Reddish brown clay & slate									
151	154	Reddish brown clay & slate; bedding 35°	13.23	.20	52.56	16.21	.32	52.20	14.46	.25	52.41
154	157	Soft red sl.	12.58	.24	53.66				12.58	.24	53.66
Average									13.09	.30	51.21
157	160	Soft red-gray slate	15.40	1.45	47.72				15.40	1.45	47.72
160	163	Red & dk.gray to black sl. (some mang.?) bedding 45°	22.90	2.21	36.24				22.90	2.21	36.24
163	166	Dk.red slate; bedding 40°	22.26	3.62	36.48				22.26	3.62	36.48
166	169	Soft red sl.									
169	172	Dk.red slate	15.65	3.11	43.90				15.65	3.11	43.90
172	175	Dk.red slate	17.34	2.09	46.18	16.05	2.29	50.82	16.98	2.15	47.27
Average									18.14	2.61	42.62
175	178	Red slate; bedding 50°; some mang.	15.16	1.89	45.92				15.16	1.89	45.92
178	182	Red slate; bedding 45° at 180; 35° at 181									
182	187	Red slate with dark streaks; mang.?; rolling bedding at 183; 15° at 184	14.03	1.77	45.40				14.03	1.77	45.40
187	192	Red slate; bedding vertical at 33°	10.32	1.02	54.82				10.32	1.02	54.82
192	197	Red slate; bedding vertical at 199; wavey at 201,	15.81	1.65	45.76				15.81	1.65	45.76
197	202	approx. 70°	16.61	2.29	42.04				16.61	2.29	42.04
202	207	Red slate	8.22	.59	56.26				8.22	.59	56.26

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 45
Hole No. 4 (Cont'd.)
Collar Elevation: 1213.3'
Depth of Hole: 370'
Location: N.E.- S.W.

Date completed: 10/26/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Analyses: Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
Average									13.33	1.54	48.15
207	212	Red slate	14.03	4.96	47.56	12.84	2.52	51.08	13.42	3.72	49.36
212	217	Red slate; some mang.; rolling bedding	12.34	2.76	49.84				12.34	2.76	49.84
217	222	Red slate; bedding 15°; some mang.	11.94	1.49	54.10				11.94	1.49	54.10
222	227	Red slate	12.42	2.44	50.40				12.42	2.44	50.40
227	232	Red slate; quartz & mang.	9.68	2.29	68.60	9.63	2.29	66.46	9.64	2.29	66.93
Average									11.95	2.54	54.13
232	235	Red slate; some mang.	22.26	7.96	31.48	14.12	2.84	55.70	18.51	5.60	42.65
235	238	Broken red slate with thin bands of mang. (?)	21.57	6.38	34.80	20.70	6.07	36.34	21.23	6.26	35.39
238	241	Dk.red slate; some mang.									
241	244	Red slate; some mang.	29.14	6.70	28.48				29.14	6.70	28.48
244	247	Light red sl. 4" good mang.									
247	250	Light red sl. some good mang.	22.14	6.78	37.68	24.88	6.15	35.42	23.61	6.44	36.47
Average									24.21	6.36	34.66
250	253	Pink to light gray slate	9.12	2.44	56.24				9.12	2.44	56.24
253	257	Pink to light gray slate; some mang.	9.93	2.30	55.00				9.93	2.80	55.00
257	261	Same, changing to red at 260	12.37	1.30	53.98	12.20	1.53	55.80	12.30	1.40	54.72
261	265	Light red sl. vertical bedding	7.33	1.06	59.34				7.33	1.06	59.34
265	270	Light red & gray slates; folded bedding; axis of folds 10°	12.05	.55	58.88				12.05	.55	58.88
Average									10.29	1.56	56.97

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 45
Hole No. 4 (Cont'd.)
Collar Elevation: 1213.3'
Depth of Hole: 370'
Location: N.E.- S.W.

Date completed: 10/26/50
Drilled by: U. S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Analyses

Depth From	Depth To	Material	Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
270	275	Light red sl. some mang.	14.65	8.98	46.74				14.65	9.98	46.74
275	280	Red slate	11.56	2.13	52.48				11.56	2.13	52.48
280	285	Red slate	9.12	.90	54.40				9.12	.90	54.40
285	290	Red slate; some mang. in fissures	12.37	2.17	55.32				12.37	2.17	55.32
290	295	Red slate; some mang.				14.44	3.15	55.90	14.44	3.15	55.90
295	300	Gray slate; some good mang.	14.81	4.47	52.44	14.19	5.59	51.42	14.45	5.13	51.84
300	303	Gray slate; some good mang.									
303	306	Red slate; folded bedding; mang. between bedding planes	12.99	5.32	52.96	14.12	2.01	60.10	13.74	3.14	57.67
306	309	Red slate	9.91	.39	54.48				9.91	.39	54.48
Average									12.70	3.39	53.66
309	312	Red slate; some good mang.	15.51	10.44	39.90	11.55	4.89	55.92	13.98	8.30	46.08
312	315	Mostly broken-up mang.	13.80	21.12	33.50	15.25	9.65	50.10	14.95	12.00	46.70
315	318	Mostly broken-up mang.									
318	321	Red slate; bedding 30°	12.10	2.32	54.28	14.76	9.73	48.22	13.86	7.21	50.28
321	325	Light red slate	12.34	11.78	47.34				12.34	11.78	47.34
325	328	Red slate; cleavage vertical (?)	9.91	.12	52.50	10.11	1.26	63.14	9.91	.12	52.50
328	332	Red slate; 6" solid mang. & grey sl.	12.34	10.24	47.40	12.04	6.90	53.70	12.17	8.31	51.04
Average									12.94	8.04	49.18
332	335	Red slate									
335	338	Light red sl.; some good mang.	9.09	2.32	63.88				9.09	2.32	63.88
338	342	Red slate; good mang.	13.23	1.73	53.94				13.23	1.73	53.94

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 45
Hole No. 4 (Cont'd.)
Collar Elevation: 1213 3'
Depth of Hole: 370'
Location: N.E.- S.W.

Date completed: 10/26/50
Drilled by: U. S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond Drill-Core

Depth From	Depth To	Material	Analyses Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
342	345	Mostly broken mang.	11.21	11.17	49.12	9.23	4.41	60.50	9.67	5.98	57.97
345	348	Red slate; some mang.	10.39	9.81	45.44				10.39	9.81	45.44
348	352	Red slate; some mang; irregular bedding	9.42	5.20	51.40				9.42	5.20	51.40
352	356	Gray & red slate; some mang.	9.58	2.64	55.38				9.58	2.64	55.38
Average									10.15	4.15	55.68
356	360	Gray & black banded slate; vertical bedding at 35°	16.08	1.22	51.82				16.08	1.22	51.82
360	365	Gray slate banded with red slate; bedding 10°	17.21	.82	48.60				17.21	.82	48.60
365	370	Gray slate, wavy bedding at 65°	6.09	.24	62.00				6.09	.24	62.00
Average									12.92	.73	54.31
143	370	Average for hole							13.57	3.24	50.49

Aitkin County
Sec Ref 1072

Serial No. 46
Hole No. 5
Collar Elevation: 1214.0'
Depth of Hole: 349'
Location: N.E.- S.W.

Date completed: 11/4/50
Drilled by: U. S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
		Analyses									
0	146										
146	150	Surface				13.92	4.73	49.28	13.92	4.73	49.28
150	155										
155	157	Carb.slate	15.14	5.83	29.34				15.14	5.83	29.34
157	160	Carb.slate	14.98	4.89	31.10	14.65	4.02	31.60	14.70	4.15	31.52
160	170	Carb.slate	18.56	7.21	24.50	12.54	1.33	36.28	13.26	2.04	34.87
170	175	Altered red slate & some carb. slate									
175	178	Red slate & light gray clay	11.74	6.30	30.54	10.58	3.66	33.80	10.88	4.33	32.97
178	181	Red to dk. red slate; bedding 35°	18.07	5.04	28.58				18.07	5.04	28.58
181	182	Gray slate									
182	185	Gray slate to 183, red slate 183 to 185	20.19	2.60	31.84	22.06	3.47	42.22	21.23	3.08	37.61
Average									14.44	3.55	33.40
185	189	Dk.red slate; bedding 18°; cleavage 70 to 90°(?)	16.20	.70	44.22	18.88	2.84	46.80	17.06	1.38	45.05
189	193	Dk.red slate; bedding 15°; cleavage vertical (?)	17.58	1.45	46.50				17.58	1.45	46.50
193	198	Dk.red slate; bedding 55°; cleavage vertical	18.72	1.81	44.04				18.72	1.81	44.04
198	203	Dk.red slate & clay	16.44	3.94	42.54	17.26	3.62	45.00	16.90	3.76	43.91
Average									17.59	2.18	44.77
203	206	Red slate; bedding 50°									
206	209	Red & light red slates; bedding 35°; cleavage vertical	13.70	.63	48.10				13.70	.63	48.10

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 46
Hole No. 5 (Cont'd.)
Collar Elevation: 1214.0'
Depth of Hole: 348'
Location: N.E.- S.W.

Date completed: 11/4/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Analyses: Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
209	213	Red slate & clay; a little mang.	15.49	3.70	42.60				15.49	3.70	42.60
213	218	Red slate; bedding 30°; bedding vertical	14.19	3.35	44.62				14.19	3.35	44.62
218	221	Red slate; bedding 20°	9.87	4.49	49.30				9.87	4.49	49.30
221	226	Light red slate	13.86	2.36	44.88	19.37	3.31	48.40	15.54	2.65	45.95
Average									14.02	2.70	46.09
226	231	Red slate; bedding 25°	12.39	1.53	52.02				12.39	1.53	52.02
231	236	Red slate	8.72	.90	57.48				8.72	.90	57.48
236	241	Red to light red slate; bedding 25°	9.95	1.10	54.92				9.95	1.10	54.92
Average									10.35	1.18	54.81
241	246	Light red sl.; bedding 33°	5.71	.59	59.90	15.71	5.08	47.62	9.47	2.28	55.28
246	250	Light red sl.	9.13	3.15	54.44				9.13	3.15	54.44
250	253	Light red sl.; some chert	15.49	6.34	45.20	15.47	6.07	49.40	15.47	6.13	48.42
253	256	Red slate; cleavage 35°									
256	259	Red slate; some mang.	8.81	.55	58.66	15.95	1.65	53.00	12.34	1.09	55.86
259	262	Red & light red bands of slate; some mang.	10.44	5.36	56.16				10.44	5.36	56.16
262	265	Red slate; some mang.; rumpled bedding	11.50	2.68	53.32	15.55	3.47	37.80	13.37	3.04	46.15
265	268	Light red to red slates; little mang.	12.07	2.29	54.64				12.07	2.29	54.64

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 46
Hole No. 5 (Cont'd.)
Collar Elevation: 1214.0'
Depth of Hole: 348'
Location: N.E.- S.W.

Date completed: 11/4/50
Drilled by: U. S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth			Analyses								
			Core			Sludge			Adjusted Average		
From	To	Material	Iron	Mang.	SiO_2	Iron	Mang.	SiO_2	Iron	Mang.	SiO_2
268	273	Red slates; bedding 40°	7.34	.12	60.46	15.38	4.06	52.70	13.68	3.23	54.34
273	279	Red slates; some mang.; bedding 38°	8.97	3.74	54.42	15.63	5.83	51.56	13.14	5.05	52.63
279	282	Red & light red slates; some mang.									
282	285	Red slate	6.85	4.73	52.10	11.31	5.67	55.52	8.81	5.14	53.60
285	289	Red slate; some mang.	11.42	4.45	50.26	10.58	4.69	56.44	11.34	4.47	50.86
289	293	Red slate	10.44	2.29	57.00				18.92	2.29	57.00
293	298	Red slate	18.92	8.27	41.50	11.88	3.55	54.86	12.70	4.10	53.31
298	304	Red slate	15.49	6.38	42.06	12.78	2.56	56.46	14.85	5.47	45.49
304	308	Red to light red slate; bedding; cleavage at 90° to bedding(?)	10.19	4.02	51.06				10.19	4.02	51.06
Average									12.34	3.80	52.68
308	313	Red slates	10.52	1.18	51.70				10.52	1.18	51.70
313	317	Banded red & gray slates; bedding 30°	10.44	.98	53.70				10.44	.98	53.70
317	322	Red slate	6.36	.78	61.66	10.91	1.26	56.48	10.00	1.16	57.52
322	325	Banded red & gray slates; bedding 35°	8.81	1.10	53.90				8.81	1.10	53.90
325	330	Banded red & gray slates; bedding 35°	11.58	1.18	50.40				11.58	1.18	50.40
330	335	Light red slate	9.79	6.38	47.24	17.58	8.39	40.92	15.98	7.98	42.22
335	338	Gray slate with red & black bands	13.86	1.45	48.70				13.86	1.45	48.70
Average									11.67	2.30	51.06

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 46
Hole No. 5 (Cont'd.)
Collar Elevation: 1214.0'
Depth of Hole: 348'
Location: N.E.- S.W.

Date completed: 11/4/50
Drilled by: U. S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth			Analyses								
			Core			Sludge			Adjusted Average		
From	To	Material	Iron	Mang.	SiO_2	Iron	Mang.	SiO_2	Iron	Mang.	SiO_2
338	343	Gray slate with red & black bands; bedding 30°	9.62	.66	53.62				9.62	.66	53.62
343	348	Same, bedding 30°; cleavage 55°	10.44	.66	53.26				10.44	.66	53.26
Average									10.03	.66	53.44
155	348	Average for hole							12.98	2.88	47.96

Aitkin County
Sec Ref 1072

Serial No. 47
Hole No. 6
Collar Elevation: 1213.8'
Depth of Hole: 334'
Location; N.E. - S.W.

Date completed: 11/16/50
Drilled by: U. S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Core Analyses Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
0	138	Surface									
138	143	Iron form. (chopped sample)				15.93	2.92	53.48	15.93	2.92	53.48
143	148	Dk.red clay & soft slate; a few mang. nodules in clay	12.55	2.36	52.52	11.02	3.03	58.78	11.23	2.94	57.92
148	155	Soft dk.red clay & slate	14.80	2.13	48.84				14.80	2.13	48.84
155	160	Red slate; bedding 52 to 55°;cleavage 25° (?)	13.52	2.92	47.66				13.52	2.92	47.66
160	165	Dk.red slate	14.72	1.77	49.20				14.72	1.77	49.20
165	170	Dk.red slate	11.26	1.57	52.30				11.26	1.57	52.30
170	175	Dk.red slate	17.70	2.52	48.62				17.70	2.52	48.62
175	180	Dk.red slate & clay; bedding 60°	18.18	1.81	44.80	14.48	2.09	55.78	16.21	1.96	50.64
180	185	Dk.red slate; bands of chert 184 to 185	13.60	2.52	52.20				13.60	2.52	52.20
185	190	Dk.red slate; chert band at 185.5;chert slate contact 75°;bedding 65°;cleavage (?)50°,approx. right angles to bedding; bedding 60° at 188	16.89	2.68	50.22				16.89	2.68	50.22
Average									14.59	2.38	51.02
190	195	Dk.red slate chert (± 1') 194 to 195	18.18	17.81	30.00	12.55	8.98	55.20	14.07	11.36	48.40
195	200	Some red sl; considerable chert; some mang.	15.77	28.37	19.40	15.77	12.61	46.06	15.77	14.86	42.25
200	203	Some red sl.; considerable chert	12.71	7.88	60.90	7.56	3.55	67.64	8.44	4.29	66.47

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 47
Hole No. 6 (Cont'd.)
Collar Elevation: 1213.8'
Depth of Hole: 334'
Location: N.E. - S.W.

Date completed: 11/16/50
Drilled by: U. S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Core Analyses Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
203	206	Red slate; some mang.; cleavage 20° (?)									
206	210	Red slate; some mang.	14.28	7.92	47.20				14.28	7.92	47.20
210	215	Red slate; some mang.	14.20	7.80	43.00	13.84	5.08	54.20	13.97	6.03	50.30
215	218	Red slate; bedding 25°	10.43	2.36	54.60				10.43	2.36	54.60
218	222	Red slate; some mang. & chert	18.46	13.67	34.80				18.46	13.67	34.80
222	227	Red slate; some mang. & chert	24.71	8.71	39.22	16.89	1.73	54.08	17.69	2.44	52.56
Average									14.54	8.20	48.66
227	230	Red clay.									
230	234	Red to dark red slate; bedding 36°	19.58	.96	47.06				19.58	.96	47.06
234	239	Red slate & clay; cleavage 25°(?)	17.81	2.48	53.60	20.11	1.93	51.80	19.16	2.16	52.55
239	242	Red slate; considerable chert; some mang.(?)	12.76	6.86	63.46	17.22	6.70	55.40	16.13	6.74	57.37
242	249	Red slate; some chert	11.31	3.03	58.00				11.31	3.03	58.00
Average									16.38	2.68	53.19
249	254	Red slate; irregular bedding	11.23	.76	53.34				11.23	.76	53.34
254	259	Red slate	18.37	.53	55.32	11.58	.39	58.88	13.41	.43	60.75
259	263	Red slate	11.39	.21	64.24				11.39	.21	64.24
263	268	Red slate; cleavage 43° (?)	12.32	.15	64.24				12.32	.15	64.24
Average									12.12	.40	60.45
268	273	Red slate & clay; a little gray slate	14.32	3.70	53.18				14.32	3.70	53.18

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 47
Hole No. 6 (Cont'd.)
Collar Elevation: 1213.8'
Depth of Hole: 334'
Location: N.E. - S.W.

Date completed: 11/16/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Analyses: Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
273	278	Red & gray slates; bedding 50°; cleavage 30° approx.right angles to bedding	8.00	.96	58.84	11.26	1.77	58.40	9.95	1.45	58.58
278	281	Red & gray slates; irregular bedding;some red clay									
281	285	Red & gray slates;folded bedding;axis of folds 38°	9.36	2.17	60.64				9.36	2.17	60.64
285	290	Red & gray slates	6.88	5.99	53.36	8.53	5.16	55.92	8.30	5.28	55.56
290	294	Gray slate with iron bands;bedding 28° at 290	8.24	2.13	53.36				8.24	2.13	53.36
294	299	Dk.gray slate; bedding 65°; cleavage 22°; some soft mang. (?)	6.64	4.14	61.50				6.64	4.14	61.50
Average									9.50	3.11	57.48
299	304	Banded red & gray slates; bedding 35°	6.40	.24	61.84				6.40	.24	61.84
304	309	Dk.gray slate; cleavage(?)45°; few iron stains	7.36	.37	59.50				7.36	.37	59.50
309	314	Gray slate, some red slate; gray slate highly fractured at 309'; quartz filling in fractures; bedding 35° at 311;cleavage (?) 46°	7.37	.56	61.22				7.37	.56	61.22

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 47
Hole No. 6 (Cont'd.)
Collar Elevation: 1213.8'
Depth of Hole: 334'
Location: N.E. - S.W.

Date completed: 11/16/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
314	319	Gray slate; bedding 50°	8.00	.15	59.56				8.00	.15	59.56
319	324	Gray slate; some iron bands; bedding 45°; vertical band of iron 1/2 inch wise 320 to 322	10.08	.12	57.64				10.08	.12	57.64
324	329	Grey slate; some iron bands; bedding 15°	6.40	.09	62.10				6.40	.09	62.10
329	334	Gray slate; few iron bands; cleavage (?) 30°	7.36	.18	61.32				7.36	.18	61.32
334		Bottom of hole									
Average									7.57	.24	60.45
138	334	Average for hole							12.48	3.05	54.44

Aitkin County
Sec Ref 1072

Serial No. 48
Hole No. 7
Collar Elevation: 1214.3'
Depth of Hole: 392'
Location: N.E. - N.E.

Date completed: 12/2/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth			Analyses								
			Core			Sludge			Adjusted Average		
From	To	Material	Iron	Mang.	SiO_2	Iron	Mang.	SiO_2	Iron	Mang.	SiO_2
0	140	Surface									
140	145					12.36	1.41	55.02	12.36	1.41	55.02
145	151		11.84	.33		10.83	1.14	60.00	11.02	.98	
151	154	Red Slate	12.48	.45		13.80	1.53	54.40	13.30	1.12	
154	157	Red-Light Red Slate	13.92	.76					13.92	.76	
Average									12.33	1.09	
157	160	Red-Light Red Slate.Bedding 50°	25.28	2.36					25.28	2.36	
160	163	Red Slate. Bedding 55° Cleavage 35° Same direction	14.24	1.12		18.13	2.25	50.20	14.63	1.03	
163	166	Red Slate. Cleavage(?) 40°									
166	169	Lt.Red Slate Folded Bedding. Axis of folds 35°	10.80	1.52					10.80	1.52	
169	173	Lt.Red Slate	14.72	.15		17.92	.49	51.00	17.14	.41	
173	176	Pink Slate	4.72	.06		14.88	.51	56.28	12.91	.42	
176	179	Pink-Lt.Red Slate.Bedding 40°	11.76	.68		11.20	1.22	60.60	11.55	.88	
179	182	Lt.Red Slate Bedding 52°	13.36	1.04		13.44	2.13	58.70	13.40	1.53	
182	185	Lt.Red Slate Bedding 25° at 153. Bedding 70° at 154.Cleavage along bedding.	16.61	3.15					16.61	3.15	
185	190	Red Slate. Bedding 45° at 186. Bedding 25° at 188.Cleavage (?) 60°	9.60	.37					9.60	.37	
190	195	Red Slate	20.56	1.77					20.56	1.77	
195	200	Red Slate. Bedding 30°	8.56	.68		15.60	1.10	58.40	13.66	.98	
200	205	Red Slate.	13.76	.80		13.44	.76	62.20	13.51	.77	

(Continued)

Serial No. 48
Hole No. 7 (Cont'd.)
Collar Elevation:
Depth of Hole: 392'
Location: N.E. - N.E.

Aitkin County
Sec Ref 1072

Date completed: 12/2/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
205	208	Red slate. Bedding 20°. Cleavage 50°.	14.72	.84					14.72	.84	
Average									14.63	1.19	
208	213	Lt.red slate. Bedding 60°.	17.84	.30		13.60	5.79	55.90	14.60	4.50	
213	216	Red slate. Bedding 50°.	9.12	4.57					9.12	4.57	
216	221	Lt.red slate.	9.92	4.61		14.32	6.03	51.90	13.38	5.72	
221	224	Red slate.Some good mang.	9.52	5.16		14.24	4.89	53.30	13.01	4.96	
224	227	Red slate.	10.08	6.19		8.48	4.41	61.30	8.91	4.89	
227	230	Red slate. Bedding 48°.									
230	235	Red slate. Bedding 50°.	10.40	.53					10.40	.53	
235	240	Red slate. One small piece of mang. oxide.Bedding 45°.	10.48	.37		11.68	3.07	61.20	11.11	1.78	
240	245	Red slate.A little chert. Some mang. oxide,Bedding 35°.	14.64	3.31		20.96	4.53	51.28	19.18	4.19	
Average									16.64	3.47	
245	250	Red slate. Bedding 50°.	9.92	.06					9.92	.06	
250	255	Red slate. 6" of solid chert or qtz.	10.24	.80		16.96	.90	63.80	15.88	.88	
255	258	Red slate. Bedding 48°.	13.36	6.62					13.36	6.62	
258	263	Red slate. Bedding 48°.	21.28	1.30		17.12	1.41	59.26	18.38	1.38	
263	268	Red slate. Bedding 48°.	16.96	.18					16.96	.18	
268	273	Red slate. Bedding 53°. Cleavage 27°.	8.72	.12					8.72	.12	
Average									13.91	1.18	

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 48
Hole No. 7 (Cont'd.)
Collar Elevation:
Depth of Hole: 392'
Location: N.E. - N.E.

