Report on the

Property

of

Lime Products Company

near

Dallas, Oregon

By Ira S. Allison
November 21, 1933

SUMMARY

The quarry of the Lime Products Co. is situated about 6½ miles by road from Dallas, Polk County, Oregon, near the western edge of Willamette Valley and is accessible both by road and by rail. The rock is a tuffaceous, sandy limestone of marine origin. Beds aggregating twenty to thirty feet or more have an average composition of 70 to 75% calcium carbonate. The tonnage readily accessible near the present quarry is estimated to be 300,000 to 400,000 tons, with additional tonages in prospect as development proceeds. The overburden varies from less than 10 feet to more than 25 feet. The principal product is agricultural limestone for treatment of acid soils.

Location and Accessibility

The property of the Lime Products Co., an Oregon Corporation, includes about 186 acres, mostly in SE¼ sec. 11, T. 8 S., R. 6 W., in Polk County, Oregon. The legal description is as follows:

Beginning at a point 9.75 chains South of the Quarter section corner between Sections 11 and 12 in Township 8 South of Range 6 West of the Willamette Meridian, and running thence West 4.63 chains; thence North 2.83 chains; thence West 2.06 chains; thence South 2.78 chains; thence West 9.06 chains; thence North 12.50 chains; thence West 21.76 chains to the center of the Dallas-Falls City County Road; thence South 27 degrees West along said County Road 2.10 chains to the West line of the North-east quarter of the Southwest corner of the Southeast quarter of Section 11 aforesaid; thence East 20 chains; thence South to the North line of Wm. Gillian D. L. C. No. 50; thence East along said line to where it intersects a small branch Northerly through the Northeast quarter of Section 14, thence following said branch in a Northerly direction to where said branch crosses the East line of said Northeast quarter of Section 14; thence North along the East line of Sections 11 and 14 aforesaid to the place of beginning, and containing in all 186.35 acres, more or less, Polk County, Oregon.

The quarry is located in the northwestern part of SE¼ NE¼ SE¼ Sec. 11, six and onehalf miles by road southwest from the county courthouse at Dallas, and about 5 miles by road northeast from Falls City. Its position is shown on Figure 1. One road from Dallas passes within 1.1 miles from the quarry, and another within about 2.3 miles. These roads are surfaced with gravel or oiled macadam and can be traveled at all seasons of the year. The private road connecting with the quarry is graded and in fairly good condition; the addition of a little crushed rock to a few soft spots will be sufficient to maintain it through the wet season. A spur of the Southern Pacific Railway also extends to the quarry site, so that facilities are available for shipment either by rail or by truck.

General Information

Elevation and Topography.— The quarry is situated at an elevation of about 500 feet above sea level in a small valley nestled within rolling hills along the eastern edge of the Coast Range and near the western margin of the Willamette Valley plain. The local relief is generally only 100 to 300 feet; the slopes in the immediate vicinity of the quarry are gentle. (See Figure 2). Drainage is furnished by small creeks which flow southward to Little Luckiamute River and thence to Willamette River.

Climate and Vegetation — The region has a mild, temperate climate with rainy winters and dry summers. The mean annual temperature is about 50° F. and the annual precipitation 60 to 70 inches, mostly in winter. Snowfall is light and the snow does not stay long on the ground. Under these equable conditions outdoor work is pos ible the year around with little delay or inconvenience from unfavorable weather conditions.

Near the quarry the hill slopes are partly open grass-land, and partly covered with brush and small hardwood trees, chiefly oak, while fir predominates on other parts of the holdings.

Water - A small amount of surface water is available in a small branch passing thru the property and additional supplies of water are obtainable from wells.

Power, Fuel and Labor. Electric power is available at the plant from the distribution lines of Mountain States Power Co.; Fuel for heating purposes is supplied by wood, which locally is abundant and cheap, and by petroleum products. Labor experienced in quarring and crushing rock (chiefly for road purposes) is readily available.

