CIRCULAR 105

Evaluation Of Ground Mica Products From New Mexico Pegmatites

by WILLIAM E. HORST and ROSHAN B. BHAPPU

STATE BUREAU OF MINES AND MINERAL RESOURCES NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY CAMPUS STATION
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Abstract

In accordance with the primary objective of the New Mexico Bureau of Mines and Mineral Resources to assist in developing the mineral resources of New Mexico, an investigation was made to demonstrate that ground-mica products of commercial quality could be produced from potential raw material sources in New Mexico.

Samples from several local sources of mica in San Miguel and Rio Arriba counties and one sample of sericite from Valencia County were obtained for processing and subsequent evaluation in the laboratory at Socorro. Various grades of dry- and wet-ground mica products were made from each raw-material sample, as well as measurements pertaining to the physical properties of the finished mica products for comparison with commercial quality products.

Results of the development project showed that the mica and sericite examined from local sources appear to be satisfactory for manufacturing commercial grades of ground-mica products. One of the mica-bearing samples was found to be inferior for making ground-mica products when color is an important physical property. Products made from this particular sample were off-color, being light tan compared with the white colored products made from other mica samples.

Other mica-bearing deposits throughout New Mexico would require evaluation to determine the most outstanding local sources of mica based on ground-mica product quality and the economic value of the potential ore deposit.

Introduction

Consumption of ground-mica products is closely related to the status of the building industry and fluctuates accordingly. Current consumption of ground-mica products is about 100, 000 tons a year with a total product value of almost six million dollars annually. A breakdown of the various uses of ground mica, which includes wet- and dry-ground products, is shown in Table 1. In 1967 fifty-nine per cent of the domestic production was produced in North 'Carolina and the balance was produced in nine states (Alabama, Arizona, California, Colorado, Connecticut, New Mexico, Pennsylvania, South Carolina, and South Dakota).

TABLE 1. GROUND-MICA PRODUCTION AND VALUE, 1966 AND 1967[1]

Ground-Mica Use	1966 Tons	1966 $/Ton	1967 Tons	1967 $/Ton
Roofing	26,211	34	27,161	34
Rubber	7,356	105	6,196	109
Paint	17,192	90	22,374	88
Plastics	927	138	903	151
Welding rods	799	49	525	48
Joint cement	24,860	65	17,063	55
Other uses	26,105	48	22,831	48
Total	103,450	61 (av.)	97,053	53 (av.)

(1) Minerals Yearbook, 1967, vol. I-II, Mica, p. 731-740, U.S. Dept. of the Interior.

The current growth rate of population and building in California and Texas offers a potential growing market for ground-mica products. It is estimated that about 15 to 20 per cent of the ground-mica production is consumed annually in the California and Texas markets and the demand for ground mica should continue to grow in these areas. The current mica requirements for these market areas are met by ground mica produced in the East and shipped via railway freight. Since New Mexico is favorably located freight-wise to serve the consumer markets of California and Texas, the mica deposits of New Mexico could become important sources of raw material provided that the quality of the ground-mica products are comparable with or better than existing commercial products.

Recent investigations at the New Mexico Bureau of Mines and Mineral Resources have shown that most of the New Mexico micas evaluated are equal to or superior to existing commercial products. The current mica production in New Mexico is very small; however, it is reasonable to believe that mica production for the ground-mica markets could be significantly increased with an adequate return on investment for the operator. The freight advantage and potential product quality of New Mexican mica are important factors in the western mica markets.