Date completed: 12/2/50
Drilled by: U.S.Bureau of Mines
Logged by: W.A.Grosh
Type of Drilling:Diamond drill-Core

Depth From	Depth To	Material	Core Analyses Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
273	278	Red slate. Some chert & mang. oxide. Bedding 50°. Cleavage(?) 25°.	12.00	2.92					12.00	2.92	
278	283	Red & gray slate.	15.76	.68		21.28	3.03	53.26	20.15	2.55	
283	285	Chert.	6.72	4.26					6.72	4.26	
285	290	Red slate. Some chert, little mang. oxide. Chert slate contact 10°. (almost vertical)	22.24	10.32		21.60	3.07	54.04	21.76	4.93	
290	295	Red slate.	23.52	12.61		22.40	3.66	48.22	22.48	4.30	
295	298	Red slate.	20.40	2.72		21.12	2.52	51.08	20.73	2.63	
298	301	Red slate. Bedding 48°.	15.68	2.13		18.72	2.29	58.64	17.08	2.20	
Average									18.17	3.45	
301	304	Red slate. Irregular bedding.	24.40	1.49					24.40	1.49	
304	307	Red slate. Bedding 50°. Cleavage 30°.	16.24	2.01					16.24	2.01	
307	312	Red slate. 6" chert at 312.	14.40	1.65		20.08	1.89	55.60	18.04	1.80	
312	317	Red & gray slates.	10.40	2.36		16.96	1.53	59.72	15.86	1.67	
317	320	Red slate. Some chert. Bedding 40°.	24.16	1.06					24.16	1.06	
320	325	Gray slate. Bedding 45°.	10.40	2.13		15.04	1.14	67.28	14.40	1.28	
Average									18.16	1.56	
325	330	Red slate. Bedding 65°.	22.40	.68					22.40	.68	
330	335	Red slate. Bedding 45°.	19.84	1.33		15.84	.70	64.28	17.80	1.01	
335	340	Red slate. Bedding 45°.	23.28	1.41					23.28	1.41	
340	345	Red slate. Bedding 20°.	19.92	.45		26.24	.45	47.46	24.78	.45	

(Continued)

Serial No. 48
Hole No. 7 (Cont'd.)
Collar Elevation:
Depth of Hole: 392'
Location: N.E. - N.E.

Aitkin County
Sec Ref 1072

Date completed: 12/2/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Analyses: Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
345	350	Red slate. Some chert at 350. Bedding 45°.	19.20	1.06					19.20	1.06	
350	355	Red slate. Bedding 35°.	16.64	1.02		16.32	.30	60.86	16.46	.61	
355	358	Red slate. Bedding 35°.									
358	360	Gray slate. Some red slate chert. Bedding 35°.	14.72	1.18					14.72	1.18	
360	362	Red slate. Bedding 40°.	20.32	.45		16.00	.53	60.42	17.11	.51	
362	366	Red slate. Some gray slate at 365. Bedding red slate 35°. Gray slate 25°.	14.48	.60					14.48	.60	
Average											
366	367	Dk.red slate & chert.							19.15	.86	
367	372	Red slate. Bedding 45°.	14.64	1.37					14.64	1.37	
372	377	Red slate. Some chert.	22.24	.76		17.92	1.06	60.80	19.06	.98	
377	382	Red slate. Folded bedding. Axis of folds 5°.	25.92	2.13		18.72	1.61	57.02	21.14	1.78	
382	387	Red slate. Some chert. Gray slate at 385'. Bedding 50°.	18.56	1.45					18.56	1.45	
387	392	Red & gray slates. Some chert. Bedding 45°. Cleavage 20°.	16.48	1.30					16.48	1.30	
Average											
									17.85	1.38	
140	392	Average for hole							16.55	1.77	

Resume' of Mn. Content
On 3.75% basis Drill Holes.

D.H. S-100

From 149 to 170 = 21 Ft @ 5.2 % Mn.

200 to 210 = 10 " @ 6.10 " (Average)

220 to 225 = 25 " @ 6.84 "

230 to 235 = 5 " @ 4.65 "

260 to 285 = 25 " @ 5.22 " (Average)

295 to 300 = 5 " @ 7.13 "

D.H. S-101

From 165 to 170 = 5 Ft. @ 4.10 "

210 to 215 = 5 " @ 8.32 "

240 to 245 = 5 " @ 4.49 "

260 to 270 = 10 " @ 4.10 " (Average)

275 to 280 = 5 " @ 3.98 "

295 to 300 = 5 " @ 4.77 "

310 to 315 = 5 " @ 3.80 "

320 to 325 = 5 " @ 4.51 "

D.H. S-102

From 165 to 170 Ft. = 5 Ft. @ 4.10 "

190 to 195 = 5 " @ 4.22 "

225 to 240 = 15 " @ 5.08 "

260 to 290 = 30 " @ 4.99 " (Average)

300 to 325 = 25 " @ 6.62 " (Average)

D.H. 5-103

From 150 to 160 Ft. = 10 Ft. @ 6.09 % Min. (Average)

165 to 170 " = 5 " @ 4.33 "

230 to 235 " = 5 " @ 3.82 "

290 to 305 " = 15 " @ 6.81 " (Average)

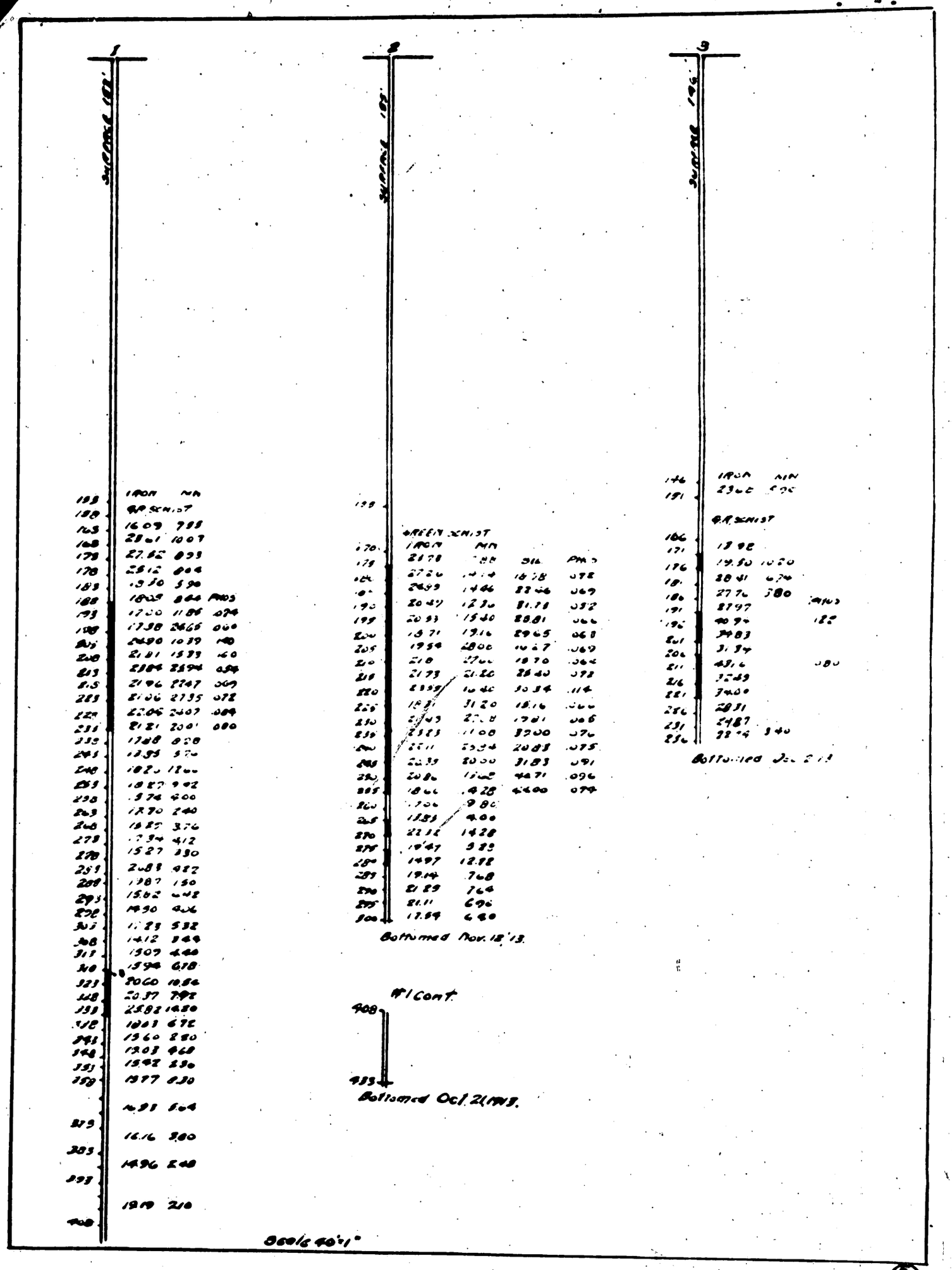
320 to 325 " = 5 " @ 7.52 "

D.H. 5-104

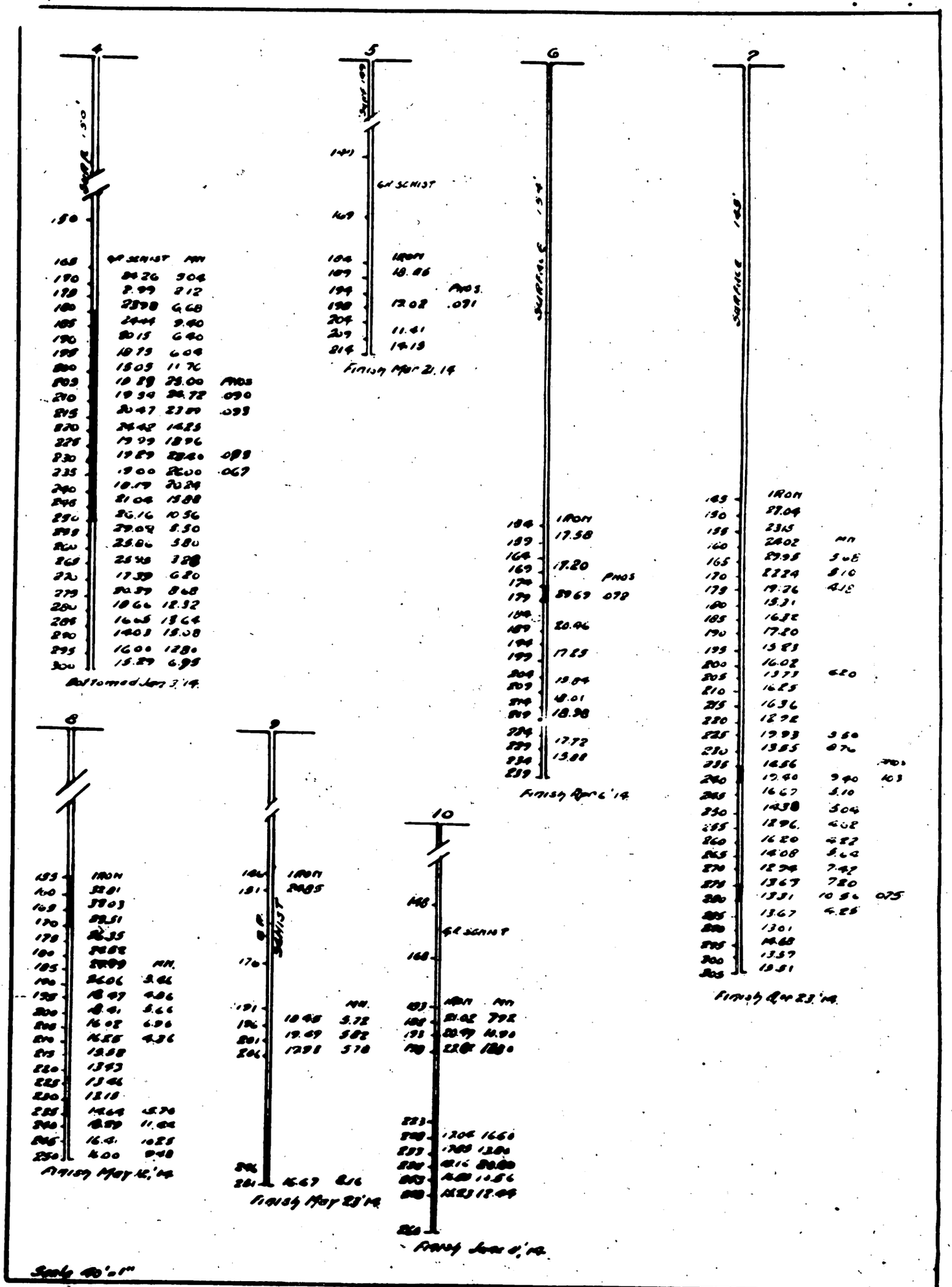
From 170 to 180 Ft. = 10 Ft. @ 4.09 " (Average)

185 to 245 " = 60 " @ 8.49 " (Average)

255 to 280 " = 25 " @ 6.09 " (Average)


1
SURFACE 100'
IRON MN
Q.R. SCHIST
2
SURFACE 102'
GREEN SCHIST
IRON MN SIL PHOS
Bottomed Nov. 18 '13.
#1 Cont.
408
433
Bottomed Oct. 21, 1913.
3
SURFACE 196'
IRON MN
Q.R. SCHIST
PHOS
Bottomed Dec. 2 '13
Scale 40'=1"

Sheet 1.


4
SURFACE 15.0'
Bottomed Jan 3 '14.
5
SURFACE 10.0'
GR SCHIST
IRON
PHOS.
Finish Mar 21 '14
6
SURFACE 15.4'
IRON
PHOS
Finish Apr 6 '14
7
SURFACE 14.8'
IRON
MN
PHOS
Finish Apr 23 '14
8
IRON
MN.
Finish May 12 '14
9
SURFACE
IRON
PHOS
GR SCHIST
MN.
Finish May 28 '14
10
GR SCHIST
IRON
MN
Finish June 6 '14
Scale 40' = 1"

Spec-T A-1

1001

	Mat.	Color	Texture	Hardness
7	Sand & Clay	Yellow	Fine	Soft
20	Clay	Blue	"	"
29	Hardpan	Gray		Medium
40	Sand	Dark	Coarse	
61	"	"	Medium	
70	"	"	Coarse	
84	Sand & Gravel	"	"	
93	"	"	Fine	
99	Gravel & Boulders	"		
102	Gravel	Gray	Medium	Hard Medium
114	Sand & Gravel	"	"	Hard
117	Clay, Sand & Boulders	"		Medium
135	Hardpan Boulders	"	Coarse	Hard
142	Sand	Lt Yellow	Fine	Soft
152	Sand, Gravel & Schist	Red	Medium	"
155				
160	20.00 Fe		5.45 Mn	SiO_2
165	21.00		4.81	
170	30.30		3.85	
175	22.20		7.10	
180	25.20	.090	10.18	31.15
185	23.70	.129	10.18	32.20
190	22.10	.156	11.96	29.75
195	16.80	.100	15.12	31.90
200	19.35		5.93	
205	21.17		7.98	
210	16.48		7.70	
215	17.33		8.25	
220	22.48		8.75	
225	15.45	.102	10.45	46.15
230	14.60		8.25	
235	19.50		6.32	
240	17.40		3.99	
245	16.80		3.49	
250	15.60		6.79	
255	13.40	.102	25.10	32.65
260	30.80		7.98	
265	15.40		1.65	
270	16.30		2.20	
275	14.80		1.18	
280	17.20		9.26	
285	19.40	.108	10.06	46.65
290	17.00		8.63	
295	16.80		5.50	
300	11.05		1.88	
305	16.76		7.00	
310	16.08		5.00	
315	15.12		9.50	
320	17.41	.092	18.00	
325	11.70	.069	4.06	
330	12.51	.078	7.30	
335	15.22	.041	14.00	
340	12.16	.079	8.52	
345	12.18		4.92	
350	13.43		3.16	
355	12.94		3.16	
360	10.35		17.00	
365	8.67		10.49	
370	15.90		6.32	
375	10.97		4.64	
380	28.01		.80	
385	15.33		1.68	
390	22.18		.64	
395	24.96		.56	
400	28.49		.86	

Cont

1002

	Mat.	Color	Texture	Hardness
7	Muskeg	Black		Soft
24	Sand & Clay	Gray		"
37	Sand, Gravel Boulders	"		Hard
43	Sand, Gravel	"	Coarse	Medium
68	Hardpan Sand, Gravel	"		"
73	& Boulders	"	"	Hard
100	Hardpan & Gravel	Brown	Medium	"
123	Gravel & Boulders	Gray	Coarse	"
133	Hardpan Sand & Gravel	"	Medium	"
142	Sand		Fine	Soft
144	Sand & Gravel	Yellow	Medium	"
150	27.70 Fe		3.58 Mn	SiO_2
155	24.10		3.00	
160	23.00		12.23	
165	24.70		4.18	
168	21.00	.064	10.83	24.40
170	23.80	.078	10.58	25.00
175	26.00		5.53	
180	19.80		7.78	
185	24.70		4.81	
190	19.40		8.08	
195	19.50		6.10	
200	24.00		8.61	
205	15.[illegible]	.060	7.60	42.84
210	[illegible]	.058	16.00	31.41
215	15.71	.092	12.40	43.51
220	16.46	.056	9.60	46.16
225	19.63	.063	7.20	45%
230	18.54	.089	22.10	38.60
235	13.44	.104	14.00	
240	15.87	.175	7.10	
245	19.35	.086	10.00	
250	15.24	.077	13.94	
255	20.16	.091	2.84	
260	16.05	.080	14.06	
265	14.43	.079	15.60	
270	19.45	.110	19.96	
275	16.67	.154	12.80	
280	17.71	.117	16.80	
285	15.91	.125	10.40	
290	17.53	.116	7.20	
295	20.61	.119	16.14	
300	19.27	.096	1.52	
305	18.41		2.56	
310	17.56		1.96	
315	18.51		7.48	
320	16.36		2.41	
325	13.87		1.76	
330	16.79		1.96	
335	20.08		3.19	
340	19.63		14.68	
345	17.82		10.50	
350	16.42		11.00	
355	16.81		6.39	
360	8.09		3.80	
365	18.16		1.98	
370	19.29		1.74	
375	14.48		1.38	
380	17.13		1.40	
385	15.19		1.84	
390	15.09		2.60	
395	15.17		2.78	
400	16.30		2.12	
405	14.70		6.48	
410				

Cont.

Sheet 2

1001 cont

	Iron	Mn
400		
405	8.66	.42
410	23.15	.34
415	15.35	.24
420	17.64	.16
425	7.37	.3[illegible]
430	12.43	.32
435	11.81	.34
440	8.04	.28
445	8.04	
450	6.02	
455	8.08	
460	6.46	
465	7.45	
470	7.25	
475	7.05	
476	Slate	

Finished May 17, 1916.

in Slate

1002 cont

	Iron	Mn
410		
415	16.32	5.08
420	13.43	1.20
425	13.17	2.32
430	9.14	2.88
435	Slate	

Finished May 17 1916

in Slate

1003

	Material	Color	Text	Hardness
3	Quicksand	Gray	Fine	Soft
10	Sand	Brown	Med.	"
	Clay	Gray		Medium
33	Sand	"	Med.	Soft
40				
	"	"	Fine	"
75				
81	"	"	Coarse	"
	"	"	Fine	"
94				
101	Gravel		"	Med.
	"		Med	"
110	Gravel & Boulders		Coarse	Hard
116	Hardpan & Boulders	Gray	"	"
134	Hardpan			
139	Sand	Yellow	Fine	Soft
145				

	Fe.	Mn.
150		7.46
155		9.32
160		1.30
165		16.04
170		10.44
175		6.36
180		9.16
185		6.80
190		8.96
195		5.94
200		6.90
205		3.92
210		12.49
215		14.54
220		5.84
225	14.95	12.88
230		15.60
235		5.40
240		9.00
245		10.96
250		8.78
255		1.80
260		7.20
265		5.68
270		6.48
275	19.75	5.40
280	22.46	5.82
285	22.22	5.52
290	27.18	11.28
295	24.52	19.20
300	14.08	6.82

Cont.

1004

	Mat.	Color	Texture	Hardness
7	Muck	Black		Soft
6	Sand	Gray	Fine	Soft
	Boulders			
	Hardpan	"	"	Hard
26				
	Hardpan	"		"
36				
	Sand & Gravel	"		Soft
76				
82	Sand	Red		"
	Clay	"		"
91				
	Hardpan & Boulders	Gray		Hard
137				
142	Hardpan	"		"
144	Sand		Medium	Soft

	Fe.	Mn.	SiO_2	Graph.
150		.44		
155		.44		
160		.44		
165		.28		
170		.08		
175		.10		
180		.14		
185		.14		
190		.16		
195		.14		
200		.28		
205		.14		
210		.18		
215		.4		
220	6.18	.32		11.27
225	7.40			21.32
230	7.50			7.95
235	15.37	.20		
240		.16		
245		.14		
250		.20		
255		.18		
260		.16		
265		.10		
270		.14		
275		.14		
280			55.00	
285			62.10	
290			52.60	
295			62.64	
300			60.80	
305	7.60		70.75	
310			70.32	
315			74.64	
320			69.24	
325		.24	62.50	
330		.24	68.00	
335		.38		14.35
340		.28		21.85
345		.68		10.35
350		.40		34.25
355		.20		26.15
360		.34		10.40
365		.32		30.95
370		.66		33.65
375		.60		29.38
380		.20		30.80
385		.52		30.60
390		.44		24.72
395		.56		29.83

Cont.

1003 cont

	Iron	Mn.
300	21.02	15.84
305	16.46	2.52
310	13.87	1.68
315	19.56	6.44
320	12.49	3.69
325	16.71	8.54
330	20.21	14.18
335	25.14	17.14
340	21.32	12.52
345	20.53	7.06
350	16.46	8.08
355	14.08	4.00
360	18.13	5.02
365	17.46	1.94
370	11.94	.56
375	16.67	2.90
380	9.84	.54
385		

Bottomed in Slate

Finished June 14 '16

1004 cont

	Mn.	Graph.
395	.60	28.45
400	.42	26.15
405	.32	29.00
410	.46	30.80
415	.44	27.85
420	.34	25.80
425	.34	25.00
430	.34	24.85
435	.40	25.50
440	.36	23.30
445		25.97
450		20.46
455		20.35

Finished June 14 '16

Bottomed in Graphitic Slate & Quartz

" "

1005

	Material	Color	Texture	Hardness
2	Muck	Black	Fine	Soft
10	Sand & Clay	Yellow	Medium	Medium
33	Clay	Grey	"	Hard
42	Gravel & Sand	"	Coarse	Med.
47	Clay & "	Red	Fine	Soft
62	Clay	Grey	Coarse	Hard
74	Sand	"	"	"
90	Clay	"	Medium	"
94	Clay & Rock	"	Coarse	"
105	Sand & Grit	"	Med	Soft
115	Gravel	"	Coarse	Med
122	Hardpan	Brown	"	Hard
135	Clay Boulders	Grey	Med	"
142	" & Sand	"	"	Med.

	Fe	Phos	Mn	SiO_2	Graph
149			10.20		
155			11.50		
160			12.32		
165			6.96		
170			5.96		
175			3.80		
180			4.64		
185			7.78		
190			6.68		
195			7.44		
200			5.12		
205			5.94		
210			2.18		
215			6.94		
220			7.44		
225	19.26	.104	14.42		
230	18.45	.097	11.60		
235		.103	12.20		
240		.180	13.76		
245		.119	10.06		
250		.125	7.20		
255		.124	14.54		
260		.099	12.44		
265		.111	8.96		
270		.087	8.60		
275		.066	10.76		
280		.063	13.76		
285		.090	21.36		
290		.179	6.52		
295		.097	12.46		
300		.081	14.90		
305		.088	1.36		
310		.130	17.60		
315		.090	12.60		
320		.108	16.64		
325		.095	11.98		
330			3.84		
335			1.70		
340					

Bottomed in Slate July 12. 1916

Sheet 4

1006

	Material	Color	Texture	Hardness
7.	Muskeg	Black		
	Sand	Gray	Fine	Soft
18.	Clay	"	"	Medium
30.	"	"	"	Soft
40.	Sand & Gravel	"	Coarse	"
	Sand	"	Fine	"
65.				
	Clay	"	"	"
85.				
	Clay & Sand	"	"	"
100.				
	Hardpan	"	Med	Hard
115.				
	"	"	"	"

	Fe	Mn
145.		
150.		92
155.		88
160.		108
165.		112
170.		96
175.		156
180.		54
185.		68
190.		64

Graphitic Slate & Quartz

215.

