Property File 012919 (92L)

0921 279

(also 092L 282)

REPORT ON

LIMESTONE DEPOSITS OF THE PACIFIC NORTHWEST

DISCUSSION:

Numerous areas in which high calcium limestone has been reported were visited. Several of the locations were immediately eliminated in the field and will not be discussed.

The most objectional feature in most of the limestone deposits of British Columbia was the presence of igneous intrusives in the form of dikes and sills. In addition to this detrimental characteristic, other deposits had been severely fractured and re-cemented with calcite and minor quantities of chlorite type minerals along the fractures. Pyrite was also present in variable amounts, especially in the highly carbonaceous limestones. Any of these features present caused the resulting lime to assume a poor color and increase the insoluble residues, thereby causing the product to be unsatisfactory.

The final criteria for acceptability of limestone for use in the manufacture of high calcium quicklime is acceptable chemical characteristics. Unfortunately, many of the limestones which have been slightly mineralized will be acceptable chemically, but unacceptable physically. In addition, many of the materials which display little or no mineralization are found to be unacceptable chemically or have the characteristic of significant reduction in size upon calcination.

As stated previously, many areas were examined and sampled. Individual discussions of specific areas are compiled in the following discussions.

QUATSINO SOUND - JEUNE LANDING

High calcium limestone has been reported to occur in Quatsino Sound near Port Alice. As a result of this information, individual beds within the deposit were sampled in order to establish the presence of any concentration of high calcium material. The beds which appeared to be the principal high calcium zones are white to dove gray. Although these may be labeled high calcium, the magnesium oxide content was excessive in all cases--the lowest value being approximately 0.98% MgO. Additionally, beds immediately adjacent were often pure dolomites with the MgO content exceeding 12%.

A small island, known as Limestone Island, at the eastern entrance to Neroutsos was also investigated and sampled. This deposit is very similar lithologically to the Quatsino Sound area with the exception of numerous dikes. The deposit is composed entirely of two specific varieties of limestone which are extremely fine grained. Composite samples of both varieties, dove gray and dark blue, were obtained and analyzed. The results are as follows:

	SAMPLE NUMBER 5-4389 (dark)	SAMPLE NUMBER 5-4389 (light)
SiO_2	0.40	0.60
$(Fe_1Al)_2O_3$	0.22	0.24
CaO	54.99	54.75
MgO	0.59	0.66
SrO	0.04	43.68
loss	43.80	0.02 ?
Total	100.00	99.73

BEAVER COVE

High calcium limestone in large quantities occurs along the Tsulton River near Beaver Cove. The limestone occurs in two varieties, white and blue, and is heavily bedded and exceedingly fine grained. In addition to being fine grained, the material is poorly cemented and has a tendency to crumble upon crushing. Upon calcination, the limestone completely disintegrates, thereby producing an unsatisfactory product. In addition to the previously stated characteristics, the SiO_2 content of the sampled material was between 1 and 2%.

EFFINGHAM INLET

Carbonaceous, high calcium, limestone occurs in Effingham Inlet directly east of Pipestem Inlet. The deposit is bordered on the north and south by igneous rocks and has been severly faulted near the center of the deposit. The limestone has been severly fractured and re-cemented with white calcite and minor amounts of included accessory minerals. Dike and sills are present, but not numerous. Upon calcination, the material assumes a buff tan color, thus making the material unsatisfactory.

Samples were taken across the entire deposit in a northwesterly direction and labeled in consecutive numbers. The results are as follows:

SAMPLE NO.	SiO_2	Fe_2O_3	Al_2O_3	CaO	SrO	MgO	Loss	Total
1	1.28	0.05	[illegible]	[illegible]	0.03	0.14	43.44	[illegible]
2	1.12	0.04	0.20	54.70	0.03	0.18	43.70	[illegible]
3	0.86	0.05	0.09	[illegible]	0.03	0.21	43.50	[illegible]
4	2.28	0.60	[illegible]	[illegible]	0.03	5.10	43.04	[illegible]
5	2.15	0.06	[illegible]	[illegible]	0.03	0.31	43.05	[illegible]
6	[illegible]	0.36	[illegible]	[illegible]		0.24	43.90	[illegible]
7	1.73	0.07	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	1.24	[illegible]	[illegible]	[illegible]	[illegible]	0.11	[illegible]	[illegible]
9	[illegible]	0.21	[illegible]	[illegible]	0.02	0.36	[illegible]	[illegible]
10	0.64	[illegible]	[illegible]	[illegible]		0.32	43.67	[illegible]
11	0.96	0.11	[illegible]	[illegible]		0.37	[illegible]	[illegible]
12	0.24	0.37	[illegible]	[illegible]		0.33	[illegible]	[illegible]

