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STATE DEPARTMENT OF GEOLOGY & MINERAL INDUSTRIES
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SERPENTINE - SUPERPHOSPHATE FERTILIZER

A discovery by a New Zealand chemist showed that serpentine, essentially magnesium silicate, mixed with commercial superphosphate produced a superior fertilizer at a lower cost to the farmer. Because of the widespread occurrence of serpentine in certain areas of Oregon, the Department wished to obtain authoritative information concerning this adaptation of serpentine for fertilizer and wrote to the Mines Department of New Zealand to obtain up-to-date information. The following letter was received in reply:

"Mines Department
P.O. Box 184, Te Aro
Wellington, New Zealand
16th January, 1945

"Dear Sir,

I have to acknowledge receipt of your letter of November 10th containing an enquiry as to the use of serpentine in fertilizers in New Zealand.

Finely ground serpentine is used in the preparation of serpentine superphosphate which is prepared by mixing 1 part of ground serpentine with 3 parts of hot superphosphate. The resulting mixture has many advantages on the straight superphosphate in particular the drying of the serpentine and superphosphate mixture due to the binding of hygroscopic water into water of crystallization of the new phosphate compounds formed during the reaction between the components of the mixture, facilitates the application of the fertilizer to the ground by the drilling machine, preserves the containing bags and generally makes for easier handling. Again the reaction results in the reduction of water soluble phosphoric acid to less than 4 per cent while the content of citric acid soluble phosphoric acid remains unchanged. The reduction on content of water soluble phosphoric acid is accompanied by a marked increase in the water soluble magnesium while silica and iron also appear in a readily soluble form. As the result of extensive field trials, it has been established that serpentine superphosphate is in all cases equal in value to standard superphosphate while in many cases it possesses greater value.

Its use has now become obligatory in New Zealand as owing to the occupation of Nauru Island by the Japanese, New Zealand is cut off from its main source of rock phosphate while there are enormous deposits of serpentine available in New Zealand. The use of serpentine helps to eke out our limited supplies of rock phosphate.

In 1943 some 62,000 tons of serpentine were used by the fertilizer industry in New Zealand as against 31,000 tons in 1942. Present indications are that the use of serpentine will expand and will be maintained even in after war years when phosphate supplies are again readily available.

"The germ of the idea was obtained from Russia where dunite has been used with the more concentrated triple superphosphate. Particulars of the Russian work by I.V. Druschinin are contained in Transactions of Science Institute for Fertilizers and Insecto-fungicides, Leningrad, (1936) while references to this work are contained in American Chemical Abstracts in particular in 30,8493 (1936) and 31,3193 (1937).

References to local practice will be found in issues of the New Zealand Journal of Science & Technology in particular the issues May 1942, September 1942, and November 1942.

Yours faithfully,

/s/ C.N. Benney
Under-Secretary"

An abstract from the New Zealand Journal of Science and Technology, issues of May, September, and November 1942*, provides some additional information concerning the technology of this fertilizer.

Results of experiments conducted in Russia showed that when from 8 to 9.5 percent dunite was added to the superphosphate, plant growth was greater than with straight triple superphosphate. This extra boost is attributed to the magnesia and colloidal silicon dioxide provided by the addition of the dunite. Raw, commercial triple superphosphates and the less concentrated superphosphates are difficult to handle due to excess moisture, which being acidic, attacks the containing bags. Also, the same moisture tends to make lumps which cause difficulty when distributed by means of a drill. The reduction of the excess acidic moisture is accomplished in two ways: first, the acid is neutralized by the dunite, and second, the excess moisture is taken up by rendering the material less hygroscopic. Although the Russians were merely attempting to neutralize their superphosphate without destroying any of its beneficial effects, the New Zealand process causes wholesale reversion of calcium superphosphate by addition of as much as 25 percent serpentine. This reversion, resulting in a lessening of water-soluble P_2O_5 without any decrease in the citrate-solubility, does not affect the fertilizing value of the serpentine-superphosphate. The unusual feature of this reversion is that the complex chemical reactions can take place in a dry, or nearly dry state, and at normal temperatures. The serpentine is merely finely ground (92.4 percent -100 mesh; 81.5 percent -165 mesh) and intimately mixed with three or four times as much superphosphate. When mixed dry the reaction between the two constituents was virtually complete at the end of two weeks. When 5 percent water was added during mixing, the reaction was greatly accelerated and was practically complete in four days.

A comparison of the water-soluble constituents of commercial superphosphate, dry mixed serpentine and superphosphate (1:3), and wet mixed serpentine and superphosphate (1:3) is given in the table below:

	Water-soluble constituents			
	P_2O_5	CaO	MgO	SO_3
Superphosphate	20.5 %	14.5 %	0.3 %	10.6 %
Serpentine-superphosphate, dry mix 14 days after mixing	7.90	3.3	2.2	3.6
Serpentine-superphosphate, wet mix 14 days after mixing	1.68	2.23	1.05	3.70
Small factory sample, wet mix (1:3) 12 days after mixing	6.46	2.23	2.05	2.76

* Copies obtained through the courtesy of Professor George W. Gleeson, Oregon State College.

