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I-XL RESEARCH LABORATORY REPORT

005612

ON VANCOUVER ISLAND

CLAYS AND SHALES

Samples submitted by: Mr. T.D. McEwan
211 - 1001 Cloverdale Avenue
Victoria, B.C.

Date samples received - Feb. 20, 1979 - 79-12A & B
- Mar. 22, 1979-79-12C, D, E, F, & G
- May 2, 1979 - G, H, & J

Description of Sample Clays and Test Results:

79-12B - top of formation - representing 5 feet - Glacial Marine Clay
- yellowy brown grey - fine silty soft clay
- no effervescence with hydrochloric acid

79-12A - bottom of formation - representing 14 feet - Glacial Marine Clay
- bluish grey - fine silty soft clay
- no effervescence with HCl

Drying Disc Study	79-12B	79-12A
plasticity	- quite short	fine silty
workability	- fair	poor
W.P.%	- 28.00	31.25
Drying Shrinkage %	- 5.52	3.65
Drying Factor	- 1.0	0.0
Nature of drying	- main center crack only	no cracks
scum	- not evident	not evident

Dry Press Hand Bars	79-12B	79-12A
Total fired shrinkage to cone 02^d-%	3.98	2.93
Color at 02^d	deep orangy brown	orangy brown
Scum	nil	nil
Total fired shrinkage to cone 2^2	31.47	28.88
Color at cone 2^2	deep maroon	dark reddy brown
Scum	nil	nil

Temperature Gradient

Zero shrinkage temp ^{o}F	1430	1560
Max. shrinkage %	13.09	9.67
at temp ^{o}F	1990	2010
Color at temp	Choc br.	deep br.
Color at 3% Shrinkage	orangy br.	orangy br.
temp at 3% Shrinkage	1830	1880
Steel hard - temp. ^{o}F	1920	1950
Free Silica	trace	trace
Fired P.C.E.	3	6

Other Materials Received:

79-12C - mottled brown grey sand
- medium grained
- no effervescence with HCl
- Fired to mottled beige & red br. speckled color at 1880^{o}F
- very little clay if any to form bars

79-12D - Ground Grey Clay - same as sample 79-12"A"
- fine silty soft clay
- no effervescence with HCl

79-12E - Wet plastic lump of grey clay - likely raw "A" sample

79-12F - 2 pieces of flat platy or blocky dense grey soft clay
- likely bottom of "A" sample

79-12G - Shale - hard dense black blocky fine grained shale
- no effervescence with HCl
- grinds down quite readily and develops a little plasticity
- normally non-plastic
- fires to medium red color as a pressed clay at 1880^{o}F with very low shrinkage.
- fired pce - 6
- fired to 2000^{o}F on fast schedule in electric kiln
- particles and lumps bloat very highly producing a coated light weight aggregate
- volume expansion probably 100% or more by estimate
- particles bloat uniformly - very porous but have a coated nature - float very nicely in water
- bloating due to colloidal carbon or carbonaceous material
- Gradient furnace results
  - expansion of bar - maximum 0.47% up to 1780^{o}F

- slight shrinkage - maximum 0.29% 1780 - 1930°F
- expansion and bloating beyond - maximum 3.58% at 2010°F
- steel hard at 1860°F

79-12H - loose weathered schist - lt. grey to deep grey platy like material, fine talcy fine grained no effervescence with HCl
- fired to bronzy beige color at 1800 - 2000°F

79-12J - Chlorite or Seracitic Schist
- hard compact chunky massive - deep bluish grey color
- fine grained talcy like
- no effervescence with HCl
- 12H - is the weathered product of this material
- fires to orange-brown color at 1900°F
- high fired shrinkage at higher temperature

Hand bars & extrusions made up of the following:

		% WP	%DS	VR10 Cone 02 3 % F.S.	Color	Scum
79-12A	All Blue Clay		5.48	4.85	org red	some
B	All Brown Clay		5.52	7.22	mar red	v.li
C	3 blue: 1 brown + .2% $BaCO_3$	31.75	5.36	5.35	org red	clea
D	3 blue: 1 brown: 1 sand + .2% $BaCO_3$	26.25	4.50	3.77	org red	clea
E	3 blue: 1 brown: 2 sand + .2% $BaCO_3$	23.75	4.68	2.77	org red	clea
F	3 blue: 1 brown + .2% $BaCO_3$	20.50	3.18	1.67	org red	clea

Hand bars made up of all
Extrusion bars made up of "D" only

79-12D - Cone 02 3

	VR 8½	VR 10	VR 10½	VR 14½	D=quite sil plasticit
Color-scum	org red nil	org red nil	org red nil	deep red nil	v. short workabili
D.S.	5.54%	5.34	5.96	5.38	excellent drying
F.S.	2.67%	1.75	1.70	4.78	very slight scum
Total shr.	8.21	7.09	7.66	10.16	

Drying Disc Summary:

	Plasticity	Workability	W.P.%	D.S.%	D.F.	Scum
A	fine silty	poor	31.25	3.65	0.0	nil
B	quite short	fair	28.00	5.52	1.0	"
C	quite good	fairly short	31.75	4.64	0.0	"
D	little silty	little short	26.25	3.43	0.0	"
E	quite silty	quite short	23.75	3.31	0.0	"
F	poor	very sandy	20.50	2.94	0.0	"

Summary of Observations and Results of tests:

1. The two Marine silts are fine drying, good color materials but can not be used alone for manufacture of brick products. They are too silty and have too short of a firing range in themselves. They would be fine materials as admixtures with other clays and shales.

2. Mixtures made up of the sand and silts result also in weak porous bodies not too suited for brick making.

3. The schists and the hard shale react much the same as the sand in producing a weak structured body.

4. The extrusion made up of the silty clays and sand, 79-12D mix, produced a rather short body, having excellent drying features but again does not have much load carrying capacity and could not be used in a production body for making brick, that could be stacked 14 to 16 courses high.

5. The hard black shale presents itself as an excellent source of lightweight aggregate material. It has excellent bloating properties at reasonable firing temperature. This material could be truly called a "coated aggregate" material producing a very highly expanded material which floats in water.

Conclusions:

1. The silty clays are an excellent admix material for brick making.

2. The silty clays should be investigated as a plasticizer-clay replacement for lime in conventional lime: cement mortars.

3. The schistic materials, like the silty clays, have some limited use as admixtures for brick making.

4. The shale is not too suited as a admixture material in brick making but has very high potential as an aggregate material, producing a lightweight expanded coated aggregate with

excellent properties.

5. The shale, also, if ground to possibly - 40 mesh, might have some possibility as a clay-plasticizer replacement in lime: cement mortars.