Uses of ground mica are dependent on the product's physical and chemical properties, particularly appearance, covering power, and lubricating ability. Details concerning the properties unique to mica and the related uses have been well documented in the literature (Chowdhury, 1941; Hidnert, 1945; Skow, 1962). Ground-mica products are generally graded according to the method of grinding, that is, dry or wet. Currently dry-grinding methods account for about 85 per cent of the ground-mica products. Some of the other grading characteristics include particle-size distribution, color, degree of delamination, and product purity. Some of the many existing uses of ground-mica products are: mica board (built up from flake mica), molded insulators, decorative uses (wallpaper, etc.), prepared roofing, lubricants, fillers in certain rubber and paper products, manufacture of tires, special refractories, well-drilling muds, paint, wallboard joint cement, welding-rod coatings, foundry facings, special stucco and plaster formulations, insulation, fireproofing material, protective coatings, textiles, plastics, mold washes, glass-bonded insulation, and pipeline enamel for insulation properties.

This investigation is essentially limited to muscovite mica; however, ground products made from sericite were also evaluated. The use of the term mica herein refers to muscovite mica.

Mica Occurrences and Areas Sampled

The mica occurrences in New Mexico have been tabulated and well described in the literature (Northrop, 1942; Johns, 1946; Bingler, 1968). The various known locations of local mica deposits are listed in Table 2.

TABLE 2. MICA OCCURRENCES IN NEW MEXICO

County	General Location
Bernalillo	Tijeras Canyon district
Colfax	Elizabethtown district
Dona Ana	Organ and South Canyon districts
Grant	Eureka district
Hidalgo	Sylvanite district
Luna	Florida Mountains and Tres Hermanas districts
Mora	Talco region; also near Mora
Rio Arriba	Bromide and Petaca districts
San Miguel	El Porvenir, Tecolote, and Willow Creek districts
Santa Fe	Old Placers district; Nambe
Socorro	Mockingbird Gap district
Taos	Glenwoody, Harding Mine, Hondo Canyon, Picuris, and Red River districts
Torrance	Corona region

The principal known mica deposits in New Mexico are west and southwest of Petaca in Rio Arriba County (Bingler, 1968) and in the Glorieta Mountains in San Miguel County. A comprehensive description of these districts has been published (Just, 1937; Jahns, 1946) which includes early production information specifically related to sheet-mica production.

Mica-bearing pegmatite samples were obtained from these two principal districts for evaluation in this investigation. A sample of sericite from the Mt. Sedgwick area in Valencia County was used in conjuction with this development program. The locations from which the various raw material samples were collected are shown in Figure 1.