SAMPLE NO.	SiO_2	Fe_2O_3	Al_2O_3	CaO	SrO	MgO	Loss	Total
13	1.89	0.64	0.15	[illegible]	0.03	5.36	43.94	100.17
14	6.00	0.29	0.17	[illegible]	0.01	1.20	13.49	99.47
15	1.59	0.03	0.22	[illegible]	0.02	0.34	43.16	100.25
16	3.73	0.06	0.18	[illegible]		0.20	42.34	99.48
17	1.87	0.08	0.22	[illegible]		0.24	[illegible]	99.74
18	0.80	0.23	0.16	[illegible]		2.34	43.88	100.54
19	0.82	0.23	0.17	[illegible]		1.95	43.95	100.37
20	2.90	0.68	0.19	[illegible]		4.28	43.10	99.67
21	2.00	0.23	0.20	[illegible]		1.19	43.33	99.95
22	0.76	0.22	0.20	[illegible]		1.27	43.75	100.20
23	1.56	0.06	0.18	[illegible]		0.34	43.39	100.27
24	1.80	0.05	0.18	[illegible]		0.23	43.34	99.96
25	0.47	0.38	0.20	[illegible]		1.97	43.53	100.05
26	0.53	0.02	0.20	[illegible]		0.30	43.62	99.85

Additional samples submitted by [illegible] Scott of the Peter Kiewit Company were analyzed with the following results:

SAMPLE NO. (KIEWIT)	SiO_2	Fe_2O_3	Al_2O_3	CaO	SrO	MgO	Loss	Total
A	0.30	0.20	0.14	[illegible]	0.01	0.36	43.67	100.21
B	0.24	0.32	0.06	[illegible]	0.01	0.80	43.67	[illegible]
C	1.26	0.39	0.04	[illegible]	0.01	1.30	43.32	[illegible]
D	1.91	0.08	[illegible]	[illegible]	[illegible]	0.23	42.88	[illegible]
E	0.48	0.10	0.06	[illegible]	0.01	0.35	43.72	[illegible]
F	0.62	0.18	0.01	[illegible]	[illegible]	0.24	[illegible]	[illegible]
G	3.88	0.25	0.02	[illegible]	0.01	0.29	42.42	[illegible]
H	5.80	1.00	0.14	[illegible]	[illegible]	4.20	41.35	[illegible]
I	0.36	0.14	0.09	[illegible]	0.01	0.40	43.88	100.33
J	0.40	0.18	0.06	[illegible]	0.02	0.33	43.72	100.11
K	0.32	0.53	0.06	[illegible]	[illegible]	1.30	[illegible]	[illegible]
L	0.29	0.30	0.06	[illegible]	[illegible]	1.22	43.91	[illegible]
M	0.35	0.11	[illegible]	[illegible]	[illegible]	0.41	43.73	[illegible]
N	0.63	0.14	0.06	[illegible]	[illegible]	1.30	43.81	[illegible]
C	1.43	0.09	0.02	[illegible]	0.02	0.24	[illegible]	[illegible]

Upon examination of the chemical analysis, it is clearly evident that this material would not be acceptable for the production of high calcium white lime.

PORT McNEILL

A deposit of interbedded white and blue gray limestone is present near Port McNeill approximately 2-1/2 miles inland. Part of the deposit has been quarried recently, and thereby presents a good exposure for examination. The actual quarry face is approximately 100 feet high and was worked in two levels. Samples of each individual lithology were taken normal to the strike as indicated on the enclosed drawing, Figure 1. The results of the analysis are as follows:

SAMPLE NO.	SiO_2	Fe_2O_3	Al_2O_3	CaO*	SrO	MgO	Loss	Total
5-1	0.32	0.03	0.02	55.74	0.09	0.13	43.60	99.84
5-2	0.92	0.07	0.21	55.74	0.11	0.26	43.14	99.74
5-3	0.16	0.07	0.25	55.34	0.14	0.17	43.62	99.71
5-4	0.26	0.02	0.14	55.54	0.18	0.17	43.70	99.81
5-5	0.48	0.08	0.20	55.24	0.31	0.23	43.54	99.77
5-6	0.38	0.02	0.04	55.34	0.36	0.16	43.66	99.80
5-7	0.32	0.06	0.14	55.44	0.22	0.23	43.62	99.81
5-8	0.34	0.01	0.08	55.38	0.38	0.17	43.72	99.70
5-9	0.35	0.07	0.23	55.47	0.21	0.26	43.57	100.10
5-10	0.47	0.02	0.06	[illegible]	0.26	0.15	43.38	99.72
5-11	0.31	0.14	0.46	[illegible]	0.23	0.22	43.33	99.69
5-12	3.14	0.02	0.16	[illegible]	0.22	0.12	42.31	99.59
5-13	0.63	0.04	0.34	55.15	0.29	0.23	43.46	99.75
5-14	0.04	0.01	0.21	[illegible]	0.36	0.19	43.[illegible]	99.82
5-15	1.18	0.02	0.14	54.93	0.12	0.19	43.12	99.58
5-16	0.29	0.03	0.08	55.75	0.04	0.25	43.63	100.03

