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PUMICE AND PUMICITE

by

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INTRODUCTION

The State Department of Geology and Mineral Industries is frequently asked, "What is my pumice worth?" The question, in a general way, is answered in this pamphlet. Since samples of pumice or pumicite from different deposits are rarely identical in physical properties, each deposit must be fully investigated, and its product examined for texture and composition when development is being considered. The following text defines and describes pumice and pumicite, classifies each according to physical characteristics, and discusses the sales volume and prices in the various classifications.

Definition

Pumice is a light, porous, volcanic rock, made of frothy natural glass, and usually found in fragmentary form, the fragments varying in size up to eight or nine inches in diameter. Pumicite, on the other hand, is made up of an accumulation of finely divided glass-like particles or shards. It is similar in chemical composition to pumice, and was blown from volcanoes during periods of eruption and subsequently more or less air-classified according to particle size while being transported by winds. The material may be loose and sandy, or the individual particles may be more or less cemented together.

Chemical Properties

Pumice and pumicite have a chemical composition which, although quite variable, is substantially as follows:

	<u>Percent</u>
Silica	72.0
Alumina	14.0
Potash and Soda	7.0
Lime and Magnesia	2.5
Iron oxide	1.0
Loss on ignition	3.5

Physical Properties

Two physical properties commonly used to describe minerals or rocks are hardness and specific gravity. Pumice is unique among rocks in that its specific gravity and hardness must be considered from two standpoints. The true hardness of 5.5 to 6 applies to the glassy material in the individual cell walls; the apparent hardness applies to the whole cellular structure. The apparent hardness may be as low as 2 or 3 and is an important factor in determining the abrasive qualities of its manufactured abrasive powders,

especially in the coarser sizes. In reality, this apparent hardness is the ability of the pumice to resist breaking down to finer sizes of lower abrading effectiveness.

The true specific gravity is the specific gravity of the glassy material in the cell walls; while on the other hand, the apparent specific gravity applies to the whole cellular structure including cell walls and air cells. Thus the true specific gravity is approximately 2.5, while the apparent specific gravity is often less than one (lump pumice usually will float in water).

The quality of pumice may be largely determined by its appearance. The important factors are color, texture, and luster. Most pumice is white to gray, but some varieties are yellow or buff, red, brown, or black. The texture depends on the size and uniformity of the particles or solidified bubbles and also on the amount of crystalline or gritty minerals included in the porous mass of glass. The luster varies from a dull earthy appearance to a bright silk-like sheen.

Pumicite particles have a hardness and specific gravity approximately the same as the true hardness and true specific gravity of pumice. Particle size may be considered as one of the physical characteristics of pumicite, because in nearly all cases, deposits are concentrations of certain size ranges due to the classifying action of the wind. When mixed with water, good pumicite settles with no tendency to form a milky or turbid suspension.

To the unaided eye pumicite looks like closely packed sand. The purer deposits are white to bluish gray; impurities or weathering may color the material yellow, red, or brown. Minute sparkles are readily noted when a specimen is viewed in bright sunlight. Magnified particles are flat, curved or shard-like, transparent, and glassy in appearance.

ECONOMICS

Classification based on Uses and Prices

Producers have three main fields or markets for their product. First, there is the highest priced field, that of select lump pumice; second, there is the medium-priced field of ground and graded pumice and pumicite, used extensively for a number of commodities and purposes listed further in this article; and third, there is the lowest-priced field of construction products such as building blocks, cast walls, etc., using pumice in the aggregate because of its light weight and good insulating qualities. Because of the wide price differential between the three main fields, and also because of the difference in equipment necessary to manufacture products for these fields, the producer's first problem is to classify properly his material.

High Grade Lump Pumice: Complete specifications for high-grade lump pumice are difficult to enumerate because requirements for different uses vary, but in general the following characteristics are desirable: Color, white to light gray or pink; size, over 3" in diameter; texture, small uniform vesicules (holes or voids), and cell structure with silky appearance; there should be no large holes, no quartz grains, no crystals of feldspar or other gritty non-cellular particles. Performance in actual use is the final determining factor in evaluating this material.