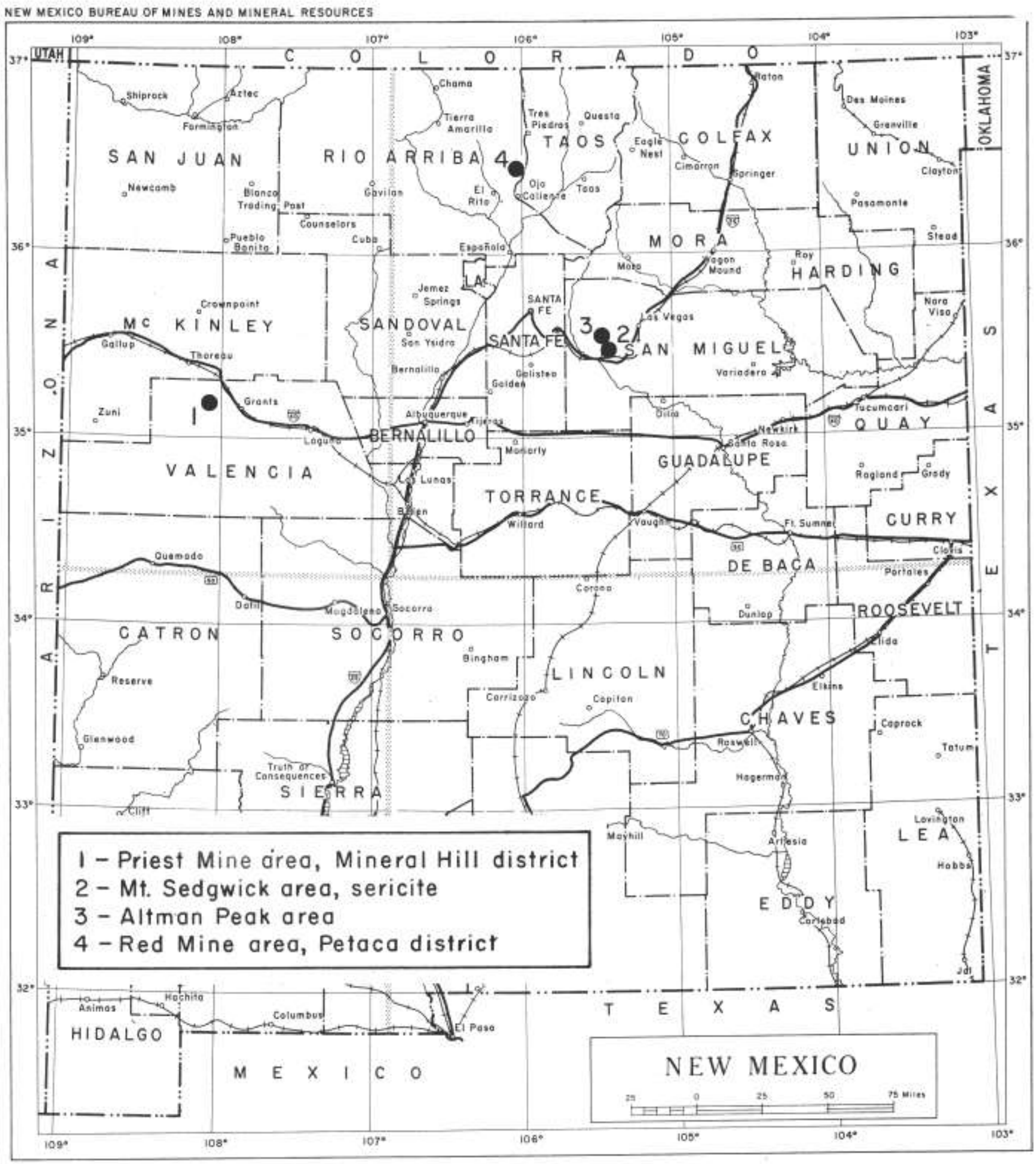

Figure 1. Map showing locations of areas sampled.

Experimental Proceedure and Results

The general laboratory procedure consisted of two phases: the first was concerned with preparing a high-quality flotation mica concentrate from the various mica-bearing pegmatite samples, and the second with grinding the up-graded mica products. Commercial grades of ground mica were prepared in the laboratory using several grinding procedures for each grade. The bulk-density, which is a measure of the degree of delamination or the covering ability of the mica flakes, and the particle-size distribution of each product were determined. Bulk density measurements were made using a standard Scott volumeter equipped with a one-inch cube; however, various methods and modifications for evaluation bulk density are utilized by suppliers and consumers of ground-mica products.

Mica Pegmatite Samples

There are several well established processes (Norman, 1941; Browning, 1963, 1965, 1966; Millsaps, 1966) for producing mica concentrate from pegmatites using froth-flotation techniques. Basically these various procedures use either a cationic- or anionic-type collector or a combination of both in the flotation process. In each process the amount of slime-type material is reduced prior to flotation and in several of the processes fairly complete slime removal is essential for effective performance concerning the subsequent separation and recovery of high-quality mica concentrate.

Flotation mica concentrate was prepared from each sample of potential mica-pegmatite ore under investigation. Preparation of the mica concentrate consisted of crushing the pegmatite sample to minus three mesh, rod-mill grinding to essentially minus 20 mesh, desliming the ground solids at 20 microns, and separating the mica by froth flotation. Mica was selectively floated from the gangue minerals, mainly feldspar and quartz, using a cationic-type collector (amine) in slightly acid solution. The standard reagent schedule for the experimental work consisted of an amine collector (Alamac 26), frother (Dowfroth 250), and sulfuric acid for pH control (pH 2.5 to 3). After flotation conditions were established for each pegmatite sample, a multiple-cycle flotation locked test was made to produce sufficient mica concentrate for subsequent evaluation of the ground-mica products. The mica flotation concentrate was filtered and carefully dried at low temperature prior to further processing.