260.

Quartz & Schist

285.

Graphitic Slate & Quartz.

320.		
325.	1373	24
330.	2327	28
335.	2770	32
340.	19.65	.36
345.		
350.	Graphitic Slate.	
355.		

Bottomed in Graphitic Slate July 1 1916

1007

	Material	Color	Texture	Hardness
9	Sand	Yellow	Fine	Soft
	Clay	Gray	"	Medium
30				
40	Hardpan	"	Coarse	Hard
	Sand	Yellow	Fine	Soft
55				
64	Sand & Boulders	Brown	"	"
68	Hardpan	Gray	Coarse	Med
80	Sand	Brown	Med	Soft
88	Clay	Gray	Fine	"
93	Sand	"	Med	"
110	Hardpan	"	Coarse	Hard
120	Clay & Boulders	"	"	"
	Hardpan & Boulders	"	"	"
146				
152	Hardpan	"	"	"
161	Sand	"	Med	Soft
165	Gray Shist		Fine	"
170	Sandstone		"	Hard
	Schist	Red & Gray		

	Mn.
195.	
200.	450
205.	516

Red Schist

230

Bottomed in Chert July 26 1916

1008

	Material	Color	Texture	Hardness
3.	Muskeg	Black	Fine	Soft
	Clay	Gray	"	"
39.				
	Clay & Boulders	"	Medium	Medium
45.				
	Hardpan	"	"	"
55.				
	Gravel & Sand.	Red	"	Soft
195.				
	Sand	Gray	Fine	Soft
150.				
153.	Clay	"	Med	Med
160.	Sand	"	Fine	Soft
165.		Mn 56		
	Gray Schist			
215.				
	Red Schist			
235.				
240.		44		
265.				
	Red Schist & Quartz			
300.	Iron			
305.	19.22	.92		
	Red Schist & Quartz & Ore			
330.	Iron	Mn		
335.	39.61	24		
	Schist & Ore			
360.				
370.	Graphitic Slate & Schist			

Finished Aug. 4. 1916
Bottomed in Graphitic Slate.

1009

	Material	Color	Texture	Hardness
0	Sand	Yellow	Medium	Soft.
15.	Clay	Coarse	"	Med.
20.	"	"	"	Hard.
27.	Sand	Yellow	"	Soft
35.	Hardpan	Gray	Coarse	Hard
40.	Sand & Boulders	"	"	Med.
	Gravel & Boulders	"	"	"
59.				
70.	Gravel & Boulders	"	"	Hard
75.	Hardpan	"	"	"
	Gravel	"	"	"
92.				
	Hardpan & Boulders	"	"	"
120.				
	Hardpan	"	"	"
139.				
	Clay	Blue	Med	"
157.				
162.	Sand	White	Fine	Soft.
165.		Mn 44		
	Graphitic Slate & Quartz	Black	"	"
205.				
210.	Graphitic Slate	"	"	"

Finished Aug 5 1916
Bottomed in Graphitic Slate.

1010

	Material	Color	Texture	Hardness
0	Muskeg	Black	Medium	Soft
10	Sand	Yellow	Fine	"
	Clay	Gray	Med.	Med.
30	Gravel & Boulders	"	"	"
	Sand & Boulders	"	"	"
65				
	Sand, Gravel Clay & Boulders	"	"	"
85				
	Gravel, Sand & Boulders	"	"	"
100				
	Sand	"	Fine	Soft
135				
	Gravel, Sand & Boulders	"	Med	Med
150				
	Boulders & Gravel	"	Coarse	Hard
165				
	Quartz & Schist	"		
	Iron	Mn		
190	1966	68		
195	1899	70		
200				
	Schist & Paintrock seams	"		
240				
	Red & Gray Schist, Mixed			
260				

Finished Aug 24 1916.
Bottomed in Schist

1011

	Material	Color	Texture	Hardness
0	Sand & Clay	Yellow	Med.	Med.
18	Hardpan	Gray	Coarse	Hard
	Hardpan & Boulders	"	"	"
36	Clay & Gravel	"	"	"
48	Gravel & Boulders	"	"	"
60				
	" " "		"	Med.
90				
	Clay, Gravel & Boulders	"	"	Hard
135				
	Clay & Sand	"	Med	Med.
160				
163	Dark Gray Schist	Iron 784		Mn .22
	Gray & Brown Schist			
175				

Finished Aug. 24 1916
Bottomed in Schist.

1012

	Material	Color	Texture	Hardness
5	Sand	Yellow	Fine	Soft
	Hardpan	Gray	Coarse	Hard
35				
	Sand & Boulders	Brown	Med.	Med.
90				
95	Gravel & Boulders	Gray	Coarse	"
	Hardpan & Boulders	"	"	"
115				
120	Clay & Boulders	"	"	"
	Hardpan & Boulders	"	"	"
175				
180	Sand & Gravel	"	"	"
	Hardpan & Boulders	"	"	"
215				
	Gravel Sand & Boulders	"	"	"
235				
	Schist & Quartz	"	"	"
245				
250		Green	"	Hard

Bottomed in Schist & Quartz
Finished Sept 21. 16

1014

	Material	Color	Texture	Hardness
1	Muskeg	Black	Med	Soft
15	Sand	Yellow	"	Med.
	Hardpan	Gray	Coarse	Hard
35				
40	Sand	"	Med	Med.
	Hardpan & Boulders	"	Coarse	Hard
70				
80	Gravel	"	Med	Med.
	Hardpan	"	Coarse	Hard.
120				
	Hardpan & Boulders	Gray	Med	Hard.
150				
	Sand	"	Fine	Soft.
165				
170	Sand & Gravel	"	Med	"
175	Black Clay	Black	"	"
180	Schist	Gray	"	Med.
	Quartz	White	Coarse	"
200				
210	Schist	Geen	"	"

Bottomed in Green Schist.
Finished Oct. 9 1916

1013 Δ Hole 60° NW

Material	Color	Texture	Hardness
Muskeg	Black	Med	Soft
20 Clay	Gray	Med	Med
25 Quicksand	"	"	"
35 Clay-Sand	"	"	"
45 Clay-Gravel	"	"	"
52 Boulder-Gravel	"	Coarse	"
62 Gravel-Clay	"	"	"
Boulders	"	"	"
15 Gravel	"	"	"
87 Gravel-Sand	"	"	"
98 Sand	Red	Med	"
102 Sand	"	"	"
115 Sand-Gravel	Gray	Coarse	Soft
122 Clay-Gravel	Blue	"	Med
139 Gravel-Sand	Gray	Med	"
153 Hardpan Boulders	"	"	"
Hardpan Solid Seams	"	"	Hard
170 Clay-Sand Seams	Green	Fine	Med
180 Sub-Lignite	Black	Med	Soft
185 Schist	Gray-Brown	"	Med
245 Green & Brown Schist			

	Iron	Mn
260	1008	326
265	2085	360
270	1503	390
275	1138	340
280	1642	340
285	1452	276
290	1790	312
295	1108	340
300	1488	346

Bottomed in Schist & Point Rock
Finished Oct 7. 1916.

Sheet 10 (P 150)

1015 Commenced Oct. 9. 1916

	Material	Color	Texture	Hardness
20	Muskeg	Black	Fine	Soft
	Clay & Sand	Gray	"	Med
22.				
	Boulder & Sand	Yellow	Med.	Soft
70.				
75.	Sand	"	Fine	Med.
	Gravel & Sand	Green	Coarse	"
91.				
96.	Gravel	Gray	"	"
100.	Boulders & Clay	"	Med.	"
	Hardpan	"	"	Hard
112.				
115.	Gravel & Boulders	"	Coarse	Med
	Hardpan	"	Med.	Hard.
130.				
	Sand & Gravel with Clay Seams	Yellow	"	Med

	Iron	Mn	Mn
143.			
145.			
150.	2819	.071	360
155.	2104	.085	19.50
160.	1824	.121	1.94
165.	1667	.020	8.14
170.	1444	.005	12.10
175.	19.16	.094	6.78
180.	1665	[illegible]	848
185.	2036	.038	9.26
190.	1986	.045	842
195.	2282	.054	840
200.	1905	.064	480
205.	1632	.064	2.30
210.	1746	.071	[illegible]
215.	1165	.083	[illegible]
220.	1088	.089	7.54
225.	1906	.118	796
230.	1201	.069	826
235.	1590	.182	1390
240.	1363	.128	1092
245.	1278	.069	10.72
250.	1939	.069	1880
255.	1387	.101	12.00
260.	1932	.069	18.14
265.	1424	.078	20.70
270.	1588	.120	792
275.		.118	674
280.		.081	6.58
285.		.091	8.50
290.		.100	2.52
295.		.109	1.90
300.		.150	5.80
305.		.135	5.56
310.		.110	2.54
315.		.146	.370
320.		.101	5.66
325.		.094	.58
330.		109	.44
335.		.006	.38
340.		.127	.36
345.		.079	.26
350.		.078	1.66
355.			1.60
360.			1.26
365.			1.92
370.			328
375.			140
380.			4.00
385.			5.80
390.			2.64
395.			2.52
400.			.82

Bottomed in Slate
Finished Nov. 2 1916

1016 Commenced Oct. 10. 1916

	Material	Color	Texture	Hardness
30	Sand	Yellow	Fine	Soft
	Clay	Gray	Med.	"
50				
	Gravel & Boulders	"	"	"
90				
	Hardpan	"	Med.	Med.
102				
	Hardpan & Boulders	"	Coarse	"
140				
145	Hardpan	"	Med.	"
155				
	Sand	"	Fine	Soft.
165.				
170.	Clay & Sublignite	Black	Med.	Med
	Schist	Gray	Fine	Soft
185				
	Quartz	"	Coarse	"
225				

Bottomed in gray Quartz.
Finished Oct. 19 1916

1017 Commenced Oct 20 1916

	Material	Color	Texture	Hardness
5	Muskeg	Black	Fine	Soft
20	Clay	Gray	"	"
30	Sand	Yellow	Coarse	"
40	Clay	Red	Med	Med
50	Hardpan + Boulders	Gray	-	
60	Sand	"	Coarse	Soft
70	Gravel	-	"	"
80	Sand	"	"	"
	Sand + Clay Seams	"	Med	"
130				
140	Gravel + Boulders	-	Coarse	Med
146	Clay	"	Med	"
150	Boulders	"	Coarse	Hard
160	Sand	Gray	Fine	Soft
170	Sub-lignite	Black	Med	"
	Talc	Gray	Fine	"
190				
	Quartz	"	-	Hard
210	Quartz + Pant-rock	Red	Med	Med
215		Mn.		
220		1.24		
225		.92		
230		1.12		
235	15.05	.075	1.24	
240	13.71	.099	1.56	
245	Pantrock + Schist	Red	.76 Med	Hard
252	Slate + Schist	Black	Fine	"
260	Slate	"	Med	"

Bottomed in Slate
Finished Nov 16 1916.

1018

	Material	Color	Texture	Hardness
15	Clay-Sand	Gray	Med	Med
	Hardpan	"	-	Hard
32	Sand	Red	Fine	Soft
38				
	Sand Gravel + Boulders	Gray	Coarse	Med
69				
	Sand	-	Fine	Med
85	Gravel + Boulders	-	Coarse	"
93				
	Hardpan	"	Med	Hard
132	Gravel	"		Med
137	Sand	"	Fine	Soft
143	25.84			
145		9.24		
150		2.14		
155		.84		
160		.58		
165		6.34		
170		3.66		
175		2.24		
180		1.32		
185		4.90		
190		.942		
195	16.16	6.36		
200		3.40		
205		3.34		
210		1.52		
215		2.08		
220		1.00		
225		.62		
230		.24		
235	16.00	.22		
	Ore + Schist			
260				
268	Chert + Slate			

Bottomed in Chert + Slate
Finished Nov 28 1916

1019

	Material	Color	Texture	Hardness
1	Muskeg	Black	Med	Soft
5	Sand	Gray	Fine	"
	Clay	"	Med	"
30				
	Sand	"	Fine	"
39	Boulders	"	Coarse	Hard
40				
48	Clay	Red	Med.	Med.
	Gravel & Boulders	Gray	Coarse	Hard
80				
87	Sand	"	Fine	Soft
95	Hardpan	"	Med	Med.
	Hardpan Boulders	"	Med.	Hard
120				
	Hardpan & Sand	"	"	"
152	Sand &			
160	Boulders	"	"	"
165	Clay	"	"	Med
	Schist	"	"	"
185				
	Schist & Quartz	"	"	"
200				

Bottomed in Schist & Quartz
Finished Nov. 28, 1916

1020

	Material	Color	Texture	Hardness
8	Muskeg	Black	Med.	Soft.
	Clay	Red & Gray	"	"
57				
60	Hardpan	Gray	"	Hard
	Gravel-Boulders	"	Coarse	"
70				
	Clay & Sand	"	Med	Med.
80				
	Sand, Clay & Boulders	Gray	Med.	Soft.
105				
	Sand	"	"	"
120				
130	Gravel & Boulders	"	Coarse	Med.
	Gravel & Sand	"	Med	"
145				
	Boulders Gravel & Sand	"	Coarse	"
158				
	Gravel & Sand	"	Med	"
168				
175	Gray Schist	"	"	Hard
185	Sub. lignite	Black	Fine	Soft.
190	Schist	Gray	Med	Hard
195	2.39	Mn. .34		
200	Schist	"	"	"

Bottomed in Schist
Finished Dec. 5, 1916

1021

	Material	Color	Texture	Hardness
	Muck & Clay	Gray	Fine	Soft
48				
56	Hardpan	"	Med	Med
68	Gravel, Sand & Boulders	"	"	"
	Sand & Gravel	Green	Coarse	Soft
90				
94	Clay & Gravel Seams	Gray	Med	Med
98	Quicksand	"	Fine	Soft
102	Gravel & Boulders	-	Coarse	Hard
107	Boulders & Gravel	-	Med	-
	Hardpan & Gravel Seams	-	"	Med
132				
136	Sand	Yellow	Fine	Soft

	Iron	Phos.	Mn
145	4742	165	498
150	3969	102	674
155	2546	131	476
160	2349	102	830
166	2416	061	594
170	1551	081	248
175	2542	065	164
180	2527	053	362
185	1604	147	294
190	1701	059	242
195	1954	077	330
200	2375	127	144
205	2782	139	100
210	2497	123	128
215	1477	056	540
220	1750	054	1012
225	2185	147	984
230	2396	190	1240
235	2446	178	266
240	1750	127	1224
245	2185	185	836
250	1474	139	956
255	2230	486	516
260	1750	076	276
265	1847	121	116
270	1931	075	1274
275			1266
280			
285			512
290			1164
295			162

Bottomed in Schist
Finished 12-20-18

1022

	Material	Color	Texture	Hardness
	Muskeg	Gray	Fine	Soft
8	Sand	Yellow	"	Med
	Clay	Gray	"	-
26				
	Sand Boulders	-	"	"
60				
	Hardpan	-	Med	Hard
70				
74	Sand & Gravel	"	-	Med
	Boulders & Sand	"	-	Hard
90				
	Boulders & Hardpan	-	-	"
160				
	Clay	-	Fine	Soft
172				
180	Schist	"	Coarse	-
	Quartz	-	Med	Med
210				

Bottomed in Quartz
Finished 1/13/17

1023

	Material	Color	Texture	Hardness
20	Sand Clay	Gray	Fine	Soft
35	Clay	"	"	"
51	Clay & Sandseams	"	"	Med
62	Boulders & Hardpan	"	Coarse	"
64				
72	Sand	"	Med	Soft
95	Sand & Gravel	Green	Med	Med
101	Gravel & Boulders	"	Coarse	"
118	Hardpan & Boulders	Gray	Med	Hard
134	Hardpan	"	"	Med
141	Sand & Gravel	Yellow	"	Soft

	Iron	Phos	Mn
145	21.07		1.80
150	21.10		.60
155	22.51		.58
160	25.90		.82
165	25.75		2.10
170			4.54
175			4.21
180			4.76
185			2.61
190			1.14
195			1.33
200			2.43
205			2.24
210			2.04
215		.127	17.38
220		.120	12.50
225		.144	12.45
230		.252	9.88
235	29.82	.164	8.13
240		.171	15.70
245		.107	8.92
250		.090	8.97
255		.068	3.60
260		.119	8.22
265			5.09
270			4.43
275			3.14
280			3.78
285		.088	10.55
290			1.38
295			.92
300			2.68
305		.094	11.64
310			8.60
315		.068	11.55
320		.100	11.97
325			4.44
330			2.89
335			2.22
340			2.44
345			3.44
350			3.26
355			5.89
358	13.31	.121	20.82

Bottomed in Chert
Finished 2/24/17

1024

	Material	Color	Texture	Hardness
5	Muskeg	Gray	Fine	Soft
61	Clay	"	Med	"
86	Sand	"	"	Med
100	Gravel & Boulders	"	"	Hard
140	Boulders & Hardpan	"	"	"
145	Sand & Gravel	"	"	Med
154	Sand	"	"	"

	Iron	Phos	Mn
160	21.52	.112	7.54
165	19.45	.075	3.00
170	21.55	.101	9.08
175			3.30
180			1.74
185			2.70
190			1.88
195			1.37
200			1.88
205			2.28
210			.82
215			.50
220			.68
225			4.94
230			6.77
235			4.85
240			2.70
245			6.65
250			4.72
255		.080	14.05
260			8.22
265			7.03
270			8.77
275			3.70
280			1.34
285			1.85
290			2.26
295			2.53
300			5.06
305			3.98
310			2.84
315			2.19
320			2.76
325			3.89
330			2.68
335			3.82
340			3.75
345			2.11
350			1.95
355	18.60		1.23
360			2.44
365			3.01

Bottomed in Slate
Finished 2/28/17

1025

	Material	Color	Texture	Hardness			
4		Gray	Fine	Soft.			
13	Sand	"	"	"			
	Clay	"	"	"			
62							
	Sand, Gravel & Boulders	"	Med	Hard.			
91							
105	Gravel & Boulders	"	Coarse	"			
110	Hardpan		Med	Med			
117							
125	Hardpan & Boulders	"	-	"			
130	Clay & Sand	"	Fine	Soft.			
138	Sand		Med.	"			
142	Clay & Sand	Mos.	Mn.	Med			
145		0.89	6.37				
150		.049	9.45				
155	22.83	.072	5.42				
160			3.98				
165		.041	6.42				
170			4.08				
175			2.98				
180			4.12				
185			4.13				
190			1.94				
195			1.62				
200			1.45				
205			7.28				
210			1.94				
215		.074	2.35				
220		.102	18.02				
225		.072	4.60				
230		.056	14.80				
235		.080	17.61				
240	22.46	.108	19.64				
245		.083	11.09				
250	18.98	.051	16.64				
255		.052	23.09				
260		.046	5.70				
265		.065	6.52				
270		.068	18.02				
275		.196	1.70				
280		.187	1.09				
285	33.34	.154	9.20				
290		.134	4.68				
295		.101	13.15				
300		.081	7.37				
305		.092	9.13				
310		.113	11.31				
315		.100	14.60				
320			7.72				
325			4.91				
330			6.87				
335	19.13		2.79				
340	18.53		1.05				
345			5.32				
350			2.02				
355			3.08				
360	16.22	.105	2.38				
362	12.52	.107	2.93				

Bottomed in Quartz
April 14 1917.

1026

	Material	Color	Texture	Hardness			
8	Muskeg	Blue	Fine	Soft.			
20	Sand & Clay	"	"	"			
30	" " "		"	"			
50	Clay	Gray	"	"			
63	Sand & Clay	"	"	"			
80	Sand, Gravel & Clay	"	"	"			
88	Sand		Med	"			
94	Gravel & Boulders	"	"	Med			
102	Hardpan	"	"	Hard.			
117	Sand-Gravel Hardpan & Boulders	"	"	"			
125	Hardpan	"	"	"			
134	Gravel & Hardpan	"	"	Med			
137	Gravel	"	Mn	"			
140			1.54				
145			1.90				
150			1.18				
155			3.48				
160			2.31				
165			2.84				
170			2.54				
175			1.45				
180			.46				
185			.54				
190			2.49				
195			2.36				
200			1.58				
205			1.49				
210	Iron	Phos	1.40				
215			.68				
220	19.43	.081	13.92				
225		.061	9.08				
230			4.05				
235			6.08				
240			3.58				
245			5.88				
250			6.75				
255			2.26				
260			1.38				
265			2.09				
270			.82				
275			2.21				
280			.73				
285			.18				
290			4.69				
295			3.60				
300			2.66				
305			1.24				
310			1.28				
315	21.55		.92				
320			1.74				
325			1.56				
330			1.74				
335			1.00				
340	24.19		.82				
344			1.82				
345			.88				
350			.78				
355			.36				
360			.82				
365			2.02				
370			1.56				
375	29.41	.200	1.33				
376	24.88	.181	1.37				

Bottomed in Schist
April 17. 1917.