"Lump pumice is used for hand-rubbing of stone, such as marble, for rubbing down paint surfaces, for finishing automobile bodies, for finishing leather, in lithographic work, and to a considerable extent in the electroplating industry for cleaning buffing wheels. A small quantity of the highest grade material is used as a toilet article". 1/

Pumice and Pumicite used as Powders: Pumice and pumicite, not suitable for select lump pumice, are milled and sold as powders with various degrees of fineness. This classification has three sub-divisions: (1) abrasive and polishing powders produced by grinding pumice; (2) scouring and polishing powders produced from pumicite; and (3) pumice for acoustic plaster.

Abrasive and polishing powders made from pumice must be hard, sharp and uniform in texture and particle size. Abrasive qualities depend to a considerable extent upon the shape of the individual particle and the apparent hardness. Scouring and polishing powders are preferably made from pumice rather than from pumicite because the flat, plate-shaped pumicite particles tend to slide over a surface rather than abrade it.

Pumice for acoustic plaster, which is used for sound insulation, is probably the highest priced of the three divisions. Only the whitest and most porous grades are suitable for this use. The large increase in the use of pumice for acoustic plaster is due to the development of radio and talking pictures; to the increase in number of apartment dwellings; and to the increase in traffic and other city noises. The value of acoustic material is dependent largely upon the exposed surface of the wall. The porous nature of pumice tends to absorb the sound waves and keep the reverberations at a minimum. Sizes used for this product are usually between eight and thirty mesh.

Pumice in Concrete Aggregate: The two deciding factors for determining the commercial value of pumice for concrete aggregate are lightness and strength of the rock, and nearness to a center of population. It is also desirable that it be free from clay and iron stains. This class of material is the lowest priced of the three main classifications because in most cases it must compete with sand and gravel.

USES OF VARIOUS CLASSIFICATIONS OF PUMICE AND PUMICITE

Lump Pumice: (U.S. Bureau of Mines Information Circular 6560, "Pumice and Pumicite" by Paul Hatmaker)

<u>Grade</u>	<u>Description</u>	<u>Utilization</u>
AA	Small, very finest quality	Automobile finishing
A	Little larger, almost same grade and quality as AA	do
XXC	Size of one or two fists	do
BBC	Approximately same as XXC but inferior grade	do
WW	Finishing stone and marble
LIT	About 7 inches in diameter	Lithographic work
HP	Similar to LIT, inferior grade	Finishing leather
1717	Lightweight, in bags	Electroplating work
BD	Cleaning buffing wheels in electroplating industry

1/ U.S. Bureau of Mines I.C. #6560, "Pumice and Pumicite", by Paul Hatmaker.

Ground Pumice and Pumicite: (Barnsdall Tripoli Corporation, 1938)

For general use, we list the following grades:

<u>Number</u>	<u>Size</u>	
Taylor Standard Screens	(-14+30)	Acoustic Plaster, Wooden handles and Wood Turning
No. 3	(-30+45)	Wooden Handles and Wood Turnings Erasers, Ink, Filtration
No. 2	(-35+50)	Filtration
No. 1½	(-40+60)	Buttons, Polishing in tumbling barrels Mechanics' Hand Soap, Paste and Powder form Steel and Copper Plates, finishing
No. 1	(-45+70)	Buttons, Polishing in tumbling barrels Steel and Copper Plates, finishing Mechanics' Hand Soap
No. ½	(-60+100)	Band Instruments, polishing Rubbing down and finishing paint Finishing Silverware Mechanics' Hand Soap
No. 0 ¾	(-100+150)	Band Instruments, polishing Dentures Glass Beveling and Cut Glass polishing Piano, finishing wood and final finish Silverware, polishing
No. 0 1/2	(-100+170)	Band Instruments, polishing Dentures Finishing Furniture Mirrors, polishing Silverware, finishing
No. 0	(-150+200)	Silverware, finishing Buttons, polishing in tumbling barrels Dentists
No. F	(-100)	Auto bodies, smoothing up before painting Furniture finishing Mirrors, polishing
No. FF	(-150)	Rubbing down and finishing paint Rubber polishing Soap Fluxing Agent, toy manufacturers Leather (suede)
No. FFF	(-200)	Druggists, resale in small packages Electroplaters Erasers, pencils Furniture finishing Lithographers Fluxing Agent, toy manufacturers
No. FFFF	(-300)	Air Floated Product for extremely fine work

SALES AND PRICES

The following data will furnish the prospective producer with a guide as to the sales volume and prices of the various products for which his raw material may be suited. The trend in general is towards greater consumption and higher prices for all products, with the largest increase in the construction field. Sales for concrete admixture and concrete aggregate increased in 1939 to 20,179 short tons or a gain of 175% over 1938 figures. Sales for acoustic plaster were 77% higher in 1939 than in 1938.