The locked-test data obtained from the three pegmatite samples are recorded in Tables 3, 4, and 5 including metallurgical balances, reagent consumption, product bulk density, and particle-size distribution of the flotation products.

TABLE 4. RESULTS OF LOCKED-TEST; RED MINE AREA PEGMATITE SAMPLES (Petaca District)

Metallurgical Balance

Product	Wt. (grams)	Wt. (%)	Mica (%)	Mica Dist. (%)
Mica Concentrate	3,519	78.2	98.1	96.7
Tailing	663	14.7	3.5	0.6
Slime	318	7.1	30*	2.7
Feed	4,500	100.0	79.3	100.0

* Estimated mica content (by difference).

Reagent Consumption (based on total feed)

Rougher:	Sulfuric acid.........2.60 lb/ton
	Alamac 26...........1.12 lb/ton
	Dowfroth 250........ 0.14 lb/ton
Cleaner (1 stage):	Sulfuric acid.........1.84 lb/ton

Mica Flotation Concentrate

Bulk density = 18.4 lb/ft^3

Particle-Size Distributions

	Ground Feed		Mica Concentrate	
Mesh	% Held	Cum % Held	% Held	Cum % Held
+20	1.1	1.1	1.3	1.3
20x28	6.7	7.8	6.9	8.2
28x35	13.3	21.1	14.4	22.6
35x48	15.3	36.4	16.6	39.2
48x65	14.6	51.0	15.3	54.5
65x100	12.9	63.9	13.4	67.9
100x150	8.9	72.8	9.2	77.1
150x200	6.5	79.3	6.9	84.0
-200	20.7	100.0	16.0	100.0
	100.0		100.0	

TABLE 5. RESULTS OF LABORATORY TEST; ALTMAN PEAK AREA PEGMATITE SAMPLE

Mica Flotation Concentrate (97-98% mica)

Bulk density = 13.2 lb/ft^3

Particle-Size Distribution of Mica Flotation Concentrate

Mesh	% Held	Cum % Held
+20	0.2	0.2
20x28	1.4	1.6
28x35	3.9	5.5
35x48	9.5	15.0
48x65	14.7	29.7
65x100	17.6	47.3
100x150	15.6	62.9
150x200	10.9	73.8
-200	26.2	100.0
	100.0	

Note: The mica concentrate used in this portion of the investigation had been prepared previously for Omega Corporation under the supervision of Dr. Bhappu from a pegmatite sample supplied by them from the Altman Peak area.

Several grinding procedures were used in the laboratory to prepare different grades of ground-mica products. Dry-grinding methods consisted of rod-mill grinding in a stainless-steel rod mill charged with stainless steel rods and fluid-energy grinding using compressed air as the energy source. The latter method was simulated by constructing a small cylindrical unit with a 100 mesh wire screen at one end to which was attached a cloth bag collector. Two opposing high-pressure air jets entered the unit where the charge of mica concentrate was ground. One dry-ground mica product, oil-well grade mica, was prepared directly by sizing the mica flotation concentrate at about 65 mesh. Wet-grinding procedures included rod-mill grinding, using the stainless steel grinding unit, and attrition grinding using a laboratory attritioner operated at 2, 000 revolutions per minute.

Sericite Sample

The sericite sample was processed directly to make finished ground products without the need of a concentration operation because of its high purity. The sample was crushed to minus three mesh for subsequent grinding to yield finished ground-sericite products. Dry grinding was done in the stainless steel rod mill. One wet-ground product was made by attrition grinding using the laboratory attritioner.