*Includes SrO

SIEWIT SAMPLE NO.								
B-1	0.34	0.13	0.30	[illegible]	0.1[illegible]	0.23	43.37	99.45
B-2	1.45	0.02	0.37	[illegible]	0.02	0.17	42.7[illegible]	99.[illegible]
B-3	0.43	0.02	0.11	[illegible]	[illegible]	0.12	[illegible]	99.85
B-4	0.41	0.04	0.17	[illegible]	[illegible]	0.10	43.[illegible]	99.75
B-5	0.56	0.07	0.25	[illegible]	0.13	[illegible]	43.[illegible]	99.[illegible]
COMPOSITE								
5-4417	0.56	0.06	0.17	[illegible]	0.21	[illegible]	43.[illegible]	[illegible]

Considering area "A" on the enclosed map, Figure 1, approximately two million tons of recoverable material could be derived if the quarry floor were maintained at the same level. Area "B" could provide approximately four times as much as area "A". Additional tonnage could obviously be derived by lowering the floor.

The material crushes well without the excessive production of fines. Upon calcination, however, the resulting quicklime has very poor physical strength and results in the accumulation of excessive fines. Regardless of this detrimental characteristic, the quicklime is extremely active and produces a white putty.

ARISTAZABAL ISLAND

Aristazabal Island is a rather large island approximately 23 miles long and 8 miles wide, which is located in the upper third of British Columbia opposite the lower end of the Queen Charlotte Islands. The deposit is approximately 8 miles in length and several miles wide and is located along the Laredo Channel. The limestone is a coarsely crystalline (crystal 1-3mm), white, massive bedded material. Dikes in the area appear to be widely scattered and relatively few. Excellent shipping conditions exist since there is deep water along the coast, and a small cove is present adjacent to the deposit.

Mineralization of the limestone is apparently absent which results in the production of a clean white lime with a minimum amount of residue. Upon calcination, the material has a tendency to break down, thereby producing an appreciable amount of fines. The resulting product, however, is extremely fast and has a pure white color which is free of any discoloration.

The chemical analysis of a composite sample is as follows:

	SAMPLE NO. 5-4390	LOSS FREE BASIS
SiO_2	0.22	0.39
Fe_2O_3	0.03	0.05
Al_2O_3	0.13	0.24
CaO	55.29	98.55
MgO	0.47	0.84
SrO	0.01	0.02
Loss	43.89	
Total	100.04	

MISCELLANEOUS AREAS

In addition to the areas previously [illegible], several other locations were visited. Many of these locations were immediately eliminated in the field and will, therefore, not be covered. Other areas, such as Hooye River, [illegible] Inlet and [illegible] Inlet were eliminated due to excessive dikes, [illegible] or extremely limited reserves. The limestone [illegible] Flattery, Washington, is a high quality material chemically, but the reserves are limited and is nearly inaccessible.

Limestone is present on Princess Royal Island, but displays numerous dike and is not readily accessible. Perhaps further exploration of the area could produce a location which would have desirable shipping and quarrying characteristics. A chemical analysis of material from this location is as follows:

SiO_2	0.18
$(Fe_1Al)_2O_3$	0.16
CaO	55.38
MgO	0.32
Loss	43.86
Total	99.90

An area which was not visited, but samples were obtained, was Dall Island, Alaska. The material from this area is a black, finely crystalline, carbonaceous limestone. The resulting quicklime produced was white, free of objectionable discolored areas and extremely active. The chemical analysis of this material is as follows:

	SAMPLE NO. CB-3	SAMPLE NO. UC-G
SiO_2	0.42	0.38
$(Fe_1Al)_2O_3$	0.16	0.16
CaO	55.13	55.21
MgO	0.67	0.47
Loss	43.66	43.76
Total		99.98

CONCLUSIONS:

Most of the limestone along the coast of British Columbia have been invaded by successive intrusion of igneous dike. Additionally many other high calcium limestones have been severly fractured and mineralized slightly along the fractures. Both of these characteristics present undesirable qualities in the resulting quicklime.

Of all the areas examined, only a few offer good prospects for the production of high calcium lime. The two most important of these areas are Aristazabal Island and Port McNeill. The deposit located on Aristazabal Island is a very coarsely crystalline limestone composed entirely of calcite crystals 1-2mm diameter. The material burned to a pure white product, but had a tendency to produce excessive fines upon calcination. Chemically, Aristazabal Island limestone is excellent.

The limestone from Port McNeill is a fine grained blue and white limestone. Upon calcination the material suffers a significant reduction in physical strength and produces excessive fines. Chemically, the material is satisfactory.

Limestone from Limestone Island appeared to be satisfactory, but due to numerous dike and sills, it may be difficult to quarry. Princess Royal Island limestone was of excellent quality, but also revealed numerous dikes. Further investigation would possibly result in a much better material. The limestone from Dall Island appeared good chemically and physically, but the area was not examined.