TABLE I
*Pumice and Pumicite
Sold or Used by Producers in the U. S. 1937-39

<u>Use</u>	1937		1938		1939	
	Short Tons	Value	Short Tons	Value	Short Tons	Value
Abrasive; cleansing, scouring compounds	48,608	\$193,559	47,103	\$188,807	52,521	\$227,447
Other abrasive uses	1,442	17,368	938	8,499	(1)	(1)
Acoustic Plaster	3,641	54,459	3,080	54,055	5,444	97,181
Concrete admixture & aggregate	13,839	23,650	7,596	18,279	20,719	24,852
Other uses	3,477	12,899	7,115	43,228	10,475	75,300
	<u>71,007</u>	<u>\$301,936</u>	<u>65,742</u>	<u>\$312,886</u>	<u>89,159</u>	<u>\$424,780</u>

An analysis of the above figures indicates that pumice prepared for acoustic plaster commands the best average price (except for a small quantity of high grade lump pumice) and has a healthy upward trend in sales; abrasives, for other than cleansing and scouring uses, are next in average price; pumice or pumicite for concrete admixture and aggregate, for cleansing and scouring, and for some other unlisted uses are in the lowest price bracket.

An analysis of sales and prices is not complete without considering importations. Crude Italian pumice formerly sold for an average of approximately \$7.50 per ton, Atlantic ports, including duty. Ground Italian pumice sold for \$25.50 C.I.F. Atlantic ports, including the import tariff of \$15.00 per ton for processed pumice. American ground Italian pumice, sized and packed in bags, has sold for \$30.00 or more per ton f.o.b. mill, New York. Some grades of Italian lump pumice are much higher priced, running from 1.5¢ to 14¢ per pound. Tonnage figures for high grade Italian lump have averaged less than 0.5% of total pumice sales, and this small fraction had an average value of approximately \$35.00 per ton. It can be readily seen that the amount sold over 1.5¢ per pound was really insignificant.

* From U.S. Bureau of Mines Minerals Yearbook 1940.
(1) Included under other uses.

SOME FACTORS GOVERNING MARKETING OPPORTUNITIES FOR OREGON PRODUCERS

Once the suitability of a producer's raw material for certain products is determined, and the past sales volume and price examined for clues to future trends, marketing factors applying to his individual enterprise must be examined.

The transportation cost to the main consuming markets is the most important factor which Oregon producers must consider. Freight from Oregon sources to New York via the railroads is about \$1.16 per hundred pounds and about 90¢ per hundred by rail and water. California pumice shipped by rail to Galveston and thence by water is 77¢ per hundred weight. Pumice from Grants, New Mexico, is shipped by rail and water to the Eastern seaboard for \$0.44 per hundred weight. This means that unless Oregon's pumice products are of better quality than the California and New Mexico material, Oregon's output must be sold at the plant for about \$2.50 to \$7.00 per ton less. It is evident from this that Oregon producers' best opportunities lie in producing superior products, or in supplying a consuming market close at hand.

Cleansing and Scouring Powders: The largest single market, that of cleansing and scouring powders, apparently must be considered outside of Oregon's marketing sphere because these products do not require a premium grade raw material, consequently such a market is better supplied from deposits closer to the main consuming centers. The small tonnage consumed in the State would hardly justify the installation of the necessary processing equipment.

Concrete Admixture and Aggregate: This is the lowest priced field, but it offers opportunities to producers of building tile, etc. Accessibility is the chief requirement. The main consuming market should be within one hundred miles of the deposit.

Acoustic Plaster: According to the figures in Table I, pumice for acoustic plaster commands a price considerably higher than many of the various other products. This may indicate a relative scarcity of satisfactory raw materials. This being so, transportation is not such an important factor, and Oregon's producers should investigate the possibilities in this field, (as stated previously in this paper sales increased 77% between 1938 and 1939). However, very little acoustic plaster is used in Oregon, and apparently the tonnage of 5,000 to 6,000 tons used in 1939 was scattered all over the United States. This indicates a rather difficult sales problem. Large plaster concerns in the most populous centers would probably be interested in acquiring a suitable grade and may prefer to deal direct with the producer rather than through a broker. Acoustic plaster sells for approximately \$70.00 per ton in Portland, while ordinary plaster sells for approximately \$20.00. The high price is probably due to the fact that the sales volume is so small in any one locality that batches must be specially made up, with an attendant high delivery cost. Nevertheless, despite the relatively small volume consumed, this field looks promising.