Dry Processing of Mica

In a general discussion concerning processing of mica, we must give some consideration to dry concentration methods, especially for rough upgrading of the mica-bearing ore at the mine site. Such a technique is quite effective for discarding a large portion of the gangue material at the mine which is usually located away from major highways, railway lines and readily available sources of water for wet processing. The rough concentrated product is then shipped to an appropriate location for further cleaning and shipping.

One of the most important principles utilized in dry processing of ores is "differential disintegration" which involves dry grinding, classification or screening and dust collection. Methods based on this premise are effectively used for separating various minerals such as clays, micas, cement rock, barite, iron ores, carnotite, asbestos, spodumene, fluorite, coal and several other. For practical purposes, differential disintegration procedures can be classified as methods depending on differences in hardness, shape, and size (scrubbing, scuffing and differential grinding); and internal stresses set up by heat (decrepitation).

Differential grinding in conjunction with subsequent size and shape separation has been employed recently to effect a rough concentration 2f micaceous ores. Such a technique is ideally suited for processing micas because of the favorable characteristics of the valuable minerals and the gangue consisting of quartz, feldspars, and other silicate minerals.

In the Socorro laboratory it has been conclusively demonstrated that with appropriate roll-crushing and screening on a specially designed triangular-bar vibrating screen it is possible to produce a coarse, rougher concentrate from run-of-mine materials which average about 20 per cent mica by weight. The rougher concentrate, amounting to about 25 per cent of the total weight of the feed and containing 75 to 80 per cent mica by weight, was then treated in a Majac-type fluid-energy laboratory mill with appropriate classification, to obtain the desired finished mica products. Figure 2 shows a schematic flowsheet of the proposed process for treating micaceous pegmatite ores.

The unique step in the above flowsheet is the screening of crushed product on the specially constructed triangular-bar vibrating screen which was designed by Mr. Martin Pollock of Santa Fe, New Mexico. The authors have seen such a mica roughing operation at the Joseph Mine near Ojo Caliente, New Mexico. This simple but effective method of rougher concentration deserves a critical evaluation in the design of mica-processing systems.