August 29, 1979

M. Shayna

M. Shayna, P. Eng.,
Director of Research &
Product Development

MS:gld

Sec. 1 #30

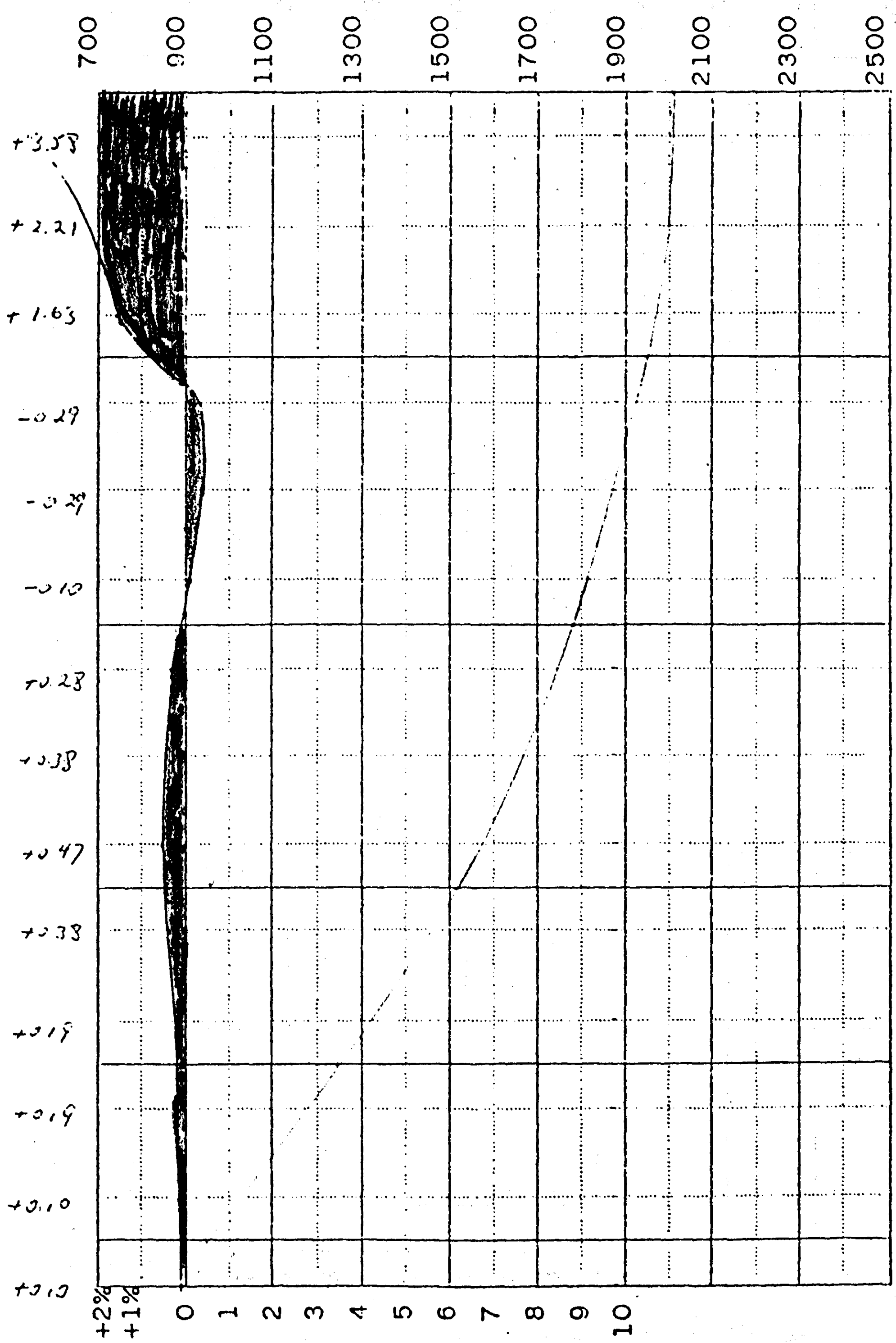
Sec. 1 #30

DATE: Aug ? '?0   SAMPLE: 79-12 G. DP

P.C.E. 6   Vancouver Island SHALE

FRONT
BACK

0	1.033	1.070	+.037	?210
	1.041	1.064	+.023	
	1.047	1.064	+.017	
1	1.053	1.050	.003	1050
	1.055	1.052	.003	
	1.058	1.057	.001	
2	1.059	1.062	+.003	17??
	1.060	1.064	+.004	
	1.058	1.063	+.005	
3	1.056	1.060	+.004	15?0
	1.055	1.057	+.002	
4	1.051	1.053	+.002	12?0
	1.046	1.047	+.001	
5	1.043	1.042	+.001	950