History

Local property. The quarry was opened up by parties several years ago for the production of limestone for agricultural purposes. The last production was early in 1932. The exact causes of the shut-down are not known to the writer, but are thought to be associated with problems of management and marketing. No figures are available for the output, but according to the size of the quarry pit, the total may have been ten or twelve thousand tons.

Adjoining Property. The Oregon Portland Cement Co. owns a tract of land lying north of the area under consideration and periodically has produced stone for use in making cement. Their quarry is situated in NW¼ of NW¼ Sec. 12, T. 8 S., R. 6 W., a little more than a half mile north-northeast of the Lime Products Co. quarry, in what is believed to be a continuation of the same deposit. The quarry presents a 40-foot face and is estimated to have yielded more than 100,000 tons of rock.

Description of the Property

Holdings. The property consists of about 186 acres of land, a quarry, a spur track and right-of-way, a partially rebuilt mill for crushing the limestone, some used machinery, a shop, powder house, wood shed, bunk-house, out-buildings and miscellaneous equipment. Although not new, the improvements are serviceable or can be made so at moderate expense. The spur track was appraised at $9548.48 by the Standard Appraisal Co., Portland, Oregon, on February 27, 1828, and an agreement with the Oregon Portland Cement Co. for joint use of about three miles of railroad was valued at $45,000 by the same firm. Although prices have since declined, these assets still have considerable value.

Workings. The quarry is of the open, hill-side type, as shown in the map, Figure 2. Its present shape is somewhat irregular; its principal dimensions are about 75 by 150 feet, with the long axis trending north-northwest and with the opening to the southeast. The overburden had been stripped off the solid rock along the west side of the quarry during previous operations and additional stripping has recently been in progress over an area of about 400 sq. ft. along the east wall, where it is planned to renew operations as soon as the mill can be made ready.

The hillside position permits disposal of waste down the slopes and affords drainage. Although the quarry is now partly wet, mainly as a result of clogging of drains during a period of idleness, the condition is remediable.

Map. A part of the property near the quarry is mapped in Figure 2. The scale of the map is 50 feet to the inch and the contour interval 5 feet. The starting elevation was determined by means of an aneroid which was set at Dallas so the elevations stated are only approximate but the relative elevations were determined with the aid of an alidade and plane table and should be accurate within a range of a few feet.

Geologic Setting

The rock exposed at the quarry is a part of what is locally called the "Dallas beds" occurring in the midst of a thick series of east-dipping sedimentary beds of marine origin. Recent studies of the fossil fauna of these beds by Stokesbary (unpublished thesis, Oregon State Agricultural College, Dept. of Geology, 1933) suggest that they are of late Eocene age. Formation names however, have not been assigned and regional correlations have not been completed.

Petrology

Character of the Rock. The rock is an impure tuffaceous, sandy limestone and grades into a calcareous, tuffaceous sandstone with which it is partly interbedded. It consists of 50 to 75% or more of Calcite (calcium carbonate) and scattered grains of quartz, mica and other mineral fragments presumed to be largely of colcanic origin. Evidently the rock was deposited on the floor of the sea at a time when volcanic origin. Evidently the rock was deposited on the floor of the sea at a time when volcanic explosions were taking place not far away. The marine origin is proved by the presence of shells of foraminifera (about the size of pin-heads), of nautilus, sea-urchins, and other marine animals. The rock is bluish white to dark bluish gray or locally almost black in color- the darker tints being due to finely divided car-bonaceous matter disseminated through the rock. Occasional waterworn pieces of carbonized wood occur here and there. The texture varies with the size of the crystals, from dense, finegrained limestone up to crystalline limestone with crystals about an eighth of an inch in diameter, and with the abundance of the tuffaceous matter which tends to give the rock a sandy texture.

Thickness The rock exposed in the quarry is approximately 30 feet thick at the highest part of the face; its exact extent below the floor of the quarry is not known. Similar rock with some inter-beds of less purity are said to have been penetrated to thicknesses of 5 to 20 feet or more in exploration drill holes, whose positions are shown on the accompanying map. The log of hole A is said to show of 11 ft. of overburden, 14.5 ft. stone, 1 ft. sand, 6.5 ft. stone, 1 ft. sand, 5.5 ft. stone, 0.5 ft. sand, 6 ft. stone, 0.5 ft. sand, and 4.5 ft. stone — total depth 51 ft. The log of hold B is said to show 9 ft. of overburden, 5 ft. stone, 2.5 ft. dirt, 1 ft. stone, 4.5 ft. dirt and 50 ft. stone, total depth 72 feet.