Sheet 16

1027

	Material	Color	Texture	Hardness
5.	Muskeg	Black	Fine	Soft
	Clay	Gray	"	"
44.				
	Clay & Hardpan	"	Med.	Med.
59.				
73.	Hardpan & Gravel	"	"	"
	Gravel & Boulders		"	"
100.				
	Hardpan & Boulders		"	"
130.				
142.	Hardpan & Sand		"	"

	Iron	Phos	Mn.
145.	21.95	.102	.78
150.	19.83	068	1.55
155.	22.62	.082	1.56
160.	20.21	012	3.88
165.	17.27	054	2.38
170.	20.21	066	4.70
175.	19.00	075	3.02
180.	14.80	065	2.10
185.	13.80	055	3.20
190.	17.64	119	3.24
195.	18.25	.068	3.83
200.	15.85	090	2.28
206.			.39
210.			6.59
215.			2.28
220.			4.75
225.			4.43
230.			1.77
235.			6.35
240.			1.18
245.			.89
250.	11.29		.32
255.	11.90		.38
260.			1.18
265.			3.55
270.			16.04
275.			12.38
280.			6.49
285.			3.83

Finished May 3, 1917

1028

	Material	Color	Texture	Hardness
	Muskeg & Clay	Black	Fine	Soft
20.				
	Clay & Sand	Gray	Med.	"
38.				
	Boulders & Hardpan	"	"	Med
80.				
89.	Gravel & Sand		Coarse	"
	Boulders Hardpan	"	"	"
129.				
137.	Boulders Gravel & Hardpan	"	Med	"

	Iron	Phos	Mn
140.	24.39		1.64
145.	19.73		2.19
150.	21.99		2.28
155.			2.37
160.			1.77
165.			4.06
170.			3.05
175.			2.47
180.			2.46
185.			.45
190.			.36
195.			.40
200.			.27
205.			.81
210.			4.39
215.			9.05
220.			10.03
225.			7.68
230.			6.21
235.			6.12
240.			1.46
245.			6.75
250.			1.09
255.	18.02	.126	1.97
260.	17.65	.053	11.12
262.	17.65	[illegible]	[illegible]

Finished May 10, 1917

1029

	Material	Color	Texture	Hardness
5	Muskeg	Black	Fine	Soft
	Clay	Gray	Fine	Soft
47				
	Clay + Gravel	"	Coarse	Medium
63				
	Sand	"	Medium	Soft
78				
	Gravel + Boulders	"	Coarse	Hard
87				
	Gravel, Sand, + Boulders	"	Medium	
96				
	Hardpan + Boulders	"	Medium	Hard
134				
	Clay, Gravel, + Boulders	"	Medium	Soft

	Fe	P	Mn
143			
150			.45
155			.40
160			.36
165			.90
170			1.74
175			1.91
180	17.05	.064	.90
185	22.08	.109	2.47
190	15.85	.085	1.74
195	16.90	.082	3.07
200	14.72	.066	4.98
205	14.64	.075	1.88
210	14.42	.079	2.01
215	12.69	.061	.78
220	12.77	.037	1.10
225	9.61	.052	3.66
230	9.96	.041	3.93
235	16.82	.059	2.33
240	12.24	.050	8.33

Finished May 9, 1917

1030

	Material	Color	Texture	Hardness
5	Muskeg	Black		
10	Sand	Yellow		
	Clay	Gray		
45				
	Hardpan	"		
60				
	Gravel, Sand, + Boulders	"		
90				
96	Clay	Red		
	Hardpan + Boulders	Gray		

	Fe	P	Mn	Texture	Hardness
143					
150	29.14	.040	8.10		
155	29.97	.050	5.08		
160	20.13	.043	3.07	Fine	Soft
165	20.81	.126	3.80		
170	25.83	.084	5.58		

Finished May 14, 1917

Sheet P

1031

	Material	Color	Texture	Hardness
	Sand + Clay	Gray	Fine	Soft
M 22	Gravel + boulders	"	"	Medium
	Hardpan, gravel, + boulders	"	Medium	"
40				
	Gravel + Sand	Mixed Gray	"	"
80				
	Gravel, Sand, + Hardpan		"	"
101				
	Hardpan, Gravel, + Boulders	Gray	"	"
121				
	Clay	Blue	Fine	"
150				
159	Sand + Gravel	Gray	Coarse + Fine	Medium + Soft
	Fe Mn			
165	27 49 54			
170	24 27 .63		Fine	Soft
180				
	Schist + Quartz	Black + white	Coarse + Fine	Soft
200				
225				
230	22 11 05			
	Schist	Variety	Coarse + Fine	Hard to soft
280				
285	20 45 13			
290	31 16 .18			

Finished May 27, 1917

1032

	Material	Color	Texture	Hardness
5	Muskeg			
	Clay	Gray	Fine	Soft
35				
	Clay	Red	Medium	Medium
57				
	Clay + Gravel	Gray	Coarse + Medium	"
84				
	Sand + Gravel	"	Coarse	Soft
120				
	Sand	"	Medium	Soft
136				
144	Gravel	"	Course	
	Hardpan	"	Medium	Hard
176				
180	Sand	"	Fine	
	Schist + Sub lignite	Variety	Coarse to Fine	Soft
195				
203	Quartz	Gray	Fine	Hard

Finished May 23, 1917

Sheet P

1033

	Material		Color	Texture	Hardness
2	Muskeg				
12	Sand		Yellow		
	Clay		Gray		
31					
	Sand, Gravel + Boulders		Brown + Gray		
101					
	Hardpan + Boulders		Gray		
121					
	Hardpan		"		
134	Hardpan, Gravel, + Boulders		"	Coarse + Medium	Hard + Medium
141	Hardpan, Gravel, + Sand		"	Medium + Fine	Medium
146					
150	12.93 Fe	.13 Mn			
155	29.27	1.99	Variety	" + "	Soft
160	27.71	1.89			
165	13.33	.95			
170	29.51	2.93	Red, Gray, Green	" + "	Medium + Soft
175	10.73	1.08	Gray + Brown	" + "	Soft
180	13.93	.45			
185	16.98	.18	" + Red	" + "	Medium + Soft
190	18.73	.09			
	Schist + Graphite		Variety	" + "	" + "
220					
225					
230	17.63	.05	"	" + "	Hard + Medium
235					

Finished May 31, 1917.

1034

	Material		Color	Texture	Hardness
	Clay + Sand		Gray	Fine	Soft
18					
	Clay		"	"	Medium + Soft
30					
	Water, Sand, + Gravel		"	Medium + Fine	Soft
90					
97	Gravel + Boulders		Mixed	Coarse + Medium	Hard
	Hardpan		Gray	Medium	Medium
139					
	Hardpan, Sand + Gravel		"	Coarse To Fine	"
152					
	Fe	Mn			
165					
170	10.91	.09			
	Schist		Variety	Medium + Fine	Medium + Soft
210					
215	7.91	.14			
225					
230					
235	5.38	.14			
240					
245	5.38	.14	"	" + "	Soft
255					
260	5.98	.14			
265					
	Schist + Paint R.		"	" + "	"
285					
290					
295	5.83	.05	"	" + "	"
300					

Finished June 18, 1917.

Sheet P

Aitkin County
Sec Ref 1072

Serial No. 42
Hole No. 1
Collar Elevation:
Depth of Hole: 332'
Location: Sec. 23, T43N - R27W

Date completed: 5/13/50
Drilled by: U. S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond Drill-Core

Depth From	Depth To	Material	Material and Analyses Iron	Mang.	Core
0	150	Sand gravel, boulders			
150	162	Green sand	Surface		
162	167	Soft iron formation			
167	172	Red mud			8.2
172	177	No core			
177	182		18.92	1.88	36.8
182	187				31.6
187	192	Red mud and lump	18.76	7.81	58.5
192	197	of red slate	17.16	4.64	48.4
197	202		13.79	6.71	40.0
202	207				26.6
207	210		16.36	20.17	
210	213				33.3
213	218	Mud and red slate			21.6
218	222	and black slate	13.79	6.87	50.0
222	227		15.79	6.05	53.4
227	232				
232	237				50.0
237	242		12.67	2.27	20.0
242	247				3.4
247	250.5	No core			
250.5	253				21.3
253	257	Red slatey	7.86	0.75	18.8
257	260				83.5
260	263		10.42	2.74	83.5
263	266				94.4
266	269.5	Clayey light decomb.	11.39	5.97	62.0
269.5	273	slate. Lump of black			90.4
273	277	slate & manganese at	9.30	0.32	85.6
277	281	260', 263'4", 269',	11.47	1.49	100.0
281	283.5	296'7", 300', 300½'			100.0
283.5	287	to 302'.	7.94	0.95	95.4
287	291.5				50.0
291.5	295		8.58	3.06	105.1
295	298				116.5
298	300.5		11.45	7.69	90.0
300.5	302				44.6
302	304		8.90	7.50	100.0
304	307	Similar but			86.0
307	309	red.	11.79	3.02	87.5
309	312.5				90.8
312.5	314		15.31	2.82	66.7
314	318	Similar to above but			66.5
318	320	red. Few small black	7.70	4.33	54.0
320	324.7	mang. nodules. Large	10.42	1.38	94.0
324.7	327.7	at 319'.	8.18	1.42	100.0
327	332		14.51	0.13	93.0
116	332		11.79	3.60	

No unaltered formation.
Bands show dips 45°±

Serial No. 43
Hole No. 2
Collar Elevation: 1218.5'
Depth of Hole: 4[illegible]'
Location: N.E. - [illegible]

[illegible]: 10/6/50
[illegible]: [illegible] of mines
[illegible]: [illegible]
[illegible]: [illegible] Diamond Drill-Core

Depth From	Depth To	Material	Core Iron	Core [illegible]	Core [illegible]	Sludge Iron	Sludge [illegible]	Sludge [illegible]	Sludge [illegible]	Adjusted Average Iron	Adjusted Average [illegible]	Adjusted Average SiO_2
0	144	Surface										
144	150	material									.93	44.99
150	155	Dk.red clay	20.56	1.41	54.[illegible]						.37	40.44
155	160	No core									.65	47.92
160	164	Dk.red clay; a few soft pieces of mn. oxide	23.77	2.29	48.[illegible]						1.11	45.40
164	169	Dk.red clay; a few streaks of wad ore	19.77	[illegible]	[illegible]					[illegible].39	1.17	50.35
Average										[illegible].71	1.[illegible]	[illegible].52
169	174	Dk.red clay & broken soft slate	18.[illegible]	[illegible]	[illegible]					[illegible].23	1.[illegible]	48.98
174	179	No core				[illegible]	[illegible]	[illegible]	[illegible]	[illegible].66	2.95	48.10
179	184	Soft red sl. & clay; a few black mn.-bearing bands in sl.; bedding 45°	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible].47	[illegible].38	39.06
184	187	No core				[illegible]	[illegible]	[illegible]	[illegible]	18.63	3.41	50.27
187	191	Red clay [illegible] soft sl.; a few [illegible] of sl. with [illegible] bands	14.85	2.39	[illegible]					14.58	2.39	52.45
Average										[illegible]	2.96	47.53
191	196	Soft red [illegible] clay [illegible]	[illegible]	[illegible]	[illegible]					[illegible]	1.41	[illegible]
196	201	Soft red sl. [illegible] or narrow [illegible] hard black sl.	[illegible]							[illegible]	[illegible]	70.83
201	206	Soft red sl.	[illegible]	[illegible]	7.31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.12	[illegible]
206	211	Soft red sl.; bedding [illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	[illegible]
211	216	Soft red sl.	[illegible]	[illegible]	[illegible]					[illegible]	.51	[illegible]
216	220	Soft red clay; [illegible] band of black slate	[illegible]	[illegible]	[illegible]					[illegible].51	[illegible]	78.22

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 43
Hole No. 2 (Cont'd.)
Collar Elevation: 1213.5'
Depth of Hole: 467'
Location: N.E.- S.W.

Date completed: 10/9/[illegible]
Drilled by: U.S. Bureau of Mines
Logged by: W. A. Groth
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Iron	Adjusted Mang.	Adjusted SiO_2
220	225	Soft red sl. & clay; bedding 45°; cleavage 31° about right angles to bedding	7.60	1.22	75.79				7.60	1.22	75.79
Average									9.93	1.07	72.06
225	230	Soft red sl.	7.11	4.73	78.90				7.11	4.73	78.90
230	235	Soft red sl.; a few bands of black slate	8.08	3.23	74.01				8.08	3.23	74.01
235	238.5	Black sl. with some pale red slate	13.42	7.60	59.43	10.74	4.71	65.71	11.72	5.76	63.41
Average									9.36	4.44	73.07
238.5	243.5	Soft pale red slate	8.08	1.45	68.32				8.08	1.45	68.32
243.5	248.5	Soft pale red sl. with bands of harder red slate	7.92	.39	68.19	6.51	.89	76.76	7.25	.63	72.25
248.5	254	Pale red sl.; cleavage 52° at 248.5'; vertical fracture plane at 249'	7.27	1.49	69.22	11.56	3.88	65.03	9.92	2.97	66.63
254	259	Soft red & light grey sl.; vertical banding at 255'; cleavage 15°	8.47	.47	71.71				8.47	.47	71.71
259	264	Soft red sl. to 261'; harder red sl. 261 to 264'; cleavage 28° to 33°; mn. filling along cleavage planes	5.17	.66	75.34				5.17	.66	75.34
264	269	Red sl. band of chert & mn.(?) at 269'; bedding 53°	13.42	.59	54.27	13.38	1.44	62.93	15.44	1.17	63.36
Average									8.74	1.25	69.55

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 43
Hole No. 2 (Cont'd.)
Collar Elevation: 1213.5'
Depth of Hole: 467'
Location: N.E.- S.W.

Date completed: 10/9/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Analyses Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
269	274	Red to dk. red clay with highly fractured sl.; a few bands of harder slate	13.90	.66	60.17				13.90	.66	60.17
274	279	Black sl. 274' to 275'; red sl. 275' to 279'	7.60	.51	69.87				7.60	.51	69.87
279	284	Red sl.(soft) to 282'; soft gray sl. 282' to 284'	6.79	.28	71.30				6.79	.28	71.30
284	289	Soft red and light gray sl.	10.99	.78	64.73	11.72	.59	67.04	11.42	.67	66.09
289	294	Soft red sl.; mn. filling in fractures and/or bedding planes	9.94	.98	65.91	11.88	1.89	65.20	10.70	1.34	65.63
294	299	Soft red sl.	8.73	.36	66.56				8.73	.36	66.56
299	303.5	Soft light gray sl.;cleavage 25° at 299' to 300'; soft red sl. at 300' to 302'; hard black sl. at 302 to 303.5' (manganiferous?)	10.51	2.44	63.30				10.51	2.44	63.30
303.5	308	Soft red clay & sl. to 306'; Light red sl. to 306 to 308', soft bedding 35°; hard black sl. at 308'	8.81	.32	67.91				8.81	.32	67.91
308	313	Red sl.; cleavage 35°; mn.band at 309';fractured pieces of mn. 312' to 313'	7.68	1.65	67.18				7.68	1.65	67.18
Average									9.57	.90	66.46

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 43
Hole No. 2 (Cont'd.)
Collar Elevation: 1213.5'
Depth of Hole: 467'
Location: N.E.- S.W.

Date completed: 10/9/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Green
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
313	318	Band of hard mn. ± 2' or more; dk. sl. at 318'	12.69	14.58	44.96	15.30	16.29	39.84	14.81	15.97	40.81
318	323	Red sl. and hard bands of mn. to 320'; softer red sl. 320 to 323'; rumpled bedding at 322'	9.40	1.73	65.64				9.40	1.73	65.64
323	327.5	Soft red sl.	11.03	5.00	59.74				11.03	5.00	59.74
327.5	333	Soft red sl. with ± 1' of hard mn.	22.54	10.64	40.33	14.98	5.91	57.17	16.74	7.01	53.25
Average									13.14	7.48	54.70
333	338	Soft red sl. and clay	8.60	.23	69.22				8.60	.23	69.22
338	343	Soft red sl.; bedding 30°; cleavage 55°; angle of cleavage & bedding ± 90°	6.81	.27	70.27				6.81	.27	70.27
343	347	Light red sl.; cleavage and bedding vertical	10.70	.86	65.60				10.70	.86	65.60
347	351.5	Red clay and sl.; bedding 27°; some wad	9.73	.19	68.21				9.73	.19	68.21
351.5	356.5	Red sl.; dk. gray sl. only slightly altered at 354'; bedding 35°; cleavage 20°	11.35	.15	67.60				11.35	.15	67.60
Average									9.38	.31	68.29
356.5	360.5	Soft dark gray slate	9.57	.55	69.07	11.07	2.21	65.21	10.33	1.40	67.10
360.5	366	Hard banded slate, dk. gray to light red; bedding 37°; cleavage 70°	7.30	.82	69.97				7.30	.82	69.97

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 43
Hole No. 2 (Cont'd.)
Collar Elevation: 1213.5'
Depth of Hole: 467'
Location: N.E.- S.W.

Date completed: 10/9/50
Drilled by: U. S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth			Analyses								
			Core			Sludge			Adjusted Average		
From	To	Material	Iron	Mang.	SiO_2	Iron	Mang.	SiO_2	Iron	Mang.	SiO_2
366	371	Hard, dk.gray sl. with streaks of iron stain; cleavage 27°	8.11	1.68	64.31				8.11	1.68	64.31
Average									8.42	1.28	67.23
371	373	Hard, dk.gray slate; rumpled bedding	5.35	4.98	53.95				5.35	4.98	53.95
373	378	Hard, reddish iron stained slate	7.19	2.29	47.57				7.19	2.29	47.57
378	383	Hard, dk.gray slate; some iron stain; cleavage 30°	8.92	.04	69.45				8.92	.04	69.45
383	388	Bedding 15°; tends to cleave on bedding planes; dk.gray slate; 2' light gray slate with thin iron seams	9.40	.63	68.53				9.40	.63	68.53
388	392	Dk.gray to moderately light gray sl.; some iron stain	7.95	1.97	64.55				7.95	1.97	64.55
392	397	Light gray slate	9.40	1.61	65.16	11.23	1.95	63.70	10.24	1.77	64.49
397	402	Light gray slate	12.16	2.13	63.04				12.16	2.13	63.04
402	407	Gray slate; some iron stain	9.57	2.49	65.03				9.57	2.49	65.03
407	412	Dk.gray slate; some iron stain; uneven fracture; rumpled bedding	8.11	1.53	67.17				8.11	1.53	67.17
412	417	Moderate gray slate; some iron stained bands	7.60	2.76	65.73				7.60	2.76	65.73
417	422	Gray slate; some iron stain; bedding 35°	7.27	1.06	69.08				7.27	1.06	69.08
422	427	Gray slate; some iron stain; bedding 35°	6.63	1.81	69.98				6.63	1.81	69.98
Average									8.33	1.49	64.58

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 43
Hole No. 2 (Cont'd.)
Collar Elevation: 1213.5'
Depth of Hole: 467'
Location: N.E. - S.W.

Date completed: 10/9/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Analyses Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
427	432	Gray slate; ± 1' badly fractured iron stained slate	8.57	.20	69.64				8.57	.20	69.64
432	437	Gray slate & red iron-stained slate	7.92	.12	71.43				7.92	.12	71.43
437	442	Dk.gray slate; bedding 40°	7.03	.12	72.82				7.03	.12	72.82
442	447	Dk. to light gray slates; some iron stain	8.08	.12	68.76				8.08	.12	68.76
447	452	Medium gray slate; several iron stained bands	8.65	.12	68.97				8.65	.12	68.97
Average									8.05	.14	70.32
452	457	Light gray slate; iron stained bands	6.95	1.18	66.44				6.95	1.18	66.44
457	462	Light gray slate; iron stained bands	8.08	2.72	62.07				8.08	2.72	62.07
462	467	Light gray slate; iron stained bands	6.47	1.57	65.27				6.47	1.57	65.27
Average									7.17	1.82	64.59
144	467	Average for hole							10.88	1.82	64.03

Aitkin County
Sec Ref 1072

Serial No. 44
Hole No. 3
Collar Elevation: 1213.1'
Depth of Hole: 340'
Location: N.E.- S.W.

Date completed: 10/6/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Analyses: Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
0	175	Surface									
175	181					13.05	2.25	62.54	13.05	2.25	62.54
181	185	Light grey clay & soft slate	12.13	3.90	57.80				12.13	3.90	57.80
185	188	Red, light red soft slate; bedding vertical	10.91	1.08	63.54				10.91	1.08	63.54
188	191	Soft red sl.; bedding vertical	10.99	2.32	63.84				10.99	2.32	63.84
191	194	Soft red sl.; bedding at 45°; rock breaks along bedding easily at 198'	12.21	2.60	56.90				12.21	2.60	56.90
Average									12.06	2.48	61.01
194	197	Light grey, closely folded slate; cleavage 15° (axis of folds) at 194 to 195'. Red sl.; bedding vertical; cleavage 70° at 196'	10.02	1.85	64.30				10.02	1.85	64.30
197	200	Red slate; bedding 43°	8.89	.59	65.78				8.89	.59	65.78
200	205	Soft red sl. & clay; bedding 15°	10.99	.95	62.22				10.99	.95	62.22
205	210	Light red sl.; bedding 50°; cleavage vertical (?)	11.24	1.28	62.77	14.34	1.77	61.95	13.67	1.66	62.13
Average									11.25	1.27	63.25
210	215	Light red, soft slate; some mang.	11.32	6.23	58.07	14.18	1.57	61.23	13.82	2.16	60.83
215	218.5	Dk. red clay; pale red slate; some mang.	12.94	3.31	61.50	14.50	1.68	59.92	13.85	2.36	60.58
218.5	221	Pale red slate; ± 3' mang.									
221	224	Red & pale red slate; cleavage 20°	11.16	1.69	63.04	11.28	1.93	66.25	11.25	1.87	65.41

(Continued)

Serial No. 44
Hole No. 3 (Cont'd.)
Collar Elevation: 1213.1'
Depth of Hole: 340'
Location: N.E.- S.W.

Aitkin County
Sec Ref 1072

Date completed: 10/6/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
224	230	Some good mang. at 224'; pale red sl.; bedding 45°	14.15	3.27	55.70	~~14.34~~ 11.03	~~4.18~~ 1.13	~~62.01~~ 64.03	~~13.20~~	~~2.94~~	~~60.98~~
230	233	Some mang. at 230'; red sl.; bedding 22°; cleavage 50°	14.96	3.84	58.16	10.87	1.33	65.34	12.34	2.23	62.76
Average									12.86	2.33	62.17
233	235	Soft, pale red slate									
235	237	No core	19.40	4.49	51.74	14.42	4.43	58.84	14.74	4.43	58.39
237	240	Pale red sl.; cleavage 52°	10.19	2.96	63.84				10.19	2.96	63.84
240	242.7	Pale, red sl.; little core; mostly mang.									
242.7	244	Clay, most of core good mang.; bedding 30°	16.49	9.00	46.80	12.24	3.43	64.01	13.59	5.20	58.55
244	247	Soft clay	15.20	5.14	55.87				15.20	5.14	55.87
247	250	Pale red sl.; some mang.									
250	253	Red slate; cleavage 47°; bedding ± horizontal; some mang.(?)	11.24	3.43	61.53	11.84	3.11	63.31	11.65	3.21	62.76
253	256	Little core; all mang.	11.48	20.23	42.10	9.70	2.64	74.42	9.87	4.29	71.38
Average									12.57	4.13	61.63
256	258	Soft red sl. or clay									
258	262	Dk. red clay; some mang.	13.10	3.51	62.35	12.08	1.77	65.60	12.34	2.21	64.78
262	265	Soft red sl.; bedding 10°; cleavage 10° in opposite directions									
265	268	No core	9.65	2.34	66.15	12.81	2.17	64.15	12.14	2.21	64.58
268	271	Red clay	13.42	1.71	63.15				13.42	1.71	63.15
Average									12.48	2.11	64.37

(Continued)

Serial No. 44
Hole No. 3 (Cont'd.)
Collar Elevation: 1213.1'
Depth of Hole: 340'
Location: N.E. - S.W.

Aitkin County
Sec Ref 1072

Date completed: 10/6/50
Drilled by: U.S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Core Analyses Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
271	274	Soft, pale red to red slate	12.29	.95	67.69	9.99	.63	67.56	10.87	.87	66.58
274	277	Red clay	10.51	.95	65.54						
277	280	Soft, pale red slate	9.54	.89	65.06	10.51	1.10	67.02	9.84	1.34	65.51
280	283	Red slate	9.54	1.77	62.98						
283	286	Soft, pale red slate	9.86	.79	67.33	12.13	1.32	67.00	12.10	.82	65.18
286	289	Red slate, rather hard; bedding 30°; cleavage 30°	12.61	.24	62.44						
Average									10.94	1.01	65.76
289	295	Red slate; 2 good bands of mang.	10.51	4.83	63.10	10.91	2.82	69.11	10.80	3.36	67.49
295	298	Red slate; 1 good band of mang.									
298	301	Red slate; some mang.	10.19	1.40	68.67	11.96	2.44	69.36	11.49	2.16	69.17
301	304	Red slate; bedding 70°									
304	307	Pale red sl.	10.35	.77	64.63	11.88	1.64	65.55	11.25	1.28	65.17
307	310	Red slate; 2 bands mang.; cleavage vertical (?)									
310	313	Pale red sl.; some mang.	12.29	7.46	54.32	13.42	2.44	62.91	12.99	4.35	59.65
313	316	Pale red sl.; some mang.									
316	319	Red slate; some mang.	13.10	5.48	58.23	64.88	3.55	61.20	14.39	4.09	60.37
319	322	Pale red sl.; some ochre; bedding 70°; cleavage 15°									
322	325	Red slate	10.02	1.30	65.33	11.16	3.51	66.02	10.65	2.53	65.71
325	328	Darker red sl.									
328	331	Some mang.; red slate; bedding 30°; cleavage vertical (?)	12.29	1.41	62.33	13.98	2.25	64.25	13.52	2.02	63.72

(Continued)

Serial No. 44
Hole No. 3 (Cont'd.)
Collar Elevetion: 1213.1'
Depth of Hole: 340'
Location: N.E.- S.W.

Aitkin County
Sec Ref 1072

Date completed: 10/6/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Analyses: Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
331	333	Dk.red slate									
333	337	Dk.red slate; bedding 35°	6.30	4.45	62.97	14.71	3.80	60.00	12.39	3.98	60.82
337	340	Gray slate; some good mang.	11.48	1.50	62.24	14.63	3.64	60.30	13.81	3.08	60.80
340		Bottom of hole									
Average									12.28	2.98	63.82
175	340	Average for hole							12.15	2.53	63.17

Aitkin County
Sec Ref 1072

Serial No. 45
Hole No. 4
Collar Elevation: 1213.3'
Depth of Hole: 370'
Location: N.E.- S.W.