From the table it will be noted that the dry-mixed sample did not react as completely as either of the two wet mixes. Difficulties in properly wetting the small factory samples, plus near-freezing temperatures during the test probably account for the difference between the two wet mixes. By allowing a greater reaction time for the factory sample an analysis much closer to the laboratory wet mix was obtained. Both wet-mixed batches became dry enough to use after three or four days and were dusty by the time the experiment ended. This apparent drying up is not due so much to any real moisture loss as it is to a redistribution of the contained water between hygroscopic water and water of crystallization.

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EARLY OREGON MINING REGULATIONS

In the early days of western mining when activity was practically all confined to placering by individuals or groups, it was soon found necessary by the miners to adopt strict regulations to prevent abuses and inequities by those who had no concern for the rights of others. The following reproduction from The City Journal of Canyon City, Oregon, January 1, 1869, gives the rules adopted for the John Day District in 1862. These rules show the result of experience in other boom districts starting at Colema, California in 1848.

The City Journal

"A Paper for the Miner, Farmer, Mechanic and Professional Man."

Vol. 1 Canyon City, Grant County, Oregon, January 1, 1869. No. 2

MINING LAWS OF JOHN DAY DISTRICT,

Adopted by the Miners, at Canyon City,
on Wednesday, Dec. 31, 1862.

Article 1. - This district shall be known as John Day Mining District, and shall hereafter be considered to contain all the territory embraced within the following bounds: Beginning at a point on John Day river on a straight line with the dividing ridge lying on the west side of Canyon creek; thence following said ridge to the dividing ridge separating the waters of the Malheur from those of John Day; thence following said ridge in an easterly direction to the sumit of the main ridge adjoining and east of Bissel's creek; thence down said ridge to John Day river; thence down said river to place of begining.

2. There shall be a Recorder elected, who shall hold office for one year from the date of his election or until his successor be elected, whose duty it shall be to keep a record of all miners' meetings held in the district; to record all claims, when requested by the claimants, in a book to be kept for that purpose; and to call miners' meetings, by posting notices in three public places in the district, when seven or more miners of the district shall present him with a petition stating the object of the meeting: provided, that in the absence of the Recorder the above named number of miners shall not be disqualified to call a meeting.

3. All claims located in this district, after the passage of these laws, shall be of the following size, viz.: A Creek Claim shall be seventy-five feet running with the stream, and extending from high water mark to high water mark. A Bank Claim shall be seventy-five feet running with the stream and extending back three hundred feet from creek claims. A Tunnel or Shaft Claim shall be seventy-five feet front and extending to the center of the hill. A Surface Claim shall be one hundred and fifty feet by one hundred feet. A Gulch Claim shall be one hundred and fifty feet running with the gulch and fifty feet in width on each side of the chanel.

4. No person or persons shall be allowed to hold more than two full claims within the bounds of this district by location, nor shall they consist of more than four parcels of ground the sum of the area of which shall not exceed two full claims; provided, nothing in this article shall be so construed as to prevent miners from associating in companies to carry on mining operations, such companies holding no more than two claims to each member, one of which must be of one class of claims and the other one of another class of claims.

5. That each gulch, bank and surface claim shall be worked within five days after the date of location, if water can be obtained.

6. That each person or company holding tunneling or shafting claims, in order to hold the same, shall be required to perform work to the amount of two days in each week. Work done on any part of a company's claims secures the title to the whole of it.

7. All persons holding claims in Canyon creek are exempted from working the same until the 15th of June next.

8. All work done preparatory to working claims, such as procuring sluice boxes or other machinery, diging tail or drain races, or cutting ditches for the purpose of bringing water upon the said claims, shall be considered the same as work done upon said claim or claims.

9. Any person or persons claiming more ground or claims than the laws of this district entitles them to forfeits all right and title to any claim whatsoever, and any and all claims of such person or persons are hereby subject to re-location.

10. Any and all claims now located, or that may be located and worked, can be laid over at any time, for any length of time not to exceed six months, by the person or persons holding the same appearing before the Recorder of the district, with two or more disinterested miners, who shall certify over their own signatures that the said claim or claims cannot be worked to advantage, and by having the same recorded according to the law of the district and by paying a fee of fifty cents each; provided that each claimant shall sign the record in person or by legal representative, stating at the same time that said claim is held by location or by purchase.

11. All persons may hold any number of claims by purchase, provided they are represented according to the provisions of the foregoing laws, previded such claims shall be shown to be bona fide purchases.

12. Claims shall be forfeited when parties holding them have neglected to fulfill the requirements of the proceeding articles, or have neglected working them for five days after water can be procured, unless prevented by sickness or other legal cause.

13. Any person or persons working bank, hill, gulch or surface claims shall not be allowed to run their tailings upon river or creek claims to the injury of the parties while working said river or creek claims.