FURNACE NO. 2G 1156

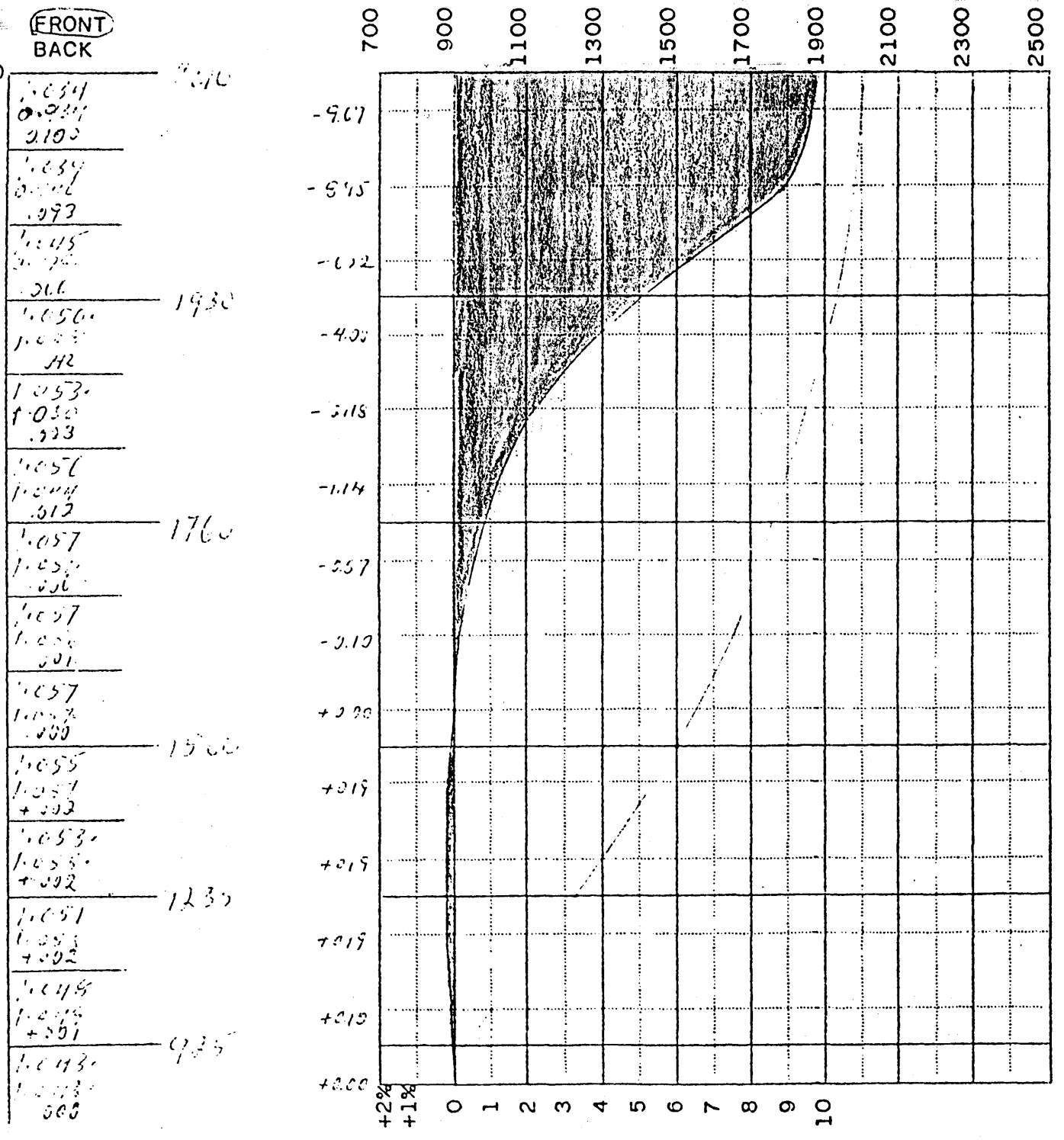
BY: G.B.