High-grade Lump Pumice: Although the consumption of high-grade lump pumice is only a small fraction of the total pumice used, a better opportunity exists now for the sale of this product than at any time in the past if material equal to Italian lump can be found. There are two drawbacks to entering

this field: (1) the difficulty of finding high-grade pumice, and (2) the relatively small demand for this type of product. None of the samples examined by this Department in 1941 to date could be considered as first quality lump pumice. Probably 350 tons of this material annually could be consumed in the United States. The average annual consumption of imported high-grade lump pumice from 1921 to 1930 was 353 long tons at an average value of \$37.87 per long ton. Evidently very little was sold at the higher prices in the ten-year period mentioned. In 1939, the average value of pumice used for abrasives (which would include high-grade lump) was approximately \$7.50 per ton. This means that only a very small proportion of the select lump pumice could have been sold. However, since importations have ceased, domestic producers of high-grade lump pumice have an opportunity to supply the relatively small high-priced market.

Pumice for Manufactured Powders (other than scouring and cleansing compounds): Pumice suitable for grinding and grading in various degrees of fineness is next in value to select lump grades. The producer has the choice of shipping the crude product to companies specializing in milling and grading this material, or of installing and operating his own milling equipment. Specifications for a good grinding grade or its abrasive qualities depend on its ultimate use. Abrasive qualities depend on the hardness, sharpness, uniformity, and shape of the particles. Microscopic examination is useful for preliminary classification, but performance in actual use is the final test. The production of pumice powders is a specialized field requiring an intimate knowledge of the consumer's problems, a carefully controlled plant, and a competent sales organization. For this reason, the production of finished pumice powders is not a lucrative field for the small operator.

*LIST OF BUYERS

"The following are some of the more important buyers of pumice and pumicite, particularly for abrasive use:

Los Angeles Soap Co., 617 East First St., Los Angeles, Calif.
Allied Industrial Products Co., 124 N. May St., Chicago, Ill.
Cudahy Packing Co., 111 West Monroe St., Chicago, Ill.
Holman Soap Co., 3104 Fox St., Chicago, Ill.
Matchless Metal Polish Co., 842 W. 49th Place, Chicago, Ill.
Mineral Soap Manufacturing Co., Lowell, Mass.
Leon Hirsch & Son, 368 Greenwich St., New York, N.Y.
Charles B. Chrystal Co. (Inc.), 11 Cliff St., New York, N. Y.
Stanley Dogget (Inc.) 1 Cliff St., New York, N.Y.
A. Klipstein & Co., 11 Darrow St., New York, N.Y.
Whittaker Clark & Daniels (Inc.), 245 Front St., New York, N.Y.
Mr. Jerome Alexander, 50 East 41st St., New York, N.Y.
Rome Soap Manufacturing Co., Rome, N.Y.
Larkin Co. (Inc.), 680 Seneca St., Buffalo, N.Y.
The DuBois Soap Co., 1120 W. Front St., Cincinnati, Ohio
National Sales (Corporation) 31-35 East 13th St., Cincinnati, Ohio.
Charles W. Young & Co., 1247 No. 26th St., Philadelphia, Pa.
Charles A. Wagner Co. (Inc.), 814 Noble St., Philadelphia, Pa.

* U.S. Bureau of Mines Information Circular 6560, "Pumice and Pumicite", by Paul Hatmaker.

Probably large plaster producers in the most populous centers would also be interested in buying pumice for acoustic plaster.

*LIST OF IMPORTERS

The following firms are among the more important importers of pumice, and due acknowledgement is made for their cooperation in assembling information on foreign material.

James H. Rhodes & Co., 153 W. Austin Ave., Chicago, Ill.
Charles B. Chrystal (Inc.), 11 Cliff St., New York, N.Y.
K. R. Griffiths & Co. (Inc.), 110 East 42nd St., New York, N.Y.
Hammill & Gillespie (Inc.), 225 Broadway, New York, N.Y.
Whittaker Clark & Daniels (Inc.), 245 Front St., New York, N.Y.

At the present time (1941) most imports have been cut off.