Date completed: 10/26/50
Drilled by: U. S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Analyses: Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
0	143	Surface material									
143	148	Iron form.; drilled with chopping bit				8.94	.39	48.30	8.94	.39	48.30
148	151	Reddish brown clay & slate									
151	154	Reddish brown clay & slate; bedding 35°	13.23	.20	52.56	16.21	.32	52.20	14.46	.25	52.41
154	157	Soft red sl.	12.58	.24	53.66				12.58	.24	53.66
Average									12.09	.30	51.21
157	160	Soft red-gray slate	15.40	1.45	47.72				15.40	1.45	47.72
160	163	Red & dk.gray to black sl. (some mang.?) bedding 45°	22.90	2.21	36.24				22.90	2.21	36.24
163	166	Dk.red slate; bedding 40°	22.26	3.62	36.48				22.26	3.62	36.48
166	169	Soft red sl.									
169	172	Dk.red slate	15.65	3.11	43.90				15.65	3.11	43.90
172	175	Dk.red slate	17.34	2.09	46.18	16.05	2.29	50.82	16.98	2.15	47.27
Average									18.14	2.61	42.62
175	178	Red slate; bedding 50°; some mang.	15.16	1.89	45.92				15.16	1.89	45.92
178	182	Red slate; bedding 45° at 180; 35° at 181									
182	187	Red slate with dark streaks; mang.?; rolling bedding at 183; 15° at 184	14.03	1.77	45.40				14.03	1.77	45.40
187	192	Red slate; bedding vertical at 33°	10.32	1.02	54.82				10.32	1.02	54.82
192	197	Red slate; bedding vertical at 199; wavey at 201, approx. 70°	15.81	1.65	45.76				15.81	1.65	45.76
197	202		16.61	2.29	42.04				16.61	2.29	42.04
202	207	Red slate	8.22	.59	56.26				8.22	.59	56.26

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 45
Hole No. 4 (Cont'd.)
Collar Elevation: 1213.3'
Depth of Hole: 370'
Location: N.E.- S.W.

Date completed: 10/26/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Analyses Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
Average									13.33	1.54	48.15
207	212	Red slate	14.03	4.96	47.56	12.84	2.52	51.08	13.42	3.72	49.36
212	217	Red slate; some mang.; rolling bedding	12.34	2.76	49.84				12.34	2.76	49.84
217	222	Red slate; bedding 15°; some mang.	11.94	1.49	54.10				11.94	1.49	54.10
222	227	Red slate	12.42	2.44	50.40				12.42	2.44	50.40
227	232	Red slate; quartz & mang.	9.68	2.29	68.60	9.63	2.29	66.46	9.64	2.29	66.93
Average									11.95	2.54	54.13
232	235	Red slate; some mang.	22.26	7.96	31.48	14.12	2.84	55.70	18.51	5.60	42.65
235	238	Broken red slate with thin bands of mang. (?)	21.57	6.38	34.80	20.70	6.07	36.34	21.23	6.26	35.39
238	241	Dk.red slate; some mang.									
241	244	Red slate; some mang.	29.14	6.70	28.48				29.14	6.70	28.48
244	247	Light red sl. 4" good mang.									
247	250	Light red sl. some good mang.	22.14	6.78	37.68	24.88	6.15	35.42	23.61	6.44	36.47
Average									24.21	6.36	34.66
250	253	Pink to light gray slate	9.12	2.44	56.24				9.12	2.44	56.24
253	257	Pink to light gray slate; some mang.	9.93	2.30	55.00				9.93	2.80	55.00
257	261	Same, changing to red at 260	12.37	1.30	53.98	12.20	1.53	55.80	12.30	1.40	54.72
261	265	Light red sl. vertical bedding	7.33	1.06	59.34				7.33	1.06	59.34
265	270	Light red & gray slates; folded bedding; axis of folds 10°	12.05	.55	58.88				12.05	.55	58.88
Average									10.29	1.56	56.97

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 45
Hole No. 4 (Cont'd.)
Collar Elevation: 1213.3'
Depth of Hole: 370'
Location: N.E.- S.W.

Date completed: 10/26/50
Drilled by: U. S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Analyses

Depth From	Depth To	Material	Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
270	275	Light red sl. some mang.	14.65	8.98	46.74				14.65	8.98	46.74
275	280	Red slate	11.56	2.13	52.48				11.56	2.13	52.48
280	285	Red slate	9.12	.90	54.40				9.12	.90	54.40
285	290	Red slate; some mang. in fissures	12.37	2.17	55.32				12.37	2.17	55.32
290	295	Red slate; some mang.				14.44	3.15	55.90	14.44	3.15	55.90
295	300	Gray slate; some good mang.	14.81	4.47	52.44	14.19	5.59	51.42	14.45	5.13	51.84
300	303	Gray slate; some good mang.									
303	306	Red slate; folded bedding; mang. between bedding planes	12.99	5.32	52.96	14.12	2.01	60.10	13.74	3.14	57.67
306	309	Red slate	9.91	.39	54.48				9.91	.39	54.48
Average									12.70	3.39	53.66
309	312	Red slate; some good mang.	15.51	10.44	39.90	11.55	4.89	55.92	13.98	8.30	46.08
312	315	Mostly broken-up mang.	13.80	21.12	33.50	15.25	9.65	50.10	14.95	12.00	46.70
315	318	Mostly broken-up mang.									
318	321	Red slate; bedding 30°	12.10	2.32	54.28	14.76	9.73	48.22	13.86	7.21	50.28
321	325	Light red slate	12.34	11.78	47.34				12.34	11.78	47.34
325	328	Red slate; cleavage vertical (?)	9.91	.12	52.50	10.11	1.26	63.14	9.91	.12	52.50
328	332	Red slate; 6" solid mang. & gray sl.	12.34	10.24	47.40	12.04	6.90	53.70	12.17	8.31	51.04
Average									12.94	8.04	49.18
332	335	Red slate									
335	338	Light red sl.; some good mang.	9.09	2.32	63.88				9.09	2.32	63.88
338	342	Red slate; good mang.	13.23	1.73	53.94				13.23	1.73	53.94

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 45
Hole No. 4 (Cont'd.)
Collar Elevation: 1213 3'
Depth of Hole: 370'
Location: N.E.- S.W.

Date completed: 10/26/50
Drilled by: U. S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth			Analyses								
			Core			Sludge			Adjusted Average		
From	To	Material	Iron	Mang.	SiO_2	Iron	Mang.	SiO_2	Iron	Mang.	SiO_2
342	345	Mostly broken mang.	11.21	11.17	49.12	9.23	4.11	60.50	9.67	5.98	57.97
345	348	Red slate; some mang.	10.39	9.81	45.44				10.39	9.81	45.44
348	352	Red slate; some mang; irregular bedding	9.42	5.20	51.40				9.42	5.20	51.40
352	356	Grey & red slate; some mang.	9.58	2.64	55.38				9.58	2.64	55.38
Average									10.15	4.15	55.68
356	360	Gray & black banded slate; vertical bedding at 35°	16.08	1.22	51.82				16.08	1.22	51.82
360	365	Gray slate banded with red slate; bedding 10°	17.21	.82	48.60				17.21	.82	48.60
365	370	Grey slate, wavy bedding at 65°	6.09	.24	62.00				6.09	.24	62.00
Average									12.92	.73	54.31
143	370	Average for hole							13.57	3.24	50.49

Aitkin County
Sec Ref 1072

Serial No. 46
Hole No. 5
Collar Elevation: 1214.0'
Depth of Hole: 349'
Location: N.E.- S.W.

Date completed: 11/4/50
Drilled by: U. S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Analyses

Depth From	Depth To	Material	Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
0	146										
146	150	Surface				13.92	4.73	49.28	13.92	4.73	49.28
150	155										
155	157	Carb.slate	15.14	5.83	29.34				15.14	5.83	29.34
157	160	Carb.slate	14.98	4.89	31.10	14.65	4.02	31.60	14.70	4.15	31.52
160	170	Carb.slate	18.56	7.21	24.50	12.54	1.33	36.28	13.26	2.04	34.87
170	175	Altered red slate & some carb. slate									
175	178	Red slate & light gray clay	11.74	6.30	30.54	10.58	3.66	33.80	10.88	4.33	32.97
178	181	Red to dk. red slate; bedding 35°	18.07	5.04	28.58				18.07	5.04	28.58
181	182	Gray slate									
182	185	Gray slate to 183, red slate 183 to 185	20.19	2.60	31.84	22.06	3.47	42.22	21.23	3.08	37.61
Average									14.44	3.55	33.40
185	189	Dk.red slate; bedding 18°; cleavage 70 to 90°(?)	16.20	.70	44.22	18.88	2.84	46.80	17.06	1.38	45.05
189	193	Dk.red slate; bedding 15°; cleavage vertical (?)	17.58	1.45	46.50				17.58	1.45	46.50
193	198	Dk.red slate; bedding 55°; cleavage vertical	18.72	1.81	44.04				18.72	1.81	44.04
198	203	Dk.red slate & clay	16.44	3.94	42.54	17.26	3.62	45.00	16.90	3.76	43.91
Average									17.59	2.18	44.77
203	206	Red slate; bedding 50°									
206	209	Red & light red slates; bedding 35°; cleavage vertical	13.70	.63	48.10				13.70	.63	48.10

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 46
Hole No. 5 (Cont'd.)
Collar Elevation: 1214.0'
Depth of Hole: 348'
Location: N.E.- S.W.

Date completed: 11/4/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Analyses: Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
209	213	Red slate & clay; a little mang.	15.49	3.70	42.60				15.49	3.70	42.60
213	218	Red slate; bedding 30°; bedding vertical	14.19	3.35	44.62				14.19	3.35	44.62
218	221	Red slate; bedding 20°	9.87	4.49	49.30				9.87	4.49	49.30
221	226	Light red slate	13.86	2.36	44.88	19.37	3.31	48.40	15.54	2.65	45.95
Average									14.02	2.70	46.09
226	231	Red slate; bedding 25°	12.39	1.53	52.02				12.39	1.53	52.02
231	236	Red slate	8.72	.90	57.48				8.72	.90	57.48
236	241	Red to light red slate; bedding 25°	9.95	1.10	54.92				9.95	1.10	54.92
Average									10.35	1.18	54.81
241	246	Light red sl.; bedding 33°	5.71	.59	59.90	15.71	5.08	47.62	9.47	2.28	55.28
246	250	Light red sl.	9.13	3.15	54.44				9.13	3.15	54.44
250	253	Light red sl.; some chert	15.49	6.34	45.20	15.47	6.07	49.40	15.47	6.13	48.42
253	256	Red slate; cleavage 35°									
256	259	Red slate; some mang.	8.81	.55	58.66	15.95	1.65	53.00	12.34	1.09	55.86
259	262	Red & light red bands of slate; some mang.	10.44	5.36	56.16				10.44	5.36	56.16
262	265	Red slate; some mang.; rumpled bedding	11.50	2.68	53.32	15.55	3.47	37.80	13.37	3.04	46.15
265	268	Light red to red slates; little mang.	12.07	2.29	54.64				12.07	2.29	54.64

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 46
Hole No. 5 (Cont'd.)
Collar Elevation: 1214.0'
Depth of Hole: 348'
Location: N.E.- S.W.

Date completed: 11/4/50
Drilled by: U. S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth			Analyses								
			Core			Sludge			Adjusted Average		
From	To	Material	Iron	Meng.	SiO_2	Iron	Meng.	SiO_2	Iron	Meng.	SiO_2
268	273	Red slates; bedding 40°	7.34	.12	60.46	15.38	4.06	52.70	13.68	3.23	54.34
273	279	Red slates; some mang.; bedding 38°	8.97	3.74	54.42	15.63	5.83	51.56	13.14	5.05	52.63
279	282	Red & light red slates; some mang.									
282	285	Red slate	6.85	4.73	52.10	11.31	5.67	55.52	8.81	5.14	53.60
285	289	Red slate; some mang.	11.42	4.45	50.26	10.58	4.69	56.44	11.34	4.47	50.86
289	293	Red slate	10.44	2.29	57.00				18.92	2.29	57.00
293	298	Red slate	18.92	8.27	41.50	11.88	3.55	54.86	12.70	4.10	53.31
298	304	Red slate	15.49	6.38	42.06	12.78	2.56	56.46	14.85	5.47	45.49
304	308	Red to light red slate; bedding; cleavage at 90° to bedding(?)	10.19	4.02	51.06				10.19	4.02	51.06
Average									12.34	3.80	52.68
308	313	Red slates	10.52	1.18	51.70				10.52	1.18	51.70
313	317	Banded red & gray slates; bedding 30°	10.44	.98	53.70				10.44	.98	53.70
317	322	Red slate	6.36	.78	61.66	10.91	1.26	56.48	10.00	1.16	57.52
322	325	Banded red & gray slates; bedding 35°	8.81	1.10	53.90				8.81	1.10	53.90
325	330	Banded red & gray slates; bedding 35°	11.58	1.18	50.40				11.58	1.18	50.40
330	335	Light red slate	9.79	6.38	47.24	17.58	8.39	40.92	15.98	7.98	42.22
335	338	Gray slate with red & black bands	13.86	1.45	48.70				13.86	1.45	48.70
Average									11.67	2.30	51.06

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 46
Hole No. 5 (Cont'd.)
Collar Elevation: 1214.0'
Depth of Hole: 348'
Location: N.E.- S.W.

Date completed: 11/4/50
Drilled by: U. S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth			Analyses								
			Core			Sludge			Adjusted Average		
From	To	Material	Iron	Mang.	SiO_2	Iron	Mang.	SiO_2	Iron	Mang.	SiO_2
338	343	Gray slate with red & black bands; bedding 30°	9.62	.66	53.62				9.62	.66	53.62
343	348	Same, bedding 30°; cleavage 55°	10.44	.66	53.26				10.44	.66	53.26
Average									10.03	.66	53.44
155	348	Average for hole							12.98	2.88	47.96

Serial No. 47
Hole No. 6
Collar Elevation: 1213.8'
Depth of Hole: 334'
Location; N.E. - S.W.

Aitkin County
Sec Ref 1072

Date completed: 11/16/50
Drilled by: U. S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Analyses: Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
0	138	Surface									
138	143	Iron form. (chopped sample)				15.93	2.92	53.48	15.93	2.92	53.48
143	148	Dk.red clay & soft slate; a few mang. nodules in clay	12.55	2.36	52.52	11.02	3.03	58.78	11.23	2.94	57.92
148	155	Soft dk.red clay & slate	14.80	2.13	48.84				14.80	2.13	48.84
155	160	Red slate; bedding 52 to 55°;cleavage 25° (?)	13.52	2.92	47.66				13.52	2.92	47.66
160	165	Dk.red slate	14.72	1.77	49.20				14.72	1.77	49.20
165	170	Dk.red slate	11.26	1.57	52.30				11.26	1.57	52.30
170	175	Dk.red slate	17.70	2.52	48.62				17.70	2.52	48.62
175	180	Dk.red slate & clay; bedding 60°	18.18	1.81	44.80	14.48	2.09	55.79	16.21	1.96	50.64
180	185	Dk.red slate; bands of chert 184 to 185	13.60	2.52	52.20				13.60	2.52	52.20
185	190	Dk.red slate; chert band at 185.5;chert slate contact 75°;bedding 65°;cleavage (?)50°,approx. right angles to bedding; bedding 60° at 188	16.89	2.68	50.22				16.89	2.68	50.22
Average									14.59	2.38	51.02
190	195	Dk.red slate chert (± 1') 194 to 195	18.18	17.81	30.00	12.55	8.98	55.20	14.07	11.36	48.40
195	200	Some red sl; considerable chert; some mang.	15.77	28.37	19.40	15.77	12.61	46.06	15.77	14.86	42.25
200	203	Some red sl.; considerable chert	12.71	7.88	60.80	7.56	3.55	67.64	8.44	4.29	66.47

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 47
Hole No. 6 (Cont'd.)
Collar Elevation: 1213.8'
Depth of Hole: 334'
Location: N.E. - S.W.

Date completed: 11/16/50
Drilled by: U. S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Analyses: Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
203	206	Red slate; some mang.; cleavage 20° (?)									
206	210	Red slate; some mang.	14.28	7.92	47.20				14.28	7.92	47.20
210	215	Red slate; some mang.	14.20	7.80	43.00	13.84	5.08	54.20	13.97	6.03	50.30
215	218	Red slate; bedding 25°	10.43	2.36	54.60				10.43	2.36	54.60
218	222	Red slate; some mang. & chert	18.46	13.67	34.80				18.46	13.67	34.80
222	227	Red slate; some mang. & chert	24.71	8.71	39.22	16.89	1.73	54.08	17.69	2.44	52.56
Average									14.54	8.20	48.66
227	230	Red clay									
230	234	Red to dark red slate; bedding 36°	19.58	.96	47.06				19.58	.96	47.06
234	239	Red slate & clay; cleavage 25°(?)	17.81	2.48	53.60	20.11	1.93	51.80	19.16	2.16	52.55
239	242	Red slate; considerable chert; some mang.(?)	12.76	6.86	63.46	17.22	6.70	55.40	16.13	6.74	57.37
242	249	Red slate; some chert	11.31	3.03	58.00				11.31	3.03	58.00
Average									16.38	2.68	53.19
249	254	Red slate; irregular bedding	11.23	.76	53.34				11.23	.76	53.34
254	259	Red slate	18.37	.53	55.32	11.58	.39	58.88	13.41	.43	60.75
259	263	Red slate	11.39	.21	64.24				11.39	.21	64.24
263	268	Red slate; cleavage 43° (?)	12.32	.15	64.24				12.32	.15	64.24
Average									12.12	.40	60.45
268	273	Red slate & clay; a little gray slate	14.32	3.70	53.18				14.32	3.70	53.18

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 47
Hole No. 6 (Cont'd.)
Collar Elevation: 1213.8'
Depth of Hole: 334'
Location: N.E. - S.W.

Date completed: 11/16/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Analyses: Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
273	278	Red & gray slates; bedding 50°; cleavage 30° approx.right angles to bedding	8.00	.96	58.84	11.26	1.77	58.40	9.95	1.45	58.58
278	281	Red & gray slates; irregular bedding;some red clay									
281	285	Red & gray slates;folded bedding;axis of folds 38°	9.36	2.17	60.64				9.36	2.17	60.64
285	290	Red & gray slates	6.88	5.99	53.36	8.53	5.16	55.92	8.30	5.28	55.56
290	294	Gray slate with iron bands;bedding 28° at 290	8.24	2.13	53.36				8.24	2.13	53.36
294	299	Dk.gray slate; bedding 65°; cleavage 22°; some soft mang. (?)	6.64	4.14	61.50				6.64	4.14	61.50
Average									9.50	3.11	57.48
299	304	Banded red & gray slates; bedding 35°	6.40	.24	61.84				6.40	.24	61.84
304	309	Dk.gray slate; cleavage(?)45°; few iron stains	7.36	.37	59.50				7.36	.37	59.50
309	314	Gray slate, some red slate; gray slate highly fractured at 309'; quartz filling in fractures; bedding 35° at 311;cleavage (?) 46°	7.37	.56	61.22				7.37	.56	61.22

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 47
Hole No. 6 (Cont'd.)
Collar Elevation: 1213.8'
Depth of Hole: 334'
Location: N.E. - S.W.

Date completed: 11/16/50
Drilled by: U.S. Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Core Analyses Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
314	319	Gray slate; bedding 50°	8.00	.15	59.56				8.00	.15	59.56
319	324	Gray slate; some iron bands; bedding 45°; vertical band of iron 1/2 inch wise 320 to 322	10.08	.12	57.64				10.08	.12	57.64
324	329	Grey slate; some iron bands; bedding 15°	6.40	.09	62.10				6.40	.09	62.10
329	334	Grey slate; few iron bands; cleavage (?) 30°	7.36	.18	61.32				7.36	.18	61.32
334		Bottom of hole									
Average									7.57	.24	60.45
138	334	Average for hole							12.48	3.05	54.44

Aitkin County
Sec Ref 1072

Serial No. 48
Hole No. 7
Collar Elevation: 1214.3'
Depth of Hole: 392'
Location: N.E. - N.E.

Date completed: 12/2/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth			Analyses								
			Core			Sludge			Adjusted Average		
From	To	Material	Iron	Mang.	SiO_2	Iron	Mang.	SiO_2	Iron	Mang.	SiO_2
0	140	Surface									
140	145					12.36	1.41	55.02	12.36	1.41	55.02
145	151		11.84	.33		10.83	1.14	60.00	11.02	.98	
151	154	Red Slate	12.48	.45		13.80	1.53	54.40	13.30	1.12	
154	157	Red-Light Red Slate	13.92	.76					13.92	.76	
Average									12.33	1.09	
157	160	Red-Light Red Slate.Bedding 50°	25.28	2.36					25.28	2.36	
160	163	Red Slate. Bedding 55° Cleavage 35° Same direction	14.24	1.12		18.13	2.25	50.20	14.63	1.03	
163	166	Red Slate. Cleavage(?) 40°									
166	169	Lt.Red Slate Folded Bedding. Axis of folds 35°	10.80	1.52					10.80	1.52	
169	173	Lt.Red Slate	14.72	.15		17.92	.49	51.00	17.14	.41	
173	176	Pink Slate	4.72	.06		14.88	.51	56.28	12.91	.42	
176	179	Pink-Lt.Red Slate.Bedding 40°	11.76	.68		11.20	1.22	60.60	11.55	.88	
179	182	Lt.Red Slate Bedding 52°	13.36	1.04		13.44	2.13	58.70	13.40	1.53	
182	185	Lt.Red Slate Bedding 25° at 153. Bedding 70° at 154.Cleavage along bedding.	16.61	3.15					16.61	3.15	
185	190	Red Slate. Bedding 45° at 186. Bedding 25° at 188.Cleavage (?) 60°	9.60	.37					9.60	.37	
190	195	Red Slate	20.56	1.77					20.56	1.77	
195	200	Red Slate. Bedding 30°	8.56	.68		15.60	1.10	58.40	13.66	.98	
200	205	Red Slate.	13.76	.80		13.44	.76	62.20	13.51	.77	

(Continued)

Serial No. 48
Hole No. 7 (Cont'd.)
Collar Elevation:
Depth of Hole: 392'
Location: N.E. - N.E.

Aitkin County
Sec Ref 1072

Date completed: 12/2/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
205	208	Red slate. Bedding 20°. Cleavage 50°.	14.72	.84					14.72	.84	
Average									14.63	1.19	
208	213	Lt.red slate. Bedding 60°.	17.84	.30		13.60	5.79	55.90	14.60	4.50	
213	216	Red slate. Bedding 50°.	9.12	4.57					9.12	4.57	
216	221	Lt.red slate.	9.92	4.61		14.32	6.03	51.90	13.38	5.72	
221	224	Red slate.Some good mang.	9.52	5.16		14.24	4.89	53.30	13.01	4.96	
224	227	Red slate.	10.08	6.19		8.48	4.41	61.30	8.91	4.89	
227	230	Red slate. Bedding 48°.									
230	235	Red slate. Bedding 50°.	10.40	.53					10.40	.53	
235	240	Red slate. One small piece of mang. oxide.Bedding 45°.	10.48	.37		11.68	3.07	61.20	11.11	1.78	
240	245	Red slate.A little chert. Some mang. oxide,Bedding 35°.	14.64	3.31		20.96	4.53	51.28	19.18	4.19	
Average									16.64	3.47	
245	250	Red slate. Bedding 50°.	9.92	.06					9.92	.06	
250	255	Red slate. 6" of solid chert or qtz.	10.24	.80		16.96	.90	63.80	15.88	.88	
255	258	Red slate. Bedding 48°.	13.36	6.62					13.36	6.62	
258	263	Red slate. Bedding 48°.	21.28	1.30		17.12	1.41	59.26	18.38	1.38	
263	268	Red slate. Bedding 48°.	16.96	.18					16.96	.18	
268	273	Red slate. Bedding 53°. Cleavage 27°.	8.72	.12					8.72	.12	
Average									13.91	1.18	

(Continued)

Aitkin County
Sec Ref 1072

Serial No. 48
Hole No. 7 (Cont'd.)
Collar Elevation:
Depth of Hole: 392'
Location: N.E. - N.E.