SCHEDULE: ?3?0

Sec: 1 #30

DATE: Feb 22/79 SAMPLE: 79-12 A 07

P.C.E. 6. Rich clay from Vancouver Island



FURNACE NO. 2E1094

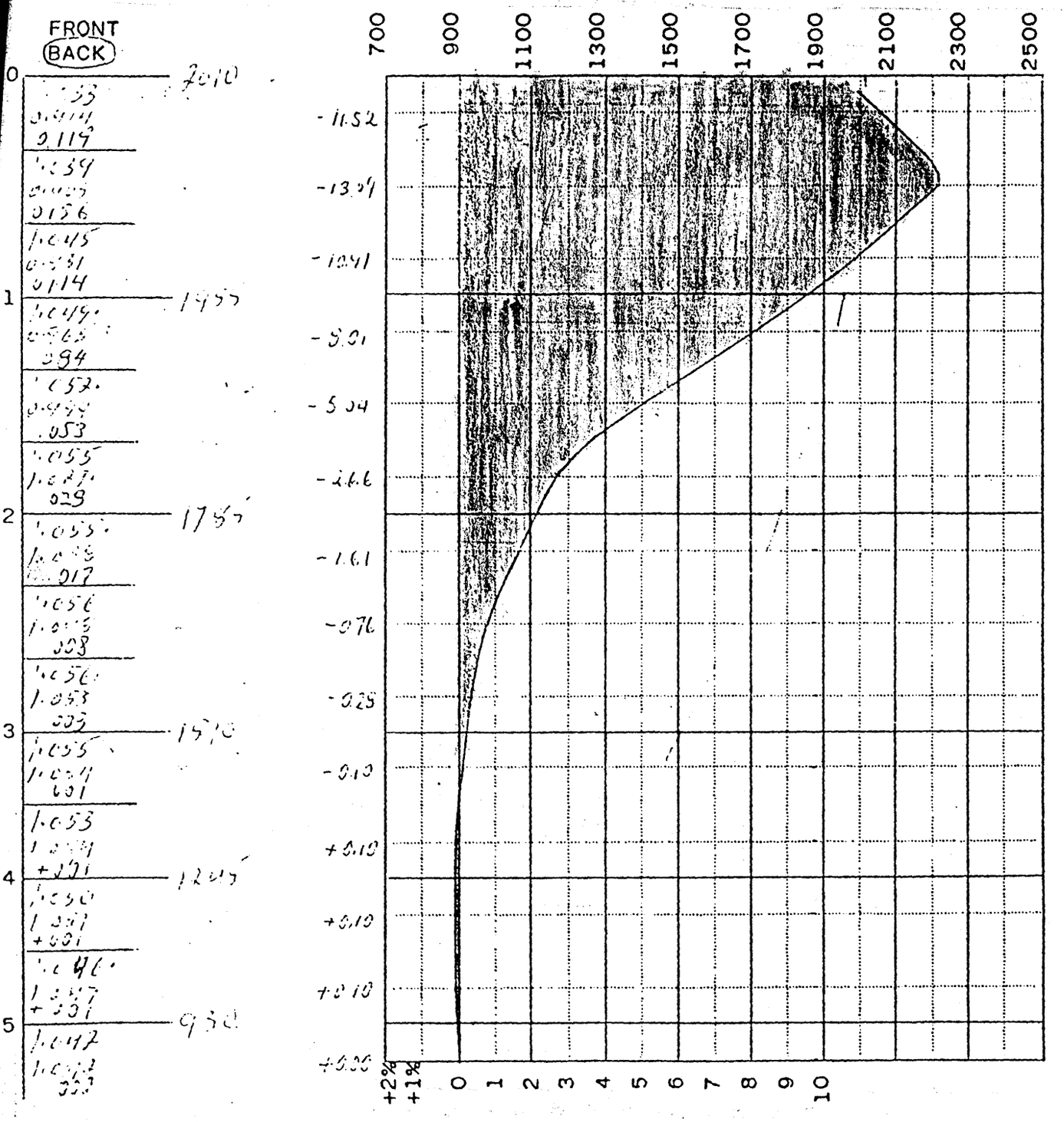
BY: A.B.