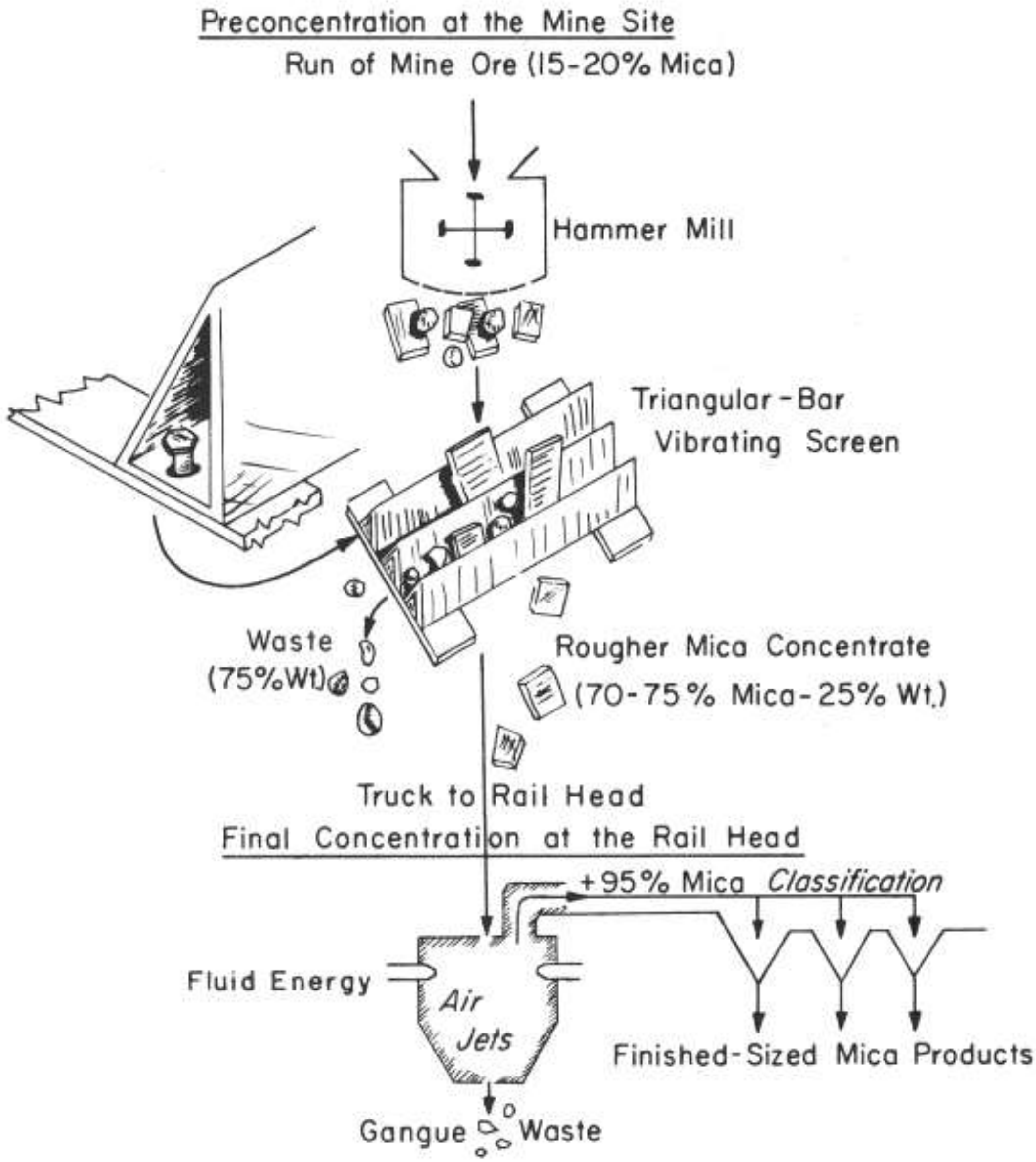

Figure 2. Flowsheet for dry processing of mica

Evaluation of Ground Products

Consumers of ground-mica products were contacted to obtain product specifications and testing procedures applicable for specific mica products. These consumers were selected to represent the major markets of ground mica which included the following grades: roofing, joint cement, paint (pigment grades), rubber, and oil well. Based on the product specifications obtained, an evaluation was made of the different grades of ground mica prepared in the laboratory from the various raw material sources. Commercial product specifications obtained during this investigation to provide a basis for comparison of New Mexican mica are included in the Apendix (Product Specification).

Roofing Grade

The largest market for ground-mica products is for roofing grades which are generally a lower value mica product. There are many grades of roofing mica and the specifications for several of these grades are shown in the Appendix (Product Specifications, Roofing Grades). The dried mica flotation concentrates made in the laboratory very closely approximated ,the specification for one of the roofing grades described in the Appendix. The particle-size distributions for each of the mica concentrates are recorded in Tables 3, 4, and 5 and a summary of the results is presented here.

(1) Priest Mica area (mica concentrate, Table 3)

This product approximates the specifications for No. 60 and No. 80 Dry-Ground Mica (United States Gypsum Company specifications). The bulk density is satisfactory at 16.9 lb/ft^3.

(2) Red Mine area (mica concentrate, Table 4)

This product approximates the particle-size specifications for No. 60 Dry-Ground Mica (United States Gypsum Company specifications). However, the bulk density of the product is 18. 4 lb/ft^3 which is significantly higher than specified at 15 to 17 lb/ft^3.

(3) Altman Peak area (mica concentrate, Table 5)

This product approximates the particle-size specifications for No. 80 and No. 160 Dry-Ground Mica (United States Gypsum Company specifications). The bulk density is 13.2 lb/ft^3 which is satisfactory being appreciably lower than specified (No. 80 17 to 22 lb/ft^3 and No. 160 20 to 25 lb/ft^3).