Date completed: 12/2/50
Drilled by: U.S.Bureau of Mines
Logged by: W.A.Grosh
Type of Drilling:Diamond drill-Core

Depth From	Depth To	Material	Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
273	278	Red slate. Some chert & mang. oxide. Bedding 50°. Cleavage(?) 25°.	12.00	2.92					12.00	2.92	
278	283	Red & gray slate.	15.76	.68		21.28	3.03	53.26	20.15	2.55	
283	285	Chert.	6.72	4.26					6.72	4.26	
285	290	Red slate. Some chert, little mang. oxide. Chert slate contact 10°.(almost vertical)	22.24	10.32		21.60	3.07	54.04	21.76	4.93	
290	295	Red slate.	23.52	12.61		22.40	3.66	48.22	22.48	4.30	
295	298	Red slate.	20.40	2.72		21.12	2.52	51.08	20.73	2.63	
298	301	Red slate. Bedding 48°.	15.68	2.13		18.72	2.29	58.64	17.08	2.20	
Average									18.17	3.45	
301	304	Red slate. Irregular bedding.	24.40	1.49					24.40	1.49	
304	307	Red slate. Bedding 50°. Cleavage 30°.	16.24	2.01					16.24	2.01	
307	312	Red slate. 6" chert at 312.	14.40	1.65		20.08	1.89	55.60	18.04	1.80	
312	317	Red & gray slates.	10.40	2.36		16.96	1.53	59.72	15.86	1.67	
317	320	Red slate. Some chert. Bedding 40°.	24.16	1.06					24.16	1.06	
320	325	Gray slate. Bedding 45°.	10.40	2.13		15.04	1.14	67.28	14.40	1.28	
Average									18.16	1.56	
325	330	Red slate. Bedding 65°.	22.40	.68					22.40	.68	
330	335	Red slate. Bedding 45°.	19.84	1.33		15.84	.70	64.28	17.80	1.01	
335	340	Red slate. Bedding 45°.	23.28	1.41					23.28	1.41	
340	345	Red slate. Bedding 20°.	19.92	.45		26.24	.45	47.46	24.78	.45	

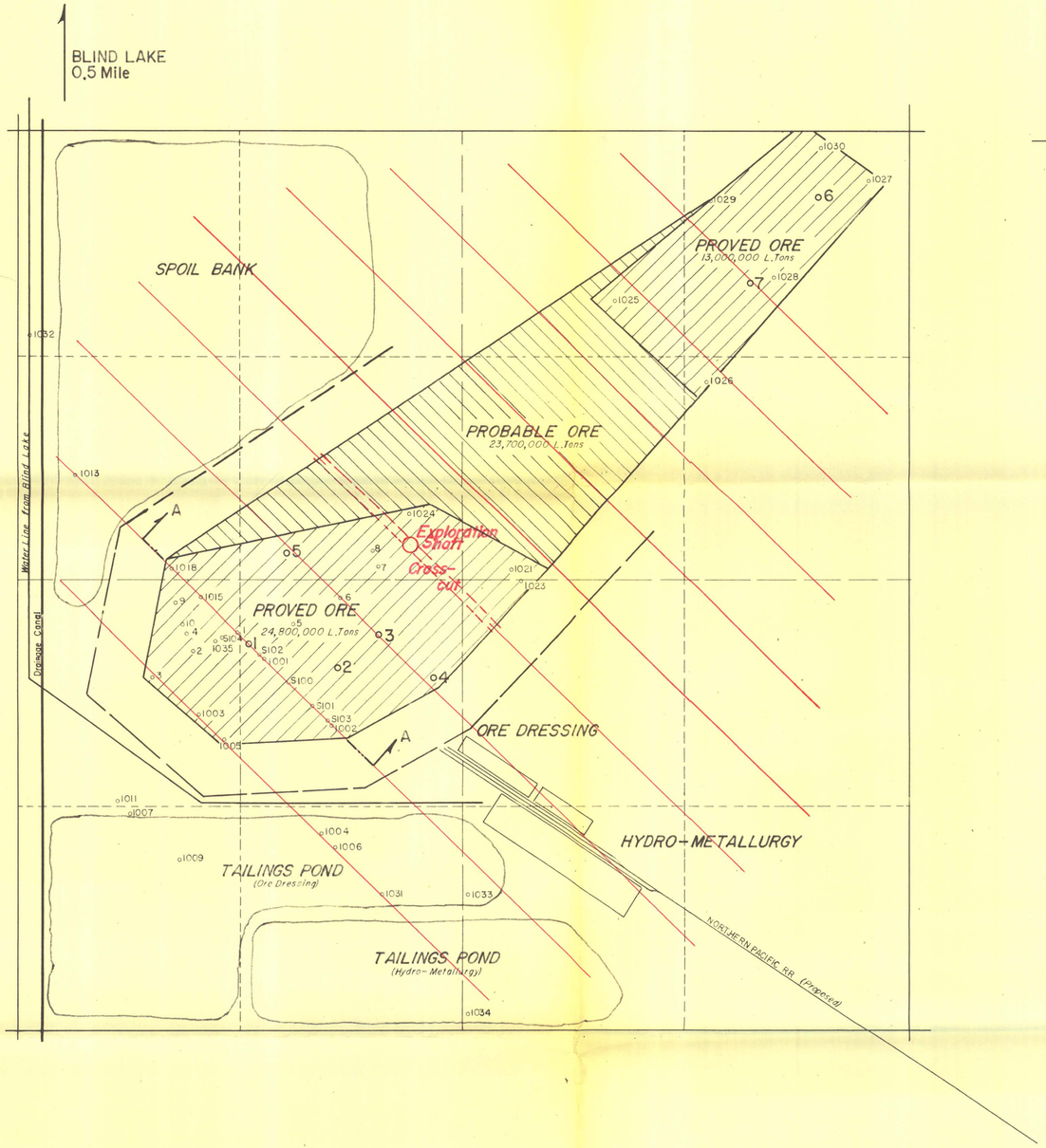
(Continued)

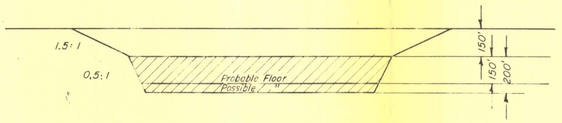
Serial No. 48
Hole No. 7 (Cont'd.)
Collar Elevation:
Depth of Hole: 392'
Location: N.E. - N.E.

Aitkin County
Sec Ref 1072

Date completed: 12/2/50
Drilled by: U.S.Bureau of Mines
Logged by: W. A. Grosh
Type of Drilling: Diamond drill-Core

Depth From	Depth To	Material	Analyses Core Iron	Core Mang.	Core SiO_2	Sludge Iron	Sludge Mang.	Sludge SiO_2	Adjusted Average Iron	Adjusted Average Mang.	Adjusted Average SiO_2
345	350	Red slate. Some chert at 350. Bedding 45°.	19.20	1.06					19.20	1.06	
350	355	Red slate. Bedding 35°.	16.64	1.02		16.32	.30	60.86	16.46	.61	
355	358	Red slate. Bedding 35°.									
358	360	Gray slate. Some red slate chert. Bedding 35°.	14.72	1.18					14.72	1.18	
360	362	Red slate. Bedding 40°.	20.32	.45		16.00	.53	60.42	17.11	.51	
362	366	Red slate. Some gray slate at 365. Bedding red slate 35°. Gray slate 25°.	14.48	.60					14.48	.60	
Average											
366	367	Dk.red slate & chert.							19.15	.86	
367	372	Red slate. Bedding 45°.	14.64	1.37					14.64	1.37	
372	377	Red slate. Some chert.	22.24	.76		17.92	1.06	60.80	19.06	.98	
377	382	Red slate. Folded bedding. Axis of folds 5°.	25.92	2.13		18.72	1.61	57.02	21.14	1.78	
382	387	Red slate. Some chert. Gray slate at 385'. Bedding 50°.	18.56	1.45					18.56	1.45	
387	392	Red & gray slates. Some chert. Bedding 45°. Cleavage 20°.	16.48	1.30					16.48	1.30	
Average											
									17.85	1.38	
140	392	Average for hole							16.55	1.77	





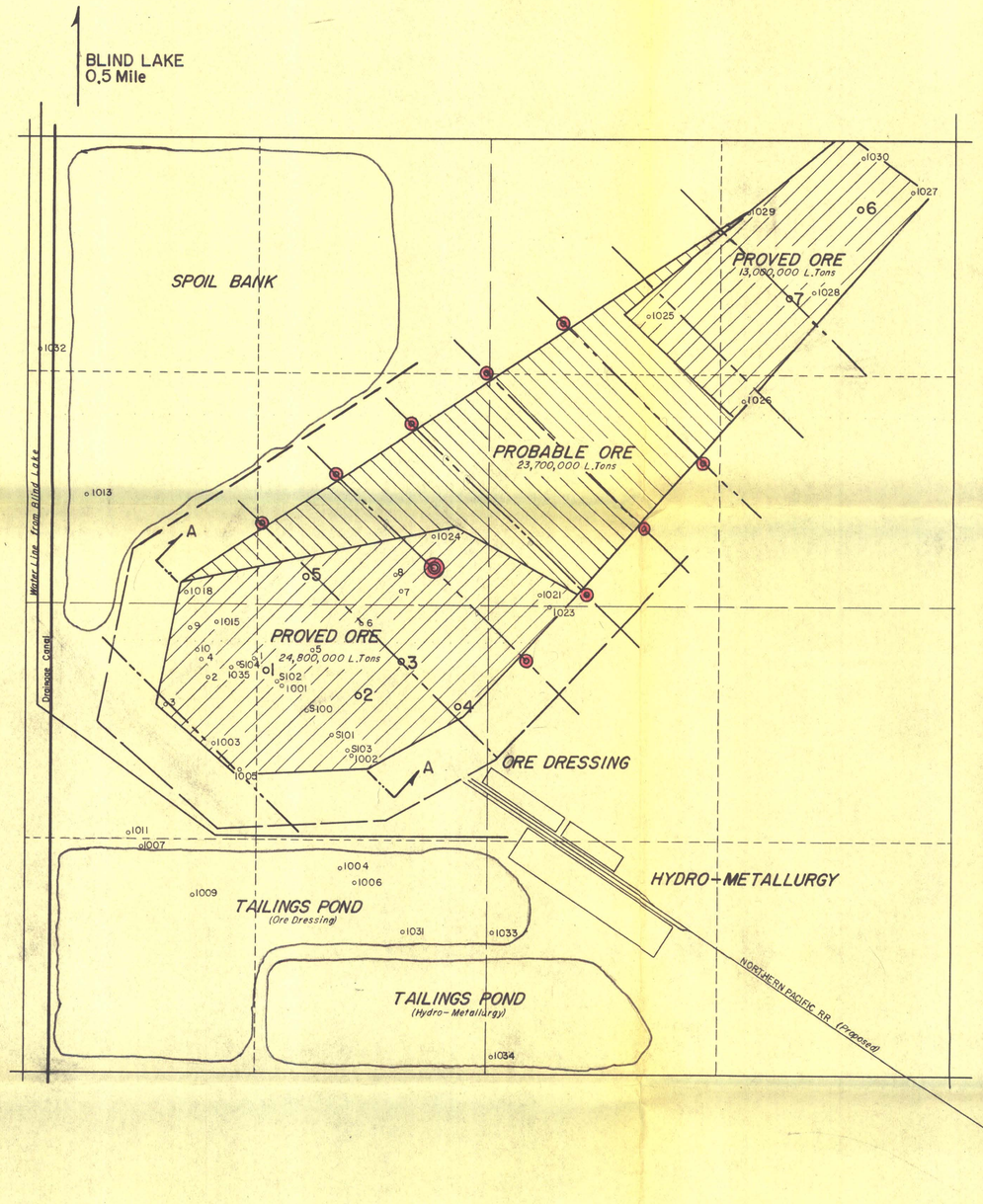
Sec. A-A

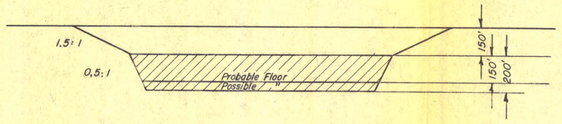
Legend

- ○ 1, etc. Churn drill holes by Crosby Exploration Co.
- ○ 1001, etc. " " " " " " "
- ○ S100, etc. " " " " M. A. Hanna Coal & Ore Co.
- O 1, etc. Diamond core-drill holes by U. S. B. M.

Red lines indicate proposed drilling sections

PROPOSED MANGANESE MINE Sec-23 T-48N R-27W Aitkin Co., Minn.	
Scale: 1" = 400'	Date 28 May 1951
	E 2





Sec. A-A

Legend

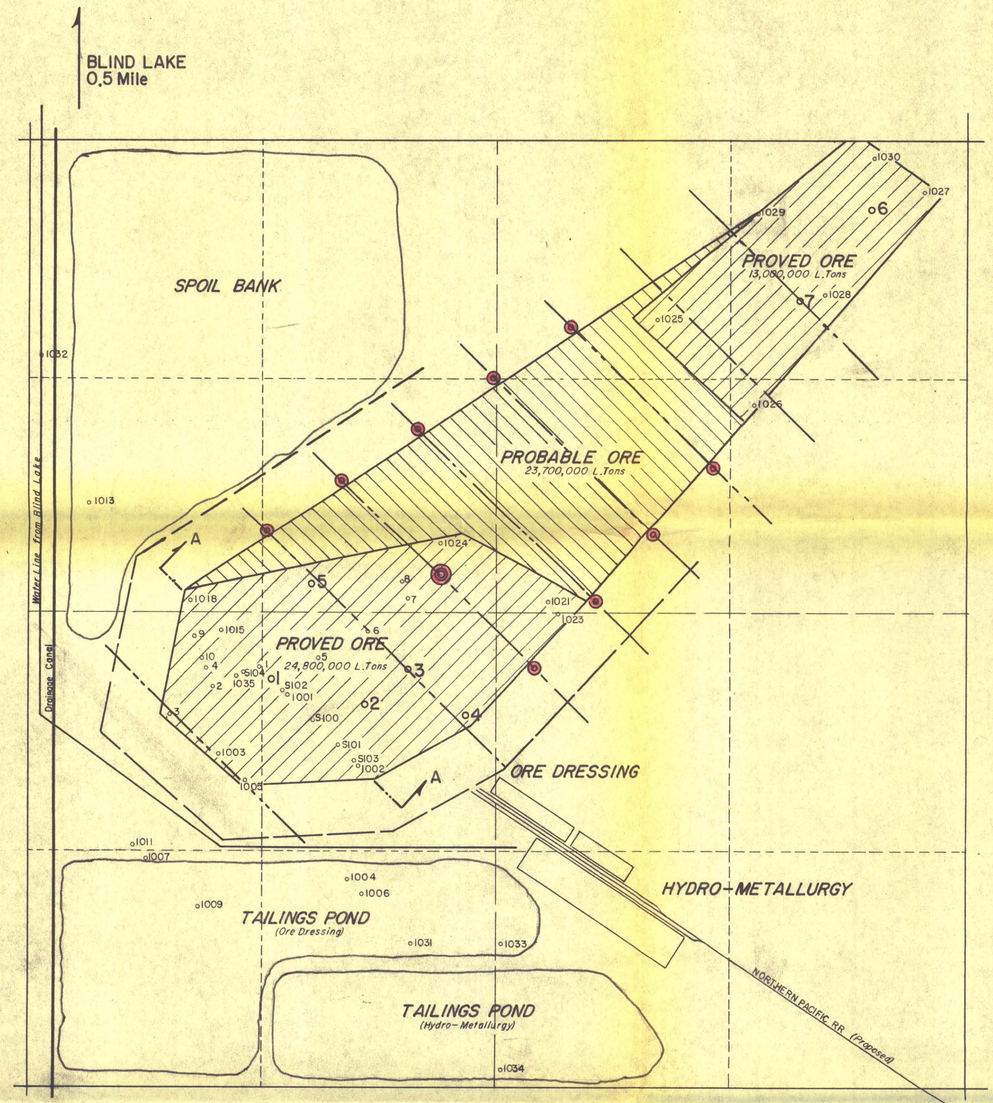
- o 1, etc. — Churn drill holes by M.P. Botsford
- o 1001, etc. — " " " " Crosby Exploration Co.
- o S100, etc. — " " " " M. A. Hanna Coal & Ore Co.
- O 1, etc. — Diamond core-drill holes by U. S. B. M.
- *Proposed drill holes*
- *Proposed exploration shaft*

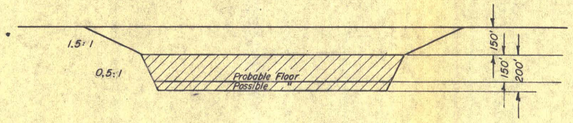
Revised map to accompany Exploration application.

THE UTAH CONSTRUCTION COMPANY
and ASSOCIATES

PROPOSED MANGANESE MINE
Sec-23 T-48N R-27W
Aitkin Co., Minn.

Scale: 1" = 400'
Date 28 May 1951
Drawn by C.T.E.B.
E 2





Sec. A-A

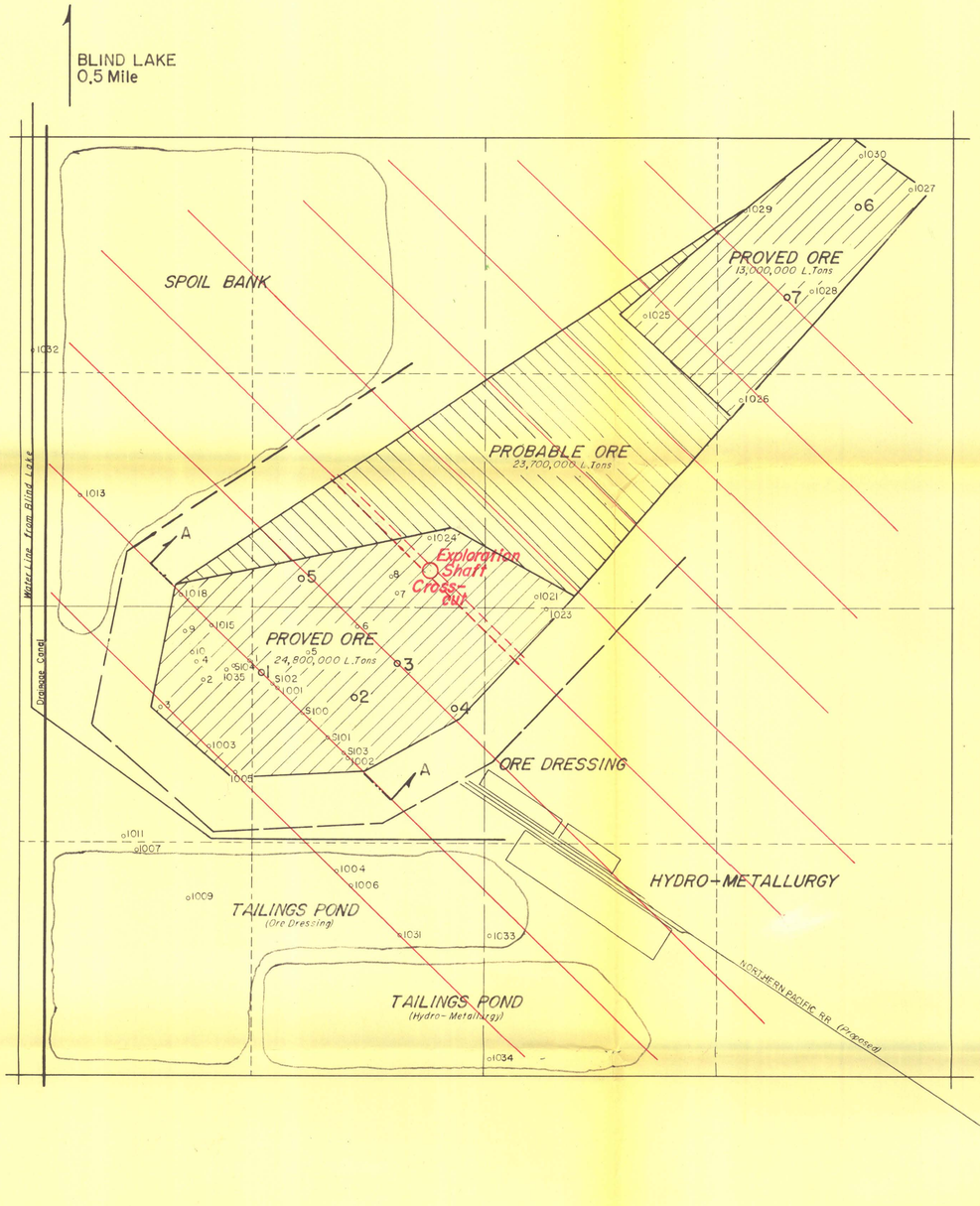
Legend

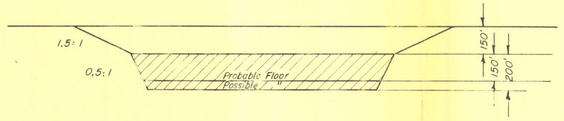
- o 1, etc. — Churn drill holes by M.P. Botsford
- o 1001, etc. — " " " " Crosby Exploration Co.
- o S100, etc. — " " " " M. A. Hanna Coal & Ore Co.
- O 1, etc. — Diamond core-drill holes by U. S. B. M.
- *Proposed drill holes*
- *Proposed exploration shaft*

THE UTAH CONSTRUCTION COMPANY
and ASSOCIATES

PROPOSED MANGANESE MINE
Sec-23 T-48N R-27W
Aitkin Co., Minn.