SCHEDULE: 2a

Sec. 1 #30

DATE: Feb 22/79 SAMPLE: 79-12 B DP

P.C.E. 3 Brick clay from Vancouver Island



FURNACE NO. 2C-1094

BY: A.B

SCHEDULE: 5-10

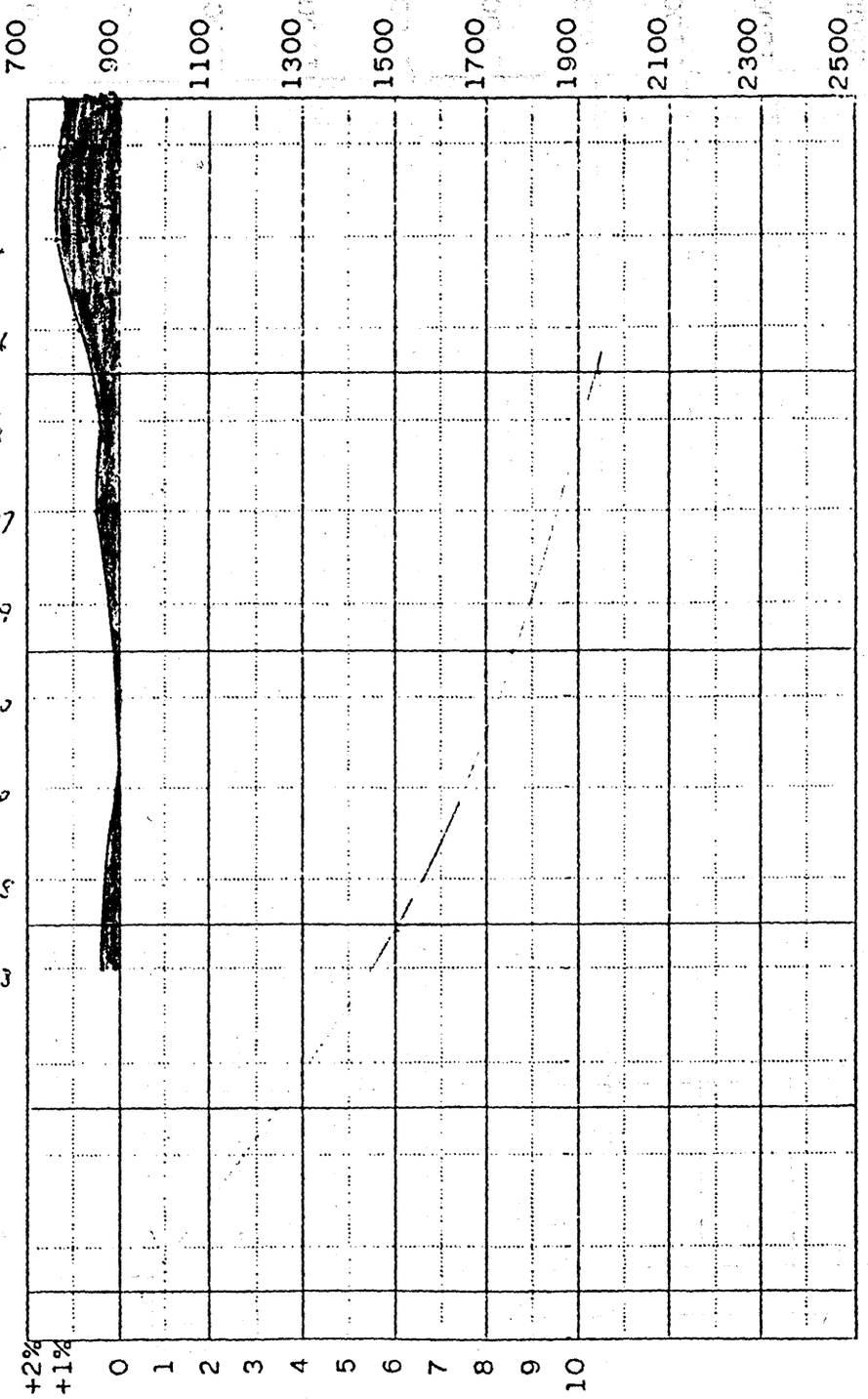
Sec. 1 #30

DATE: Oct 4/94 SAMPLE: 79-12 H DP

C.E. #3 Dynasil

FRONT
BACK

	2010		
1.040			
1.033		+1.25	
+.013			
1.045			
1.030		+1.44	
+.015			
1.050			
1.059		+0.86	
+.009			
1	1910		
1.057			
1.061		+0.38	
+.004			
1.059			
1.064		+0.47	
+.005			
1.062			
1.064		+0.19	
+.002			
2	1760		
1.063			
1.064		+0.10	
+.001			
1.063			
1.064		+0.10	
+.001			
1.061			
1.064		+0.28	
+.003			
3	1505		
1.060			
1.064		+0.33	
+.004			
1.055			
4	1245		
1.054			
1.051			
5	950		
1.046			



FURNACE NO. 2G1156

BY: A.B.