Hole C is said to show 18.5 ft. clayey overburden, 9.5 ft. broker shale and stone, 3 ft. stone, 0 ft. sand and 23 ft. stone—total depth 55 ft. Hole D is said to have penetrated 17 ft. of clayey overburden and 13 ft. of broker shale and rock—total depth 28 ft. None of the cores were seen by the writer but the logs suggest that layers of hard limestone, more or less interbedded with thin sandy streaks, are present in thickness sufficient to justify active quarrying.

Chemical Composition. Samples of rock from this deposit, numbered 402, 461, 462 and 463, were analyzed by the Montana Assay Office, Portland, Oregon, under date of February 15, 1928, and showed 77.03, 70.2, 62.8, and 70.5% $CaCo_3$ respectively, or an average of 70.13%. The exact source, size and other data on the samples however, are not known.

A series of samples analyzed for the Dallas Lime Plant, Harry M. Wirt, Mgr., by the Experiment Station Chemist, J. S. Jones, in June, 1929, gave the following results:

#17,680	66.00% $CaCo_3$
17,681	85.50
17,682	62.50
17,683	76.00
17,684	72.20
17,685	80.00

The average of these six analyses is 73.70% $CaCO_3$.

A sample sent in about the same time by Mr. J. R. Beck, County Agent of Polk County, showed 72.50% $CaCO_3$ (Ex . Sta. No. 17,688).

Another lot sent in by Mr. Beck in Sept., 1929, and analyzed by Mr. Jones, showed the following:

#17,710	77.25% $CaCO_3$	
17,711	77.25%	From stock piles on
17,712	77.30	farms
17,713	79.10	From the quarry
17,714	92.80	Labeled "Rock from new ledge."

The three analyses numbered 17,710 and 17,712, inclusive, are deemed to be of special value because they show the character of the rock which was actually being delivered to the farmers from the quarry at that time and because the sampling was done by the county agent, shose honesty and motives are unquestionable. The average of all the analyses listed above is 73.56% Ca Co_3. Excluding the extremely low analysis (51.75%) and the unusually high one (92.30%), the average is but little different—73.74%.

Analyses of the cores obtained from holes A, B anc C were made by the State Chemist in two series. The first tests were made on pieces taken at specific levels in the holes; the second tests were on sections of the cores, mostly in 10-foot lengths, which were crushed as a whole and then quartered down to convenient size. The writer did not see the cores and had no part in preparing the samples and therefore cannot judge their reliability except on the basis of consistency with the field exposures and the results of other tests. Because they seem to meet these requirements, they are included here as they were reported to me. The results are said to be as follows:

In Hole A

At 19 ft. level	61.56% $CaCO_3$	11 to 21 ft. section	70.875%
24 ft. level	75.55	21 to 31 ft. section	76.875
29 ft. level	73.06	31 to 41 ft. section	81.125
39 ft. level	67.65	41 to 51 ft. section	59.750
50 ft. level	44.32		
Average	64.43	Average 11 to 41 ft.	76.29
		Average 11 to 51 ft.	72.15

In Hole B

At 11 ft. level	52.18%	9 to 22 ft. section	69.875
26 ft. level	72.29	22 to 32 ft. section	66.875
37 ft. level	42.81	32 to 42 ft. section	56.37
		42 to 52 ft. section	54.50
		52 to 62 ft. section	45.375
		62 to 72 ft. section	40.0
Average 55.76		Average 9 to 32 ft. section	68.37
		Average of all	55.50

In Hole C

28 to 38 ft. section	80.5% $CaCO_3$
38 to 48 ft. section	79.5
48 to 55 ft. section	86.87
Average	82.29

Of these analyses those representing Hole A, averaging 76.29% $CaCO_3$, for 30 ft. and 72.15% for 40 ft., those representing the 9 to 32 ft. levels in Hole B., averaging 68.37%, and those representing Hole C, showing the unusually good average of 82.29% for 27 ft., are especially noteworthy.