14. The holders of a claim or claims shall have the right to work the same without any hindrance from later claimants. Subsequent locaters shall not be allowed to dam up the water so as to turn it back on the prior claim, nor to run tailings, nor to erect any obstruction to the detriment of the prior claimants.

15. From and after this date, parties owning claims in a creek, ravine or gulch, shall be entitled to cut a tail or drain race through any ground below them; such tail race shall be cut through the lowest point in the center of said creek or gulch, and any or all dirt that comes out of the aforesaid race shall be depesited on the bank. Any objection, if such should be made, shall be left to the decision of four referees, and in case of disagreement, they to choose an umpire.

16. It shall be the duty of the Recorder to place on Record all claims brought to him for that purpose, when such claims shall not interfere with or affect the rights and interests of prior locaters, recording the same in order of their date; for which service he shall receive fifty cents for each claim recorded, and fifty cents for recording transfers, bills of sale, deeds of and to any mining property. It shall also be the duty of the Recorder to keep his books open at all times to the inspection of the public. He shall have the power to appoint a deputy, for whose official act he shall be held responsible.

17. The limits of this district shall not be changed without the consent of a regularly called mass meeting of the miners of the district.

18. No miners' meetings held outside of Canyon City for the purpose of making laws to govern any portion of the district, or to amend these laws in any manner, shall be considered as legal.

19. No Asiatic shall be allowed to mine in this district.

20. These laws may be altered or amended by a two-third vote of those present owning claims in the district, at any time ten days' notice of such intention shall have been given by posting notices in three public places in the district.

21. All mining laws made previous to the foregoing are hereby repealed.

Geo. L. Woodman,
Recorder.

Dec. 31st, 1862.

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BAUXITE FOUND NEAR SALEM

High-grade bauxite float has been found by the Oregon Department of Geology and Mineral Industries in several localities both north and south of Salem. Pieces of this float made up largely of gibbsite, a well known bauxite mineral, are scattered widely over the surface, and also occur as nodules distributed in the overburden at places in the southern part of the Eola Hills and in several localities in the Salem Hills. Chemical analyses of this float show 50 to 60 percent alumina, 1 to 13 percent iron, and 2 to 6 percent silica. The Department has been searching for and investigating bauxite deposits for over a year.

As exposed in some roadcuts under this float material, low-grade high iron bauxite occurs as a bedded deposit several feet thick, similar in chemical characteristics to the ferrugineus bauxite found in Washington and Columbia Counties and described in a recent report issued by the Department. Alcoa Mining Company is now making an extensive investigation of the Washington County deposits.

Samples so far analyzed by the Department indicate that the Salem low-grade ferruginous bauxite contains about 35 percent alumina, 20 percent iron, and 10 percent silica. Insufficient sampling has been done to predict what the average grade will be for all deposits.

From the small amount of field work so far done by the Department, the deposits in the Salem area appear to have large areal distribution and reserves may be extensive.

According to the Department, the large amount of high-grade gibbsite found as float may be significant. This float is much more common in the Salem area than in Washington and Columbia Counties. Whether or not the large amount of high-grade float material will prove to be commercially important has not yet been determined. If it is proved to occur in large enough quantity, it will be highly important as a source of alumina to supply Northwest aluminum plants. High-grade bauxite is also important in the chemical industry, as a refractory, in oil refining, and as an abrasive. The Department plans further field work in the Salem area with particular attention to commercial possibilities of the high-grade material.

Sampling records of the Salem deposits are on file in the Department office at 702 Woodlark Building, Portland, and may be examined by interested persons.

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SPECTROGRAPHIC ANALYSES OF OREGON CLAYS

Recently spectrographic analyses were made by the Department on specimens of clays from the Hobart Butte and Molalla deposits. This preliminary work was to indicate the elements in the clays which occur in minor amounts. Further work in the study of more representative samples is planned. The Hobart Butte specimen was a piece of white kaolinite with no arsenic minerals. The Molalla clay specimen was light-gray in color and probably was representative of relatively high iron. Following are the analyses of the two specimens:

	Hobart Butte	Molalla
Concentration	Element	Element
Over 10%	Silicon Aluminum	Silicon Aluminum
10% - 1%	Titanium Strontium Sulphur	Titanium Iron
1% - 0.1%	Calcium Iron Barium	Calcium Magnesium Sulphur
0.1% - .01%	Zirconium Chromium Vanadium Lithium Boron	Zirconium Chromium Vanadium Lithium Sodium Manganese Barium Strontium
.01% - .001%	Magnesium Manganese	Cobalt Nickel Boron
Below .001%	- - -	- - -

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CLEARING HOUSE

CH-No. 83: For Sale, gold mine, Idaho County, Idaho, about 2½ miles south of Dixie postoffice. Known as Robinson Dyke. Large tonnage available. Surface mining methods may be employed. Formerly produced concentrates shipped to Bunker Hill smelter. Anyone interested should write or see owner, Mrs. Mary Robinson, King Albert Apts., 1809 S.W. 11th Avenue, Portland, Oregon.

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