SCHEDULE: 2010

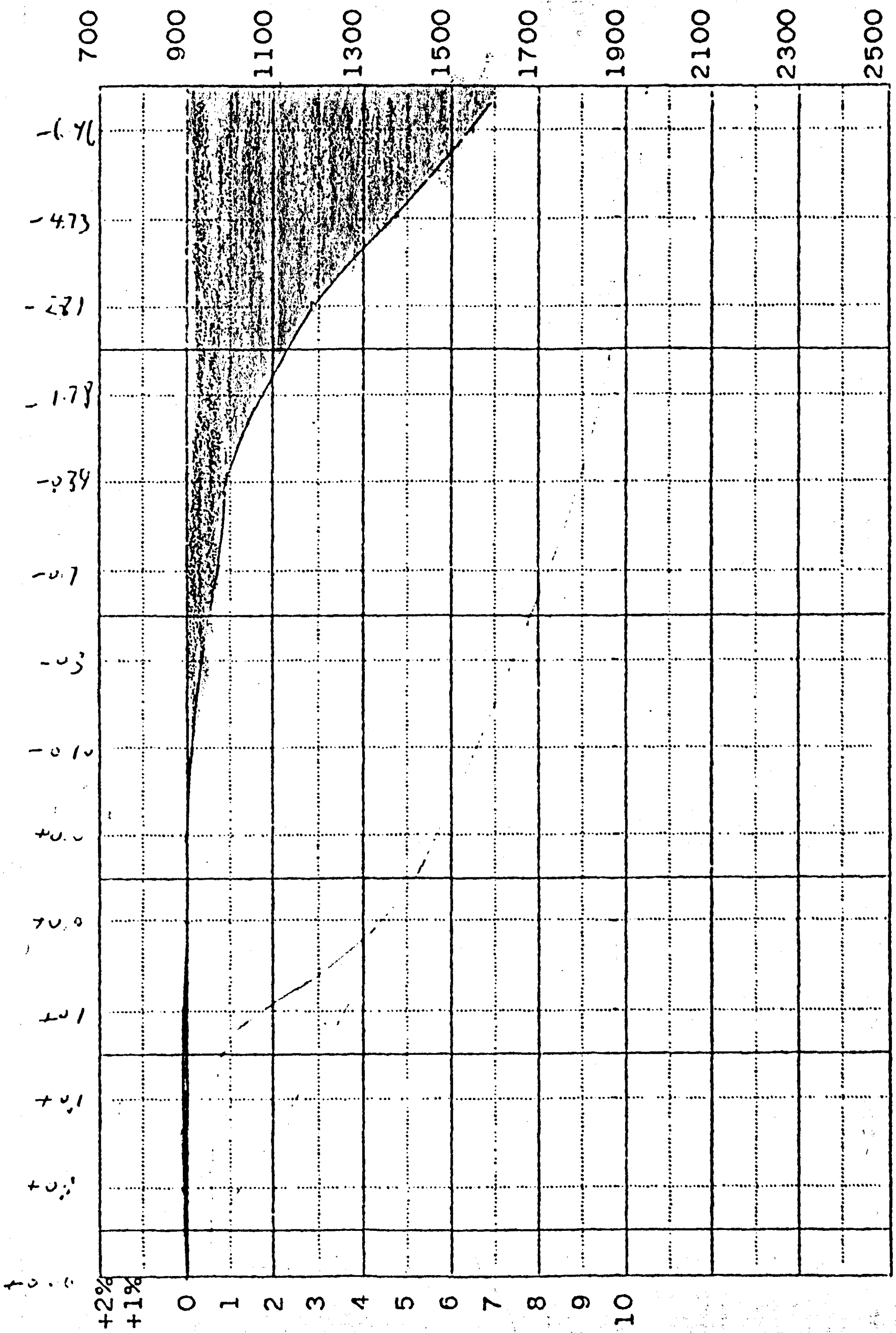
Sec. 1 #30

DATE: April 18/79 SAMPLE: 79-12 D at (Victoria clay)