Some process modifications would be required, compared with the laboratory conditions used, to produce mica products meeting the precise specifications for roofing-grade mica schist (United States Gypsum Company specifications). A comparison of laboratory grinding results and commercial product specifications are shown in Table 6. The product bulk density was appreciably lower than specified.

TABLE 6. MT. SEDGWICK SERICITE DRY GROUND TO ROOFING-GRADE SPECIFICATIONS

Sericite Product Cum % Passing	Mesh	Commercial Specifications Cum % Passing
	Particle-Size Distribution	
100	28	trace held
83.5	65	85% max
68.0	100	80% max
37.5	200	55% max
24.7	325	30% max
	Bulk Density	
43.4 lb/ft^3		48 to 52 lb/ft^3

Attempts were made to grind the sericite sample to meet other grades of roofing mica; however, they were unsuccessful either because of the resulting particle-size distribution or bulk density. Generally, the bulk density was several times greater than specified for roofing mica, except for mica schist. Typical bulk densities obtained ranged from 42 to 50 lb/ft^3.

Joint-Cement Grade

Dry-ground mica is the major ingredient in the manufacture, of wallboard joint cement which is used in dry-wall construction. In this particular application the overlapping mica platelets provide a crack-resistant finish for the wallboard joints. This feature plus the spreading ability of the fine mica platelets are enhanced when the ground mica is well delaminated. Therefore, it is very important to achieve excellent delamination, that is, low bulk density, when preparing joint-cement grade mica.

Ground products meeting the particle-size requirements for joint-cement grade mica were prepared by dry-grinding mica flotation concentrate in the stainless-steel rod mill. The bulk density of the ground products was appreciably higher than specified as shown in Table 7.

TABLE 7. DRY-GROUND MICA PREPARED BY ROD-MILL GRINDING

Joint-Cement Grade Specifications*		Source of Mica Concentrate		
		Priest Mine Area	Red Mine Area	Altman Peak Area
Fineness				
Mesh	Weight (%)	Weight (%)	Weight (%)	Weight (%)
+40	none	none	none	none
40x100	1.0 max	0.4	0.4	0.4
325	55 to 70	62.4	60.4	56.0
Bulk Density				
lb/ft^3	14.5	21.5	22.5	17.6
Color				
	white*	light tan	white	white

* See Appendix, Product Specifications, Joint-Cement Grade.

To overcome the poor delamination experienced with rod-mill grinding, fluid-energy grinding using compressed air as the energy source was also evaluated. This grinding technique delaminated and reduced the size of the mica particles by direct particle contact in the presence of high-pressure air. Because of equipment limitations, the finished ground product was simulated by combining the minus 100 mesh and smaller size particles in the proper proportion to meet the joint-cement grade size specification. The resulting size distribution was based on the average results obtained during rod-mill grinding of the three mica flotation concentrates presented in Table 8.

TABLE 8. AVERAGE PARTICLE-SIZE DISTRIBUTION, ROD-MILL GRINDING OF MICA FLOTATION CONCENTRATE

Mesh	Cum Wt % Held
+65	trace
+100	0.4
+150	11.7
+200	26.1
+325	40.4

The dry-ground joint-cement grade mica products made by fluid-energy grinding met the bulk density requirements of less than 14.5 lb /ft^3. The results obtained were as follows:

Mica Concentrate Source	Product Bulk Density
Priest Mine area	13.0 lb/ft^3
Red Mine area	12.5 lb/ft^3
Altman Peak area	11.7 lb/ft^3

Experimental results showed that joint-cement grade mica could be made from the three mica flotation concentrates evaluated that would meet the particle-size and bulk-density specifications. However, an off-color (light tan) ground product resulted when grinding the mica concentrate prepared from the Priest Mine area sample. This off-color product resulted from the presence of iron staining of the mica platelets even in the very fine particle sizes. It is likely that this type of mica-bearing raw material would not be suitable for producing joint-cement grade mica because of color requirements of the finished product.