The average of all the analyses of these core sections is 66.81% $CaCO_3$. If only the upper 21 ft. of Hole B is included, the average is 78.11% $CaCO_3$.

Since the analyses reported above showed variations principally from about 60 to about 80% $CaCO_3$, and an apparent average of somewhat over 70%, the writer on November 18, 1933 selected two samples to serve as a check. One was a composite consisting of twenty pounds of rock broken off in small chunks at vertical intervals of a few inches across a 12-foot face(and thus across the bedding) on the east side of the quarry. Both high-grade and somewhat sandy material were included in the sample without prejudice. The entire amount was crushed and quartered successively and the final portion of about 50 grams ground fine for analysis. This is Sample I. The other sample consisted of one thin slab of rock broken off parallel to the face, including parts of several beds, and weighing 39 pounds. This slab was broken down and quartered, and a finely ground portion of about 50 grams saved for analysis. This constitutes Sample II.

Analysis of these new samples were made by Dr. R. E. Stephenson, Soils Dept., Oregon State College, with the following results:

Sample I------------------65% $CaCO_3$
Sample II-----------------75% $CaCO_3$

These values accord very well with the other data.

The grand average of 32 analyses given above, including four made by the Montana Assay Office, thirteen by Prof. J. S. Jones, thirteen of the core sections by the State Chemist and two new samples by Dr. R. E. Stephenson, shows a content of 70.60% $CaCO_3$. In view of these analyses and the further fact that the quarry previously delivered material of 77.5% grade, it appears that production of rock running 70 to 75% $CaCO_3$ may reasonably be expected. Care in quarrying so as to exclude all weathered and apparently sandy rock and include only firm, fresh rock might raise the grade to a little better than 75%

Weathering The rock weathers to a porous, brown sandy material, principally in the early stages by leaching of the calcium carbonate and in the later stages by alteration of the tuff grains. The leached sandy residue grades into sticky brown clayey over-burden, but the contact with the unleached rock is fairly sharp so that it is possible by simple inspection to segregate good rock from that which has been spoiled by weathering. On the other hand the contact between them is not a plane surface but is highly irregular with irregular peaks and hollows showing a relief of 5 or 6 ft. or more, as is characteristic of coroded limestone surfaces. Most of the hollows are located along joint fissures which have permitted ready access by surface waters. Differential leaching of the beds also tends to produce corrugations parallel to the bedding lines along the sides of joints or at other exposures. These irregularities require the use of some hand labor in clearing the overburden and weathered rock out of the hollows and recesses, although the greater part of the striping can be done by power machinery.

Workability. The rock is easy to drill, easy to blast, and easy to crush and grind. It is not appreciably harder than most limestones in spite of the impurities.

It therefore rates high in workability

Structure. The rock is well bedded but the bedding is shown best by light and dark banding and not by bedding plane separations. Faint sandy streaks and corrugations on the weathered edges also indicate the bedding lines. The beds at the quarry strike somewhat east of north and dip southeast at a gentle angle. Readings taken at different places vary somewhat, possibly on account of local movements or slumping. The regional strike of the area is N. 10°E., and the prevailing dip 5° to 15° eastward. The extension of the quarry will carry the face mostly up-dip or parallel to the strike— both favorable directions.

The main joints in the rock are nearly vertical and strike nearly vertical and strike nearly N-S in one set and E-W in another. A few others do not conform to any system. The joints are spaced from a few feet to a few tens of feet apart. In general they are not abundant. Although jointing facilitates removal of rock, it also facilitates weathering and spoilage of the rock, so that in this case the weak to moderate development of joints is a favorable, rather than an unfavorable, condition.

Quantity of Rock Available

On the basis of the exposures in the quarry and the results of test drilling, together with the analyses quoted above, it appears that there is available in the immediate vicinity of the present quarry a thickness of at least 20 ft. and possibly 30 ft. more of rock of about 75% grade.