Scale: 1" = 400'
Date 28 May 1951
Drawn by C.T.E.B.
E 2





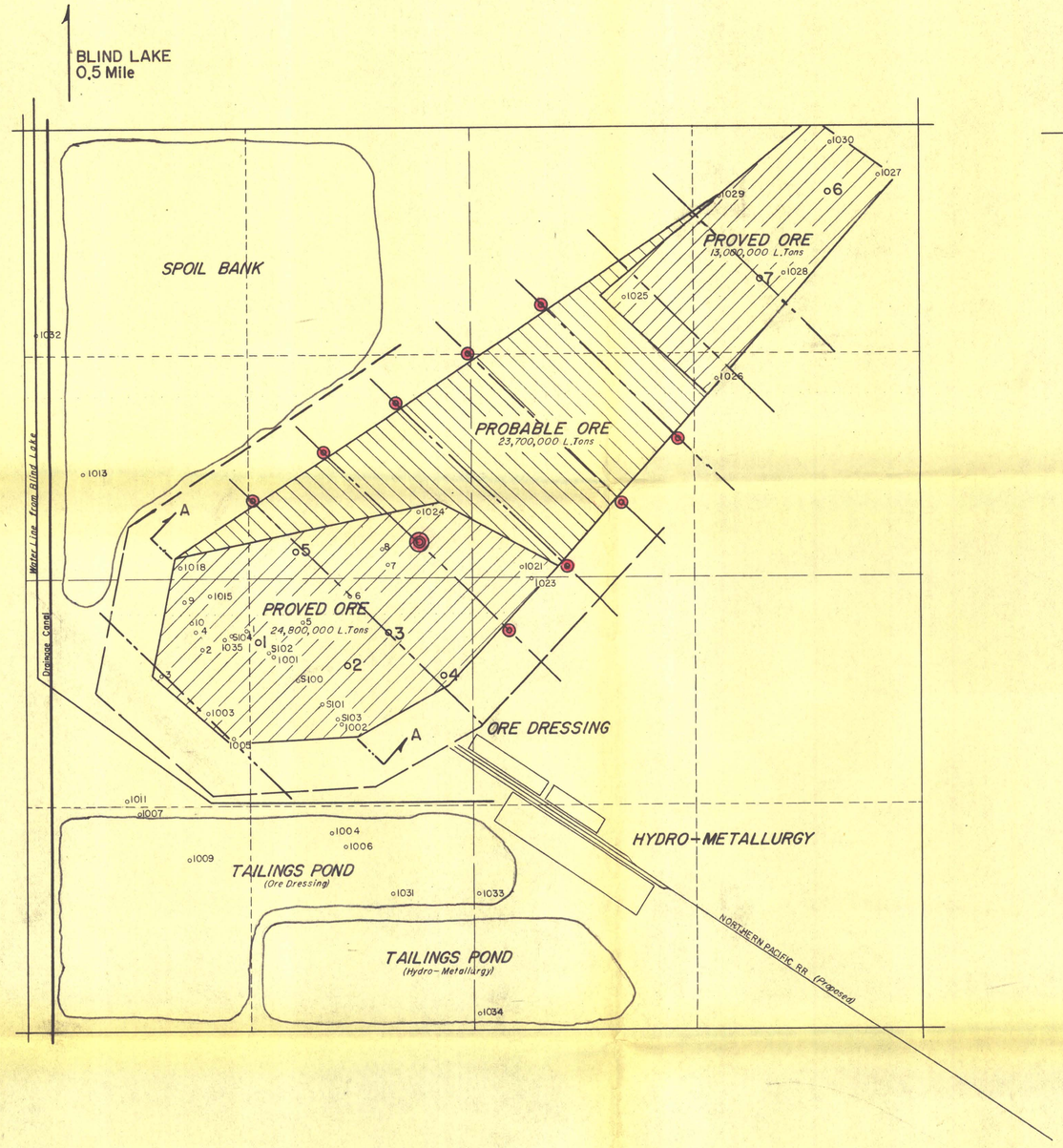
Sec. A-A

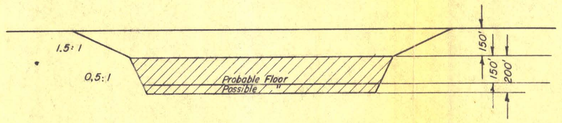
Legend

- o 1, etc. — Churn drill holes by Crosby Exploration Co.
- o 1001, etc. — " " " " " " "
- o S100, etc. — " " " " M. A. Hanna Coal & Ore Co.
- O 1, etc. — Diamond core-drill holes by U. S. B. M.

Red lines indicate proposed drilling sections

PROPOSED MANGANESE MINE Sec-23 T-48N R-27W Aitkin Co., Minn.	
Scale: 1" = 400'	Date 28 May 1951
	E 2





Sec. A-A

Legend

o 1, etc.	Churn drill holes by M.P. Botsford
o 1001, etc.	" " " " Crosby Exploration Co.
o S100, etc.	" " " " M. A. Hanna Coal & Ore Co.
O 1, etc.	Diamond core-drill holes by U. S. B. M.
◎	*Proposed drill holes*
◎	*Proposed exploration shaft*

THE UTAH CONSTRUCTION COMPANY
and ASSOCIATES

PROPOSED MANGANESE MINE
Sec-23 T-48N R-27W
Aitkin Co., Minn.

Scale: 1" = 400'

Date *28 May 1951*

Drawn by C.T.E.B.

E 2

SEC. 23-48-27

EXPLORATION REPORT

NE-SW - - D.H. S-100 - - Vertical Structure
200' SE of DH 1001 on Sec. D - Elev. 1216.3

FROM	TO	MATERIAL	IRON	PHOS.	MANG.	SILC.
			CRUDE ORE			
0	149	Surface				
149	170	Mn. Form	17.61	.062	5.20	43.34
170	195	"	13.23	.115	1.75	52.27
195	200	"	10.94	.295	1.93	64.26
200	205	"	12.55	.076	7.25	58.59
205	210	"	8.53	.056	4.96	62.44
210	215	"	17.70	.069	3.47	54.68
215	220	"	15.28	.128	3.25	55.83
220	225	"	13.03	.096	6.34	53.64
225	230	"	12.71	.060	1.93	61.72
230	235	"	15.12	.105	4.65	56.94
235	240	"	14.96	.100	2.94	55.49
240	245	"	12.55	.074	2.76	62.19
245	250	"	12.39	.071	2.13	62.70
250	255	"	11.91	.046	2.30	59.80
255	260	"	12.71	.062	3.15	60.63
260	265	"	14.48	.072	4.73	58.15
265	270	"	12.80	.066	3.90	57.78
270	275	"	16.64	.082	7.15	50.36
275	280	"	12.48	.090	5.14	56.67
280	285	"	14.03	.065	5.38	56.14
285	290	"	10.67	.078	3.55	64.21
290	295	"	11.32	.077	3.37	64.90
295	300	"	13.10	.071	7.13	56.80
300	305	"	12.45	.140	1.85	61.95
305	310	"	13.58	.084	3.39	59.39
310	315	"	12.26	.108	3.61	58.77

Hole started 5-25-49
Hole finished 6-17-49

NE-SW - - D.H. S-101 - - Vertical Structure
200' SE of DH S-100 on Sec. D - Elev. 1215.6

FROM	TO	MATERIAL	IRON	PHOS.	MANG.	SILC.
			CRUDE ORE			
0	133	Surface				
133	140	Formation	23.33	.085	3.19	35.34
140	145	"	22.44	.086	2.21	39.28
145	150	"	19.46	.134	1.99	42.55
150	155	"	21.73	.085	2.86	38.74
155	160	"	18.33	.052	1.73	45.05
160	165	"	20.76	.048	3.15	40.32
165	170	"	24.85	.084	4.10	34.97
170	175	"	19.16	.065	3.39	46.56
175	180	"	16.75	.074	2.66	57.28
180	185	"	17.50	.070	2.30	56.28
185	190	"	14.90	.065	1.83	60.58
190	195	"	16.36	.068	.87	62.96
195	200	"	12.15	.084	1.68	63.56
200	205	"	13.12	.070	.53	67.76
205	210	"	15.72	.097	.32	66.10
210	215	"	17.14	.084	8.32	51.74
215	220	"	13.74	.073	2.50	63.64
220	225	"	13.74	.122	2.56	63.92
225	230	"	16.33	.063	3.49	60.10
230	235	"	11.96	.082	3.49	65.92
235	240	"	12.61	.062	2.74	66.54
240	245	"	15.02	.057	4.49	61.08
245	250	"	12.27	.052	2.25	68.10
250	255	"	18.98	.070	3.31	55.92
255	260	"	13.24	.077	3.11	64.52
260	265	"	13.57	.052	4.26	63.12
265	270	"	13.24	.054	3.94	64.20
270	275	"	13.57	.078	2.84	64.84
275	280	"	12.11	.051	3.98	66.54
280	285	"	10.98	.126	1.49	71.00
285	290	"	12.76	.120	3.15	65.80
290	295	"	11.80	.118	2.52	69.20
295	300	"	15.20	.128	4.77	60.66
300	305	"	11.80	.096	2.32	69.02
305	310	"	15.84	.186	3.07	62.48
310	315	"	13.58	.100	3.80	64.26
315	320	"	12.94	.094	3.59	62.60
320	325	"	18.92	.102	4.51	55.42

Hole started 6-17-49
Hole finished 7-19-49

NE-SW - - D.H. S-102 - - Vertical Structure
223' NW of DH S-100 on Sec. D - Elev. 1215.8

FROM	TO	MATERIAL	IRON	PHOS.	MANG.	SILC.
			CRUDE ORE			
0	125	Surface				
125	151	"				
151	155	Formation	10.99	.088	1.10	69.56
155	160	"	21.18	.045	2.90	49.40
160	165	"	15.84	.057	1.73	58.46
165	170	"	23.44	.044	4.10	45.08
170	175	"	23.90	.041	2.88	47.08
175	180	"	20.19	.048	2.76	52.52
180	185	"	20.03	.048	2.48	53.72
185	190	"	20.03	.046	3.35	51.20
190	195	"	15.83	.050	4.22	55.32
195	200	"	15.18	.036	2.80	58.34
200	205	"	15.34	.048	2.99	56.56
205	210	"	15.34	.040	1.89	61.82
210	215	"	11.30	.063	2.13	67.64
215	220	"	15.67	.102	1.81	62.08
220	225	"	12.60	.067	2.40	66.76
225	230	"	14.86	.063	5.79	57.96
230	235	"	16.96	.075	4.53	57.40
235	240	"	15.34	.066	4.93	58.82
240	245	"	14.39	.202	2.48	64.60
245	250	"	13.42	.065	3.55	63.80
250	255	"	12.45	.139	2.36	68.18
255	260	"	11.32	.083	2.68	68.66
260	265	"	14.79	.070	5.95	60.06
265	270	"	16.01	.119	5.14	58.92
270	275	"	13.74	.244	4.20	61.12
275	280	"	13.24	.069	4.83	61.14
280	285	"	14.05	.085	4.98	62.08
285	290	"	13.40	.092	4.87	62.66
290	295	"	10.17	.065	.93	72.58
295	300	"	12.92	.122	3.43	66.[illegible]
300	305	"	12.92	.085	4.87	62.[illegible]
305	310	"	14.00	.079	6.36	[illegible].06
310	315	"	9.33	.128	6.93	57.[illegible]
315	320	D. D.	15.84	.090	9.58	[illegible]
320	325	"	15.61	.086	5.59	[illegible]

Hole started 6-25-49
Hole finished 7-23-49

NE-SW - - D.H. S-103 - - Verticle Structure
127' SE of DH S-101 on Sec. D - Elev. 1215.8

FROM	TO	MATERIAL	IRON	PHOS.	MANG.	SILC.
			CRUDE ORE			
0	146	Surface				
146	150	Formation	25.12	.043	2.94	43.26
150	155	"	22.47	.039	6.86	39.92
155	160	"	21.83	.045	5.32	44.84
160	165	"	12.36	.040	1.60	66.80
165	170	"	18.94	.059	4.33	48.42
170	175	"	16.69	.092	3.55	[illegible].18
175	180	"	13.96	.110	2.36	[illegible].19
180	185	"	15.57	.114	1.40	56.22
185	190	"	17.01	.069	1.34	51.58
190	195	"	13.32	.065	1.48	63.20
195	200	"	14.44	.041	3.51	70.36
200	205	"	10.43	.132	1.69	71.74
205	210	"	13.64	.152	.99	66.14
210	215	"	11.23	.075	.22	72.36
215	220	"	15.20	.109	1.41	64.12
220	225	"	9.21	.061	.35	70.79
225	230	"	16.65	.160	1.77	61.43
230	235	"	17.14	.103	3.82	58.03
235	240	"	14.71	.111	2.44	61.04
240	245	"	12.45	.052	1.38	66.19
245	249	"	11.56	.040	3.45	64.90
249	254	D. D.	12.53	.084	1.18	67.55
254	259	"	19.40	.150	2.32	56.62
259	264	"	13.10	.110	.99	63.72
264	269	"	12.94	.118	1.18	65.40
269	275	Formation	10.50	.123	1.53	64.80
275	280	"	10.50	.091	2.64	65.98
280	285	"	11.46	.105	3.55	64.00
285	290	"	10.58	.108	3.66	63.82
290	295	"	15.34	.092	8.67	51.33
295	300	"	16.80	.167	6.15	51.30
300	305	"	11.63	.094	5.63	57.91
305	310	"	7.18	.061	.53	75.30
310	315	"	7.50	.065	.35	77.06
315	320	"	8.32	.039	.59	77.02
320	325	"	12.56	.092	7.52	60.32

Hole started 7-22-49
Hole finished 8-15-49

NE-SW - D.H. S-104 - Verticle Structure - 25' E
of DH 1035 on line between 1035 & 1 - Elev. 1215.0

FROM	TO	MATERIAL	IRON	PHOS.	MANG.	SILC.
			CRUDE ORE			
0	148	Surface				
148	155	Formation	6.63	.041	1.33	77.07
155	160	"	16.17	.062	2.05	49.66
160	165	"	17.30	.056	.47	50.91
165	170	"	20.37	.081	1.40	45.85
170	175	"	21.42	.060	4.20	40.62
175	180	"	19.89	.058	3.98	42.69
180	185	"	17.46	.078	3.59	45.64
185	190	"	16.98	.081	7.39	39.04
190	195	"	20.05	.084	8.53	37.42
195	200	"	19.24	.120	5.87	44.60
200	205	"	18.43	.088	10.58	41.35
205	210	"	20.37	.106	6.32	39.48
210	215	"	20.21	.094	8.82	36.35
215	220	"	15.68	.078	5.22	46.69
220	225	"	21.67	.105	12.76	34.11
225	230	"	15.20	.079	9.73	51.29
230	235	"	13.10	.111	11.23	42.52
235	240	"	15.83	.089	9.69	41.56
240	245	"	17.12	.055	5.71	46.86
245	250	"	13.40	.065	.66	60.08
250	255	"	11.79	.057	1.57	63.75
255	260	"	10.34	.052	4.18	64.49
260	265	"	11.95	.085	10.13	54.72
265	270	"	13.86	.058	6.66	58.24
270	275	"	8.64	.080	4.16	70.10
275	280	"	9.46	.042	5.32	67.18
280	285	"	7.09	.082	1.68	76.60
285	290	"	8.97	.066	2.68	71.34
290	295	"	13.46	.062	3.35	60.75
295	300	"	7.78	.038	.35	70.95
300	305	"	13.79	.039	.39	61.66
305	310	"	13.79	.043	1.77	64.04
310	315	"	9.24	.083	1.52	67.49
315	320	D. D.	8.43	.102	.39	74.66
320	325	D. D.	11.35	.053	.39	74.52

Hole started 7-29-49
Hole finished 8-18-49

NOTE: D. D. Analysis are of sludge only.

FINAL

HANNA COAL & ORE CORPORATION
Crosby, Minn.
AS OF 8-25-49

SEC. 23-48-27

EXPLORATION REPORT

NE-SW - - D.H. S-100 - - Vertical Structure
200' SE of DH 1001 on Sec. D - Elev. 1216.3

FROM	TO	MATERIAL	CRUDE ORE IRON	PHOS.	MANG.	SILC.
0	149	Surface				
149	170	Mn. Form	17.61	.062	5.20	43.34
170	195	"	13.23	.115	1.75	52.27
195	200	"	10.94	.295	1.93	64.26
200	205	"	12.55	.076	7.25	58.59
205	210	"	8.53	.056	4.96	62.44
210	215	"	17.70	.069	3.47	54.68
215	220	"	15.28	.128	3.25	55.83
220	225	"	13.03	.096	6.34	53.64
225	230	"	12.71	.060	1.93	61.72
230	235	"	15.12	.105	4.65	56.94
235	240	"	14.96	.100	2.94	55.49
240	245	"	12.55	.074	2.76	62.19
245	250	"	12.39	.071	2.23	62.70
250	255	"	11.91	.046	2.30	59.80
255	260	"	12.71	.062	3.15	60.63
260	265	"	14.48	.072	4.73	58.15
265	270	"	12.80	.066	3.90	57.78
270	275	"	16.64	.082	7.15	50.36
275	280	"	12.48	.090	5.14	56.67
280	285	"	14.03	.065	5.38	56.14
285	290	"	10.67	.078	3.55	64.21
290	295	"	11.32	.077	3.37	64.90
295	300	"	13.10	.071	7.13	56.80
300	305	"	12.45	.140	1.85	61.95
305	310	"	13.58	.084	3.39	59.39
310	315	"	12.26	.108	3.61	58.77

Hole started 5-25-49
Hole finished 6-17-49

NE-SW - - D.H. S-101 - - Vertical Structure
200' SE of DH S-100 on Sec. D - Elev. 1215.6

FROM	TO	MATERIAL	CRUDE ORE IRON	PHOS.	MANG.	SILC.
0	133	Surface				
133	140	Formation	23.33	.085	3.19	35.34
140	145	"	22.44	.086	2.21	39.28
145	150	"	19.46	.134	1.99	42.55
150	155	"	21.73	.085	2.86	38.74
155	160	"	18.33	.052	1.73	45.05
160	165	"	20.76	.048	3.15	40.32
165	170	"	24.85	.084	4.10	34.97
170	175	"	19.16	.065	3.39	46.56
175	180	"	16.75	.074	2.66	57.28
180	185	"	17.50	.070	2.30	56.28
185	190	"	14.90	.065	1.83	60.58
190	195	"	16.36	.068	.87	62.96
195	200	"	12.15	.084	1.68	63.56
200	205	"	13.12	.079	.53	67.76
205	210	"	15.71	.097	.32	66.10
210	215	"	17.14	.084	8.32	51.74
215	220	"	13.74	.073	2.50	63.64
220	225	"	13.74	.122	2.56	63.92
225	230	"	16.33	.063	3.46	60.10
230	235	"	11.96	.082	3.49	65.92
235	240	"	12.61	.062	2.74	66.54
240	245	"	15.02	.057	4.49	61.08
245	250	"	12.27	.052	2.25	68.10
250	255	"	18.98	.070	3.31	55.92
255	260	"	13.24	.077	3.11	64.52
260	265	"	13.57	.052	4.26	63.12
265	270	"	13.24	.054	3.94	64.20
270	275	"	13.57	.078	2.84	64.84
275	280	"	12.11	.051	3.98	66.54
280	285	"	10.98	.126	1.49	71.00
285	290	"	12.76	.120	3.15	65.80
290	295	"	11.80	.118	2.52	69.20
295	300	"	15.20	.128	4.77	60.66
300	305	"	11.80	.096	2.32	69.02
305	310	"	15.84	.186	3.07	62.48
310	315	"	13.58	.100	3.80	64.26
315	320	"	12.94	.094	3.59	62.60
320	325	"	18.92	.102	4.51	55.42

Hole started 6-17-49
Hole finished 7-19-49

NE-SW - - D.H. S-102 - - Vertical Structure
223' NW of DH S-100 on Sec. D - Elev. 1215.8

FROM	TO	MATERIAL	CRUDE ORE IRON	PHOS.	MANG.	SILC.
0	125	Surface				
125	151	"				
151	155	Formation	10.99	.088	1.10	69.56
155	160	"	21.18	.045	2.90	49.40
160	165	"	15.84	.057	1.73	58.46
165	170	"	23.44	.044	4.10	45.08
170	175	"	23.90	.041	2.88	47.08
175	180	"	20.19	.048	2.76	52.52
180	185	"	20.03	.048	2.48	53.72
185	190	"	20.03	.046	3.35	51.20
190	195	"	15.83	.050	4.22	55.32
195	200	"	15.18	.036	2.80	58.34
200	205	"	15.34	.048	2.99	56.56
205	210	"	15.34	.040	1.39	61.82
210	215	"	11.30	.063	2.13	67.64
215	220	"	15.67	.102	1.81	62.08
220	225	"	12.60	.067	2.40	66.76
225	230	"	14.86	.063	5.79	57.96
230	235	"	16.96	.075	4.53	57.40
235	240	"	15.34	.066	4.93	58.82
240	245	"	14.39	.202	2.48	64.60
245	250	"	13.42	.065	3.55	63.80
250	255	"	12.45	.139	2.36	68.38
255	260	"	11.32	.083	2.68	63.66
260	265	"	14.79	.070	5.95	60.06
265	270	"	16.01	.119	5.14	58.92
270	275	"	13.74	.244	4.20	63.12
275	280	"	13.24	.069	4.83	61.14
280	285	"	14.05	.085	4.98	62.08
285	290	"	13.40	.092	4.87	62.66
290	295	"	10.17	.065	.93	72.58
295	300	"	12.92	.122	3.43	66.[illegible]
300	305	"	12.92	.085	4.87	62.[illegible]
305	310	"	14.00	.079	6.36	[illegible].06
310	315	"	9.33	.128	6.93	57.[illegible]
315	320	D. D.	15.84	.090	9.58	[illegible]
320	325	"	15.61	.086	5.59	[illegible]

Hole started 6-25-49
Hole finished 7-23-49

NE-SW - - D.H. S-103 - - Verticle Structure
127' SE of DH S-101 on Sec. D - Elev. 1215.8

FROM	TO	MATERIAL	CRUDE ORE IRON	PHOS.	MANG.	SILC.
0	146	Surface				
146	150	Formation	25.12	.043	2.94	43.26
150	155	"	22.47	.039	6.86	39.92
155	160	"	21.85	.045	5.32	44.84
160	165	"	12.36	.040	1.60	66.80
165	170	"	18.94	.059	4.33	48.42
170	175	"	16.69	.092	3.55	[illegible].18
175	180	"	13.96	.110	2.36	[illegible].19
180	185	"	15.57	.114	1.40	56.22
185	190	"	17.02	.069	1.34	51.58
190	195	"	13.32	.065	1.48	63.20
195	200	"	14.44	.041	3.51	70.36
200	205	"	10.43	.132	1.69	71.74
205	210	"	13.64	.152	.99	66.14
210	215	"	11.23	.075	.22	72.36
215	220	"	15.20	.109	1.41	64.12
220	225	"	9.21	.061	.35	70.79
225	230	"	16.65	.160	1.77	61.43
230	235	"	17.14	.103	3.82	58.03
235	240	"	14.71	.111	2.44	61.04
240	245	"	12.45	.052	1.38	66.19
245	249	"	11.56	.040	3.45	64.90
249	254	D. D.	12.53	.084	1.18	67.55
254	259	"	19.40	.150	2.32	56.62
259	264	"	13.10	.110	.99	63.72
264	269	"	12.94	.118	1.18	65.40
269	275	Formation	10.50	.123	1.53	64.80
275	280	"	10.50	.091	2.64	65.98
280	285	"	11.46	.105	3.55	64.00
285	290	"	10.58	.108	3.66	63.82
290	295	"	15.34	.092	8.67	51.33
295	300	"	16.80	.167	6.15	51.30
300	305	"	11.63	.094	5.63	57.91
305	310	"	7.18	.061	.53	75.30
310	315	"	7.50	.065	.35	77.06
315	320	"	8.32	.039	.59	77.02
320	325	"	12.56	.092	7.52	60.32

Hole started 7-22-49
Hole finished 8-15-49

NE-SW - D.H. S-104 - Verticle Structure - 25' E
of DH 1035 on line between 1035 & 1 - Elev. 1215.0