P.C.E. ______ Blue clay 3 Brown clay 1 Sand 1

FRONT
BACK

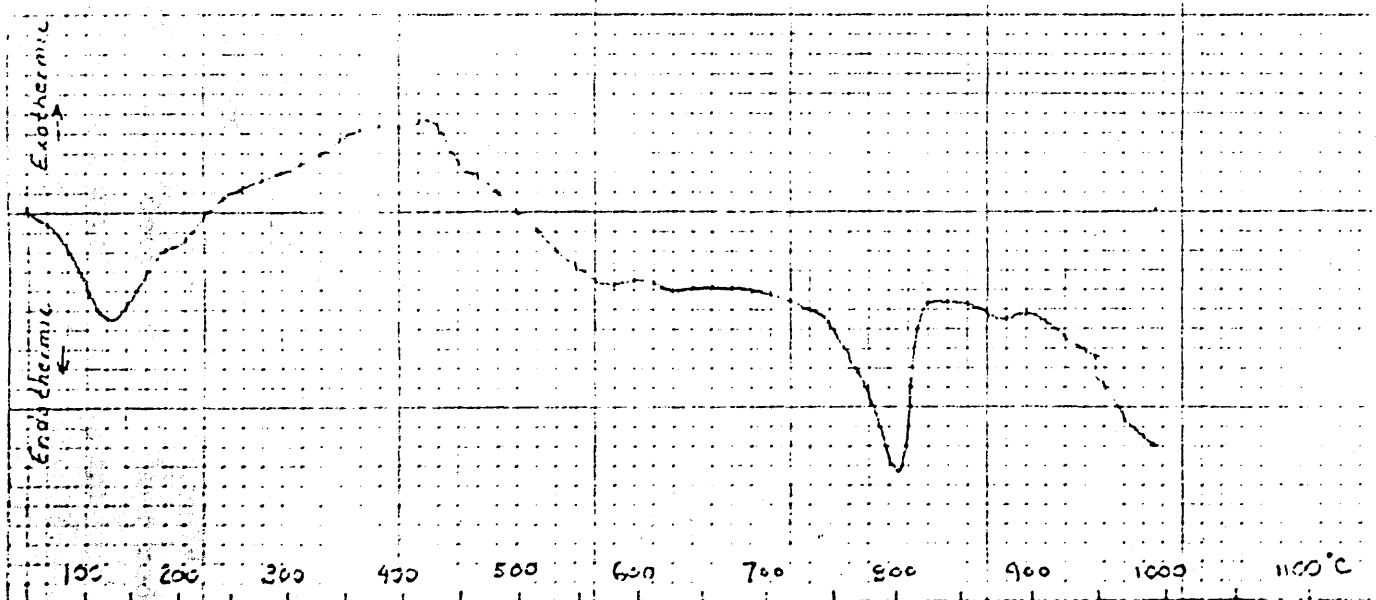
Depth	Readings	
0	1.071 / 0.99? / .061	?90
	1.015 / 0.962 / .043	
	1.011 / 0.982 / .029	
1	1.010 / 0.992 / .018	1470
	1.010 / 1.001 / .09	
2	1.009 / 1.002 / .07	1640
	1.012 / 1.00? / .03	
	1.015 / 1.017 / .01	
3	1.019 / 1.019 / .00	1420
	1.016 / 1.016 / .00	
4	1.015 / 1.016 / +.01	980 ?
	1.015 / 1.016 / +.01	
5	1.014 / 1.015 / +.01	960
	1.017 / 1.017 / .00	



FURNACE NO. 2 C 1117.

BY: A.B.

SCHEDULE: 10?



DTA# 421 FIELD SAMPLE No. 8.979
=7912 G (Very Hard Shale)
BLACK SHALE nr. VICTORIA, B.C
WT. 01496 LOI 8.49%