The rectangular block in which drill hole B is located, north of the quarry, is approximately 200 ft. square. On the conservative basis of 20-ft. layer of usable rock, this block would yield about 800,000 cu. ft. (200 x 200 x 20) of rock, or (allowing 12 cu. ft. per ton) about 66,666 tons.

On the basis of a 20-foot thickness, a strip east of the quarry, averaging 250 feet wide from north to south and extending say 550 feet east and west (approximately the distance from the quarry to drill hole C), would yield about 2,750,000 cu. ft. (250 x 550 x 20), or about 229,166 tons. A 30-ft. thickness in this block would increase the figure to 343,750 tons. The drill hole data tend to support the larger figure.

Additional rock lies west of the quarry and probably east of C also. Moreover there is additional acreage which has not been prospected, but present data do not justify inclusion of the outlying areas in an estimate of tonnage. It is sufficient for the moment to take account only of the rock readily available in the limited areas immediately north and east of the present quarry. As stated these include about 66,666 tons in the north of B block and 229,166 to 343,750 tons or more in the east block—or a total of 295,832 to 410,416 tons, or in round numbers 300,000 to 400,000 tons. At a production rate of 50 tons per day, 300 days a year, this quantity would last 20 to 26 years; at 100 tons a day, 10 to 13 years; and proportional periods at any other rate.

The estimate of the Standard Appraisal Co., Portland, Oregon, Feb. 27, 1928, gave "1,600,000 tons of limestone averaging 71.8% calcium carbonate on the total area of approximately twelve acres," but the basis of the estimate was not stated. It is possible that future developments may reveal substantial additions to the known reserves but at the present time predictions of enormous tonnages are scarcely warranted. That a very substantial supply is available however is reasonably certain.

Overburden

The overburden has been fairly well removed from an area of about 300 sq. ft. northwest of the quarry, and partially removed from an area of about 400 sq. ft. along the east side. It appears to be 3 to 10 feet thick in this section. The drill hole at A is said to have penetrated 11 feet of overburden, that at B 9 ft., whereas at C and D the overburden of clay and broken rock seemed to be 28 ft. Increase of overburden near C appears to be indicated, but the data are insufficient to show whether it may be expected to average 15 ft., 20 ft., 25 ft. or some other figure. Since A and B are not far from a small wash beside which the quarry was opened, it seems likely that the overburden in the vicinity of these drill holes probably does not exceed 10 to 15 feet except perhaps in local pockets along joints in the underlying rock. Thickness up to these figures will not preclude quarring; whether the removal of the thicker overburden will be economical will depend on future developments. The analyses, it will be recalled, seem to show a good grade of rock underlying the thick overburden at C.

Marketing

The principal use of the product will be for agricultural limestone, the great need of which in the Willamette Valley is attested by soil scientists of Oregon State College and the Agricultural Experiment Station. An area within 100 miles of this deposit could use profitably its entire output at a capacity rate. Outside the Dallas area there are no other limestone beds in Willamette Valley to supply this need. A deposit of vein calcite at Blackbutte, 17 miles south of Cottage Grove, Oregon, and 110 miles from Dallas, is the nearest substitute. Limestone deposits in southwestern Oregon and in extreme eastern Oregon can be supplied to Willamette Valley farmers only at rates which substantially limit consumption. Increased use of local material offsetting unnecessary transportation charges, is greatly to be desired.

The product should be sold on the basis of its content of calcium carbonate and at a sufficient discount to warrant the handling of the inert fraction

Preparation

For use in soil treatment the rock must be crushed and ground to fine sizes. At the time of the writer's visit to the property a size # 9 3/4 Acme jaw crusher for primary breaking, a 2-foot Smith gyratory crusher and a 12 x 30 inch Union Iron Works roll, operated by 30-, 40-, and 20-horsepower General Electric motors using 220-volt current, together with appropriate conveyors and hoppers, all more or less used, were being installed and should be ready for operation within a short time.

Respectfully submitted

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