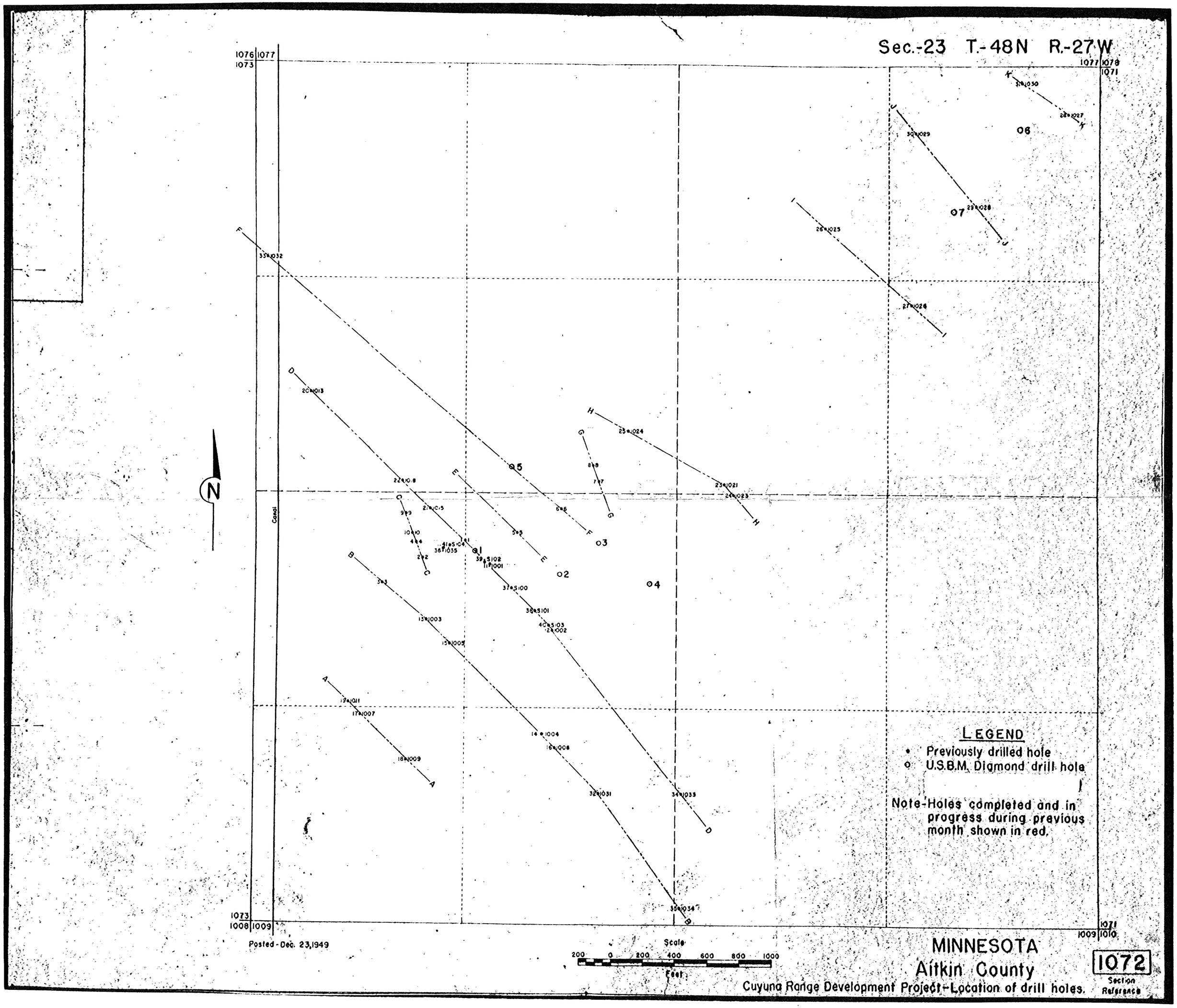
FROM	TO	MATERIAL	CRUDE ORE IRON	PHOS.	MANG.	SILC.
0	148	Surface				
148	155	Formation	6.63	.041	1.33	77.07
155	160	"	16.17	.062	2.05	49.66
160	165	"	17.30	.056	.47	50.91
165	170	"	20.37	.081	1.40	45.85
170	175	"	21.42	.060	4.20	40.62
175	180	"	19.89	.053	3.98	42.69
180	185	"	17.46	.078	3.59	45.64
185	190	"	16.98	.081	7.39	39.04
190	195	"	20.05	.084	8.53	37.42
195	200	"	19.24	.120	5.87	44.60
200	205	"	18.43	.088	10.58	41.35
205	210	"	20.37	.106	6.32	39.48
210	215	"	20.21	.094	8.82	36.35
215	220	"	15.68	.078	5.22	46.69
220	225	"	21.67	.105	12.76	34.11
225	230	"	15.20	.079	9.73	51.29
230	235	"	13.10	.111	11.23	42.52
235	240	"	15.83	.089	9.69	41.56
240	245	"	17.12	.055	5.71	46.86
245	250	"	13.40	.065	.66	60.08
250	255	"	11.79	.057	1.57	63.75
255	260	"	10.34	.052	4.18	64.49
260	265	"	11.95	.085	10.13	54.72
265	270	"	13.86	.058	6.66	58.24
270	275	"	8.64	.080	4.16	70.10
275	280	"	9.46	.042	5.32	67.18
280	285	"	7.09	.082	1.68	76.60
285	290	"	8.97	.066	2.68	71.34
290	295	"	13.46	.062	3.35	60.75
295	300	"	7.78	.038	.35	70.95
300	305	"	13.79	.039	.39	61.66
305	310	"	13.79	.043	1.77	64.04
310	315	"	9.24	.083	1.52	67.49
315	320	D. D.	8.43	.102	.39	74.66
320	325	D. D.	11.35	.053	.39	74.52

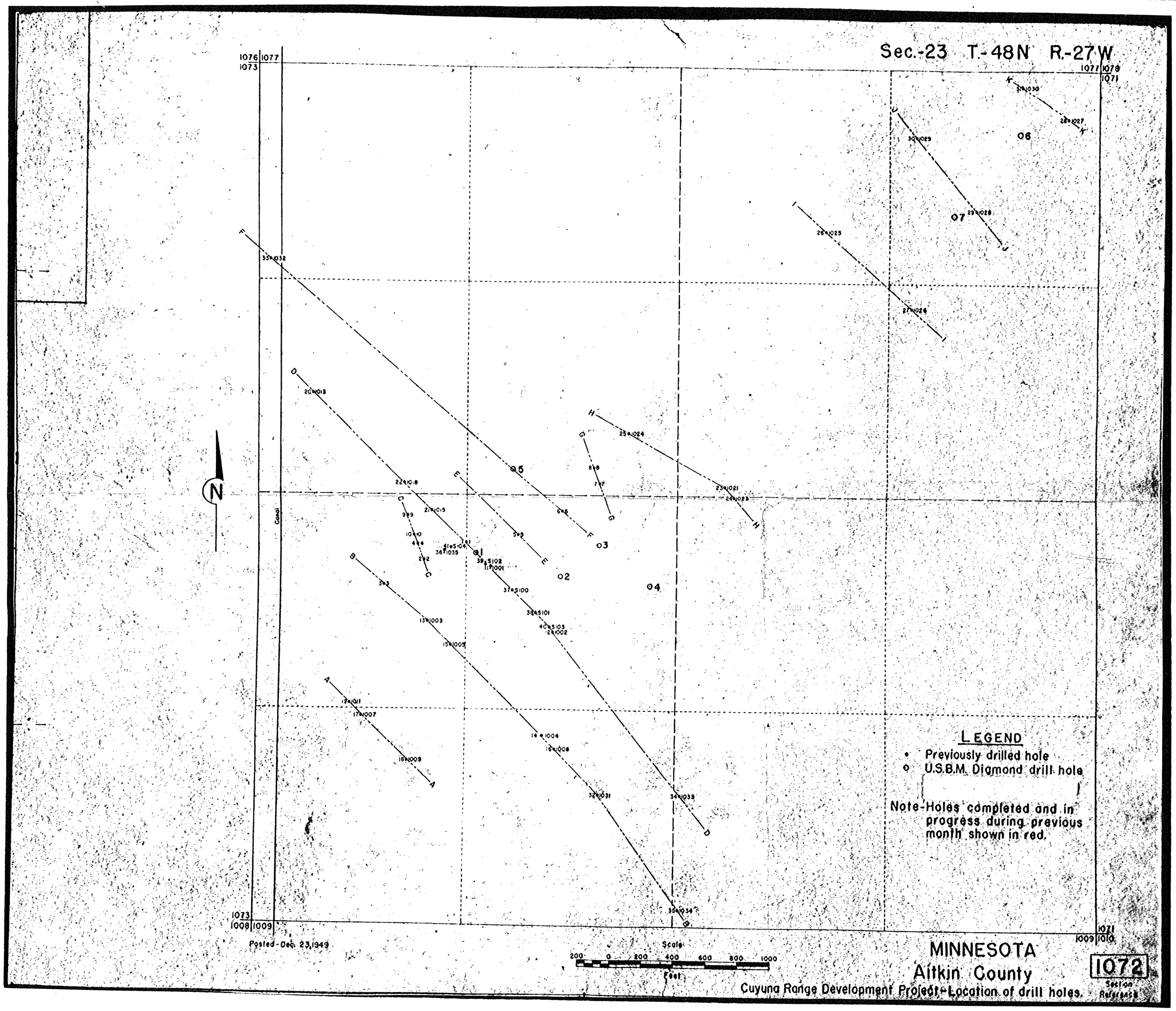
Hole started 7-29-49
Hole finished 8-18-49

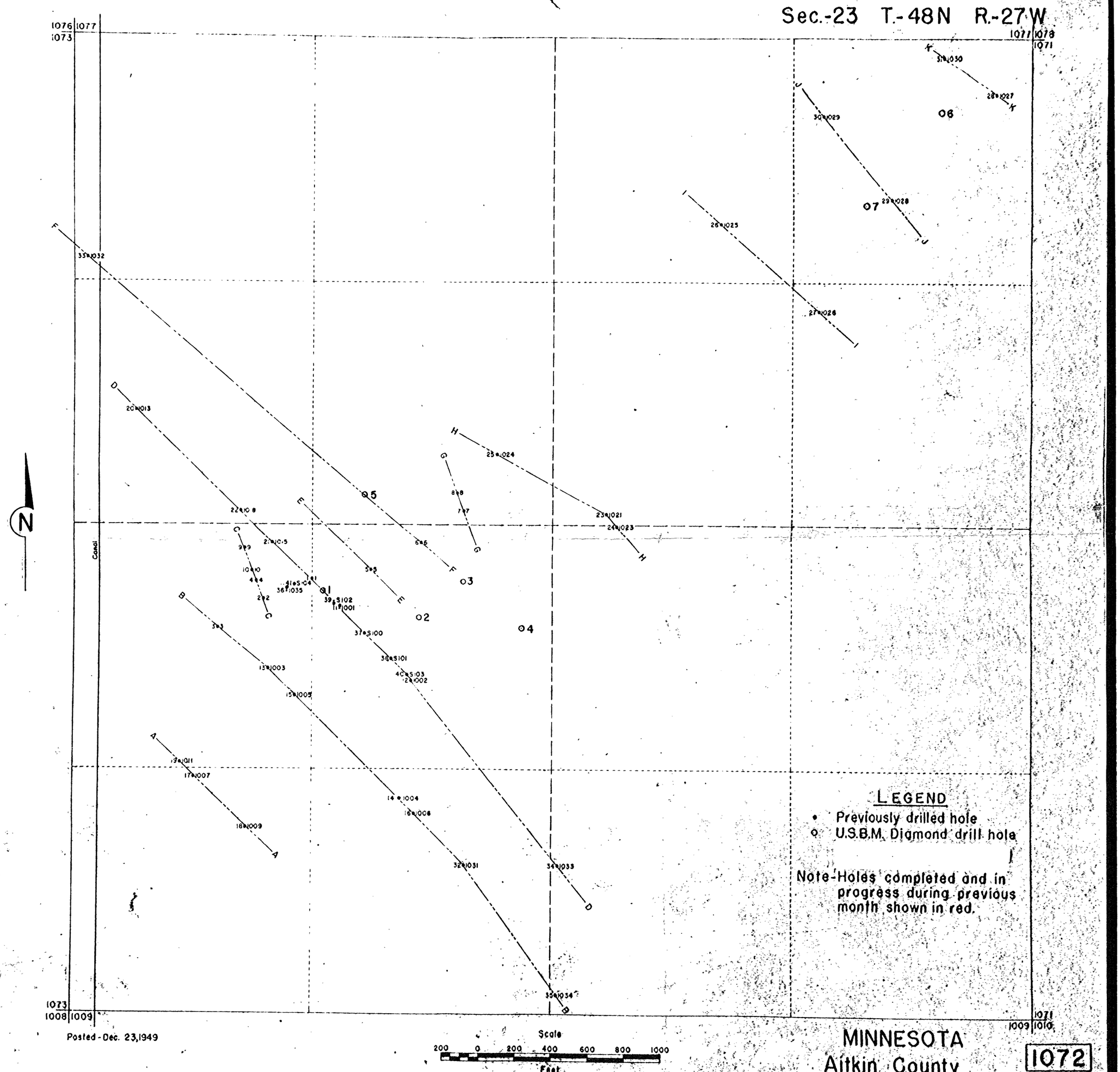
NOTE: D. D. Analysis are of sludge only.

FINAL

HANNA COAL & ORE CORPORATION
Crosby, Minn.
AS OF 8-25-49


Sec.-23 T.-48N R.-27W
1076 1077
1073
1077 1078
1071
N
Canal
Q5
Q1
Q2
Q3
Q4
Q6
Q7
LEGEND
• Previously drilled hole
o U.S.B.M. Diamond drill hole
Note-Holes completed and in progress during previous month shown in red.
1073
1008 1009
1009 1010
Posted - Dec. 23, 1949
Scale
200 0 200 400 600 800 1000
Feet
MINNESOTA
Aitkin County
Cuyuna Range Development Project-Location of drill holes.
1072
Section Reference


Sec.-23 T.-48N R.-27W
1076 1077
1073
1077 1078
1071
01
02
03
04
05
06
07
08
Canal
N
LEGEND
• Previously drilled hole
o U.S.B.M. Diamond drill hole
Note-Holes completed and in progress during previous month shown in red.
Scale
200 0 200 400 600 800 1000
Feet
1073
1008 1009
1071
1009 1010
Posted-Dec. 23, 1949
MINNESOTA
Aitkin County
Cuyuna Range Development Project-Location of drill holes.
1072
Section Reference


Sec.-23 T.-48N R.-27W
1076 1077
1073
1077 1078
1071
N
Canal
01
02
03
04
05
06
07
LEGEND
• Previously drilled hole
o U.S.B.M. Diamond drill hole
Note-Holes completed and in progress during previous month shown in red.
1073
1008 1009
1009 1010
1071
Posted - Dec. 23,1949
Scale
200 0 200 400 600 800 1000
Feet
MINNESOTA
Aitkin County
Cuyuna Range Development Project-Location of drill holes.
1072
Section Reference

SEC. 23-48-27

EXPLORATION REPORT

NE-SW - - D.H. S-100 - - Vertical Structure
200' SE of DH 1001 on Sec. D - Elev. 1216.3

FROM	TO	MATERIAL	IRON	CRUDE ORE PHOS.	MANG.	SILC.
0	149	Surface				
149	170	Mn. Form	17.61	.062	5.20	43.34
170	195	"	13.23	.115	1.75	52.27
195	200	"	10.94	.295	1.93	64.26
200	205	"	12.55	.076	7.25	58.59
205	210	"	8.53	.056	4.96	62.44
210	215	"	17.70	.069	3.47	54.68
215	220	"	15.28	.128	3.25	55.83
220	225	"	13.03	.096	6.84	53.64
225	230	"	12.71	.060	1.93	61.72
230	235	"	15.12	.105	4.65	56.94
235	240	"	14.96	.100	2.94	55.49
240	245	"	12.55	.074	2.76	62.19
245	250	"	12.39	.071	2.13	62.70
250	255	"	11.91	.046	2.30	59.80
255	260	"	12.71	.062	3.15	60.63
260	265	"	14.48	.072	4.73	58.15
265	270	"	12.80	.066	3.90	57.78
270	275	"	16.64	.082	7.15	50.36
275	280	"	12.48	.090	5.14	56.67
280	285	"	14.03	.065	5.38	56.14
285	290	"	10.67	.078	3.55	64.21
290	295	"	11.32	.077	3.37	64.90
295	300	"	13.10	.071	7.13	56.80
300	305	"	12.45	.140	1.85	61.95
305	310	"	13.58	.084	3.39	59.39
310	315	"	12.26	.108	3.61	58.77

Hole started 5-25-49
Hole finished 6-17-49

NE-SW - - D.H. S-101 - - Vertical Structure
200' SE of DH S-100 on Sec. D - Elev. 1215.6

FROM	TO	MATERIAL	IRON	CRUDE ORE PHOS.	MANG.	SILC.
0	133	Surface				
133	140	Formation	23.33	.085	3.19	35.34
140	145	"	22.44	.086	2.21	39.28
145	150	"	19.46	.134	1.99	42.55
150	155	"	21.73	.085	2.86	38.74
155	160	"	18.33	.052	1.73	45.05
160	165	"	20.76	.048	3.15	40.32
165	170	"	24.85	.084	4.10	34.97
170	175	"	19.16	.065	3.39	46.56
175	180	"	16.75	.074	2.66	57.28
180	185	"	17.50	.070	2.30	56.28
185	190	"	14.90	.065	1.83	60.58
190	195	"	16.36	.068	.87	62.96
195	200	"	12.15	.084	1.68	63.56
200	205	"	13.12	.070	.53	67.76
205	210	"	15.71	.097	.32	66.10
210	215	"	17.14	.084	8.32	51.74
215	220	"	13.74	.073	2.50	63.64
220	225	"	13.74	.122	2.56	63.92
225	230	"	16.33	.063	3.49	60.10
230	235	"	11.96	.082	3.49	65.92
235	240	"	12.61	.062	2.74	66.54
240	245	"	15.02	.057	4.49	61.08
245	250	"	12.27	.052	2.25	68.10
250	255	"	18.98	.070	3.31	55.92
255	260	"	13.24	.077	3.11	64.52
260	265	"	13.57	.052	4.26	63.12
265	270	"	13.24	.054	3.94	64.20
270	275	"	13.57	.078	2.84	64.84
275	280	"	12.11	.051	3.98	66.54
280	285	"	10.98	.126	1.49	71.00
285	290	"	12.76	.120	3.15	65.80
290	295	"	11.80	.118	2.52	69.20
295	300	"	15.20	.128	4.77	60.66
300	305	"	11.80	.096	2.32	69.02
305	310	"	15.84	.186	3.07	62.48
310	315	"	13.58	.100	3.80	64.26
315	320	"	12.94	.094	3.59	62.60
320	325	"	18.92	.102	4.51	55.42

Hole started 6-17-49
Hole finished 7-19-49

NE-SW - - D.H. S-102 - - Vertical Structure
223' NW of DH S-100 on Sec. D - Elev. 1215.8

FROM	TO	MATERIAL	IRON	CRUDE ORE PHOS.	MANG.	SILC.
0	125	Surface				
125	151	"				
151	155	Formation	10.99	.088	1.10	69.56
155	160	"	21.18	.045	2.90	49.40
160	165	"	15.84	.057	1.73	58.46
165	170	"	23.44	.044	4.10	45.08
170	175	"	23.90	.041	2.88	47.08
175	180	"	20.19	.048	2.76	52.52
180	185	"	20.03	.048	2.48	53.72
185	190	"	20.03	.046	3.35	51.20
190	195	"	15.83	.050	4.22	55.32
195	200	"	15.18	.036	2.80	58.34
200	205	"	15.34	.048	2.99	56.56
205	210	"	15.34	.040	1.89	61.82
210	215	"	11.30	.063	2.13	67.64
215	220	"	15.67	.102	1.81	62.08
220	225	"	12.60	.067	2.40	66.76
225	230	"	14.86	.063	5.79	57.96
230	235	"	16.96	.075	4.53	57.40
235	240	"	15.34	.066	4.93	58.82
240	245	"	14.39	.202	2.48	64.60
245	250	"	13.42	.065	3.55	63.80
250	255	"	12.45	.139	2.36	68.38
255	260	"	11.32	.083	2.68	68.66
260	265	"	14.79	.070	5.95	60.06
265	270	"	16.01	.119	5.14	58.92
270	275	"	13.74	.244	4.20	63.12
275	280	"	13.24	.069	4.83	61.14
280	285	"	14.05	.085	4.98	62.08
285	290	"	13.40	.092	4.87	62.66
290	295	"	10.17	.065	.93	72.58
295	300	"	12.92	.122	3.43	66.08
300	305	"	12.92	.085	4.87	62.[illegible]
305	310	"	14.00	.079	6.36	[illegible].06
310	315	"	9.33	.128	6.93	57.[illegible]
315	320	D. D.	13.84	.090	9.58	[illegible]
320	325	"	15.61	.086	5.59	[illegible]

Hole started 6-25-49
Hole finished 7-23-49

NE-SW - - D.H. S-103 - - Verticle Structure
127' SE of DH S-101 on Sec. D - Elev. 1215.8

FROM	TO	MATERIAL	IRON	CRUDE ORE PHOS.	MANG.	SILC.
0	146	Surface				
146	150	Formation	25.12	.043	2.94	43.26
150	155	"	22.47	.039	6.86	39.92
155	160	"	21.83	.045	5.32	44.84
160	165	"	12.36	.040	1.60	66.80
165	170	"	18.94	.059	4.33	48.42
170	175	"	16.69	.092	3.55	52.18
175	180	"	13.96	.110	2.36	55.19
180	185	"	15.57	.114	1.40	56.22
185	190	"	17.01	.069	1.34	51.58
190	195	"	13.32	.065	1.48	63.20
195	200	"	14.44	.041	3.51	70.36
200	205	"	10.43	.132	1.69	71.74
205	210	"	13.64	.152	.99	66.14
210	215	"	11.23	.075	.22	72.36
215	220	"	15.20	.109	1.41	64.12
220	225	"	9.21	.061	.35	70.79
225	230	"	16.85	.160	1.77	61.43
230	235	"	17.14	.103	3.82	58.03
235	240	"	14.71	.111	2.44	61.04
240	245	"	12.45	.052	1.38	66.19
245	249	"	11.56	.040	3.45	64.90
249	254	D. D.	12.63	.084	1.18	67.55
254	259	"	19.40	.150	2.32	56.62
259	264	"	13.10	.110	.99	63.72
264	269	"	12.94	.118	1.18	65.40
269	275	Formation	10.50	.123	1.53	64.80
275	280	"	10.50	.091	2.64	65.98
280	285	"	11.46	.105	3.55	64.00
285	290	"	10.58	.108	3.66	63.82
290	295	"	15.34	.092	8.67	51.33
295	300	"	16.80	.167	6.15	51.30
300	305	"	11.63	.094	5.63	57.91
305	310	"	7.18	.061	.53	75.30
310	315	"	7.50	.065	.35	77.06
315	320	"	8.32	.039	.59	77.02
320	325	"	12.56	.092	7.52	60.32

Hole started 7-22-49
Hole finished 8-15-49

NE-SW - D.H. S-104 - Verticle Structure - 25' E
of DH 1035 on line between 1035 & 1 - Elev. 1215.0

FROM	TO	MATERIAL	IRON	CRUDE ORE PHOS.	MANG.	SILC.
0	148	Surface				
148	155	Formation	6.63	.041	1.33	77.07
155	160	"	16.17	.062	2.05	49.66
160	165	"	17.30	.056	.47	50.91
165	170	"	20.37	.081	1.40	45.85
170	175	"	21.42	.060	4.20	40.62
175	180	"	19.89	.058	3.98	42.69
180	185	"	17.46	.078	3.59	45.64
185	190	"	16.98	.081	7.39	39.04
190	195	"	20.05	.084	8.53	37.42
195	200	"	19.24	.120	5.87	44.60
200	205	"	18.43	.088	10.58	41.35
205	210	"	20.37	.106	6.32	39.48
210	215	"	20.21	.094	8.82	36.35
215	220	"	15.68	.078	5.22	46.69
220	225	"	21.67	.105	12.76	34.11
225	230	"	15.20	.079	9.73	51.29
230	235	"	13.10	.111	11.23	42.52
235	240	"	15.83	.089	9.69	41.56
240	245	"	17.12	.055	5.71	46.86
245	250	"	13.40	.065	.66	60.08
250	255	"	11.79	.057	1.57	63.75
255	260	"	10.34	.052	4.18	64.49
260	265	"	11.95	.085	10.13	54.72
265	270	"	13.86	.058	6.66	58.24
270	275	"	8.64	.080	4.16	70.10
275	280	"	9.46	.042	5.32	67.18
280	285	"	7.09	.082	1.68	76.60
285	290	"	8.97	.066	2.68	71.34
290	295	"	13.46	.062	3.35	60.75
295	300	"	7.78	.038	.35	70.95
300	305	"	13.79	.039	.39	61.66
305	310	"	13.79	.043	1.77	64.04
310	315	"	9.24	.083	1.52	67.49
315	320	D. D.	8.43	.102	.39	74.66
320	325	D. D.	11.35	.053	.39	74.52

Hole started 7-29-49
Hole finished 8-18-49

NOTE: D. D. Analysis are of sludge only.

FINAL

HANNA COAL & ORE CORPORATION
Crosby, Minn.
AS OF 8-25-49