Oil-Well Grade

Several grades of ground mica are used in the oil industry in connection with lost-circulation problems. Ground mica for this application is generally used as fine or coarse grades. The coarse-grade material is essentially -6 + 50 mesh U. S. Standard as shown in the product specifications in the Appendix (Product Specifications, Oil-Well Grades). Since this investigation was limited to preparing ground-mica products from mica flotation concentrate, the coarse grade of oil-well mica was not considered. Other methods of mica concentration such as spiral concentration (operated to take advantage of the shape difference between mica and the gangue minerals) or dry-concentration processes would be required to produce a coarse-grade mica product. Fine-grade oil-well mica was prepared by sizing the mica flotation concentrate at about 60 mesh (U.S. Standard). The minus 60 mesh fraction from each of the mica flotation concentrates was very similar regarding its particle-size distribution compared with size specifications recorded in Table 9. Although bulk-density requirements are not specified, the sealing ability of the ground-mica product which appears to be related to its bulk density is an important physical property for its use in the oil industry.

TABLE 9. FINE-GRADE OIL -WELL MICA PREPARED IN THE LABORATORY

	Fine-Grade Specification	Mica Concentrate Source: Priest Mine A· a	Red Mine Area	Altman Peak Area
Particle-Size Distribution				
Mesh	Weight (%)	Weight (%)	Weight (%)	Weight (%)
+60	3	3.0	2.6	2.4
60x100	24	34.3	29.6	21.6
100	73	62.7	67.8	76.0
Bulk Density				
lb/ft^3	not specified	17.4	17.1	19.8

Paint (Pigment) and Rubber Grades

Product specifications for wet-ground paint and rubber grades of mica are very similar concerning particle size and bulk density; however, color is more important for paint grades. These wet-ground grades are the higher-priced ground-mica products, but their consumption only represents about 10 to 15 per cent of the ground-mica market. Currently the rubber industry accounts for about 50 per cent of the wet-ground mica production which includes some biotite products. Wet-ground mica products have a high sheen and brilliance, light color, and generally low bulk density. The quality of one or more of these properties is sacrificed when dry-grinding methods are used, but the resulting manufacturing cost of the ground product is significantly reduced.

Only wet-ground paint and rubber grades of mica were prepared during this investigation. There is a wide variety of wet-ground grades of mica used in the paint and rubber industries and the specifications for some of the commercial grades are included in the Appendix (Product Specifications, Paint and Rubber Grades). Generally the bulk density is in the range of 10 to 13 lb/ft^3 and particle-size requirements are all material passing 100 mesh and about 80 to 93 per cent.passing 325 mesh depending on the individual consumer. Ground products were made from the three mica flotation concentrates by wet rod-mill grinding gave the desired particle-size distribution and bulk density, but the products were off-color resulting from contamination of abraded grinding media in the ground product.

TABLE 10. RESULTS OF WET ROD-MILL AND ATTRITION GRINDING

	Source of Mica Concentrate		
	Priest Mine Area	Red Mine Area	Altman Peak Area
Wet Rod-Mill Grinding Results			
	Particle-Size Distribution Weight Per cent Held		
Mesh			
+150	none	none	none
150x200	0.8	0.8	none
200x270	4.4	1.6	0.8
270x325	6.0	3.2	5.2
325	88.8	94.4	94.0
	100.0	100.0	100.0
Bulk Density, lb/ft^3	12.6	11.5	12.0
Wet Attrition Grinding Results			
Bulk Density, lb/ft^3	16.1	12.9	12.6
Color	light tan	white	white

Attrition-grinding tests were made to demonstrate the color qualities that may be expected in commercial wet-grinding of the different mica flotation concentrates being evaluated. The color of two of the attrition-ground products was excellent; however, an off-color (light tan)product resulted from the ground mica concentrate made from the Priest Mine area raw material. This same off-color product was also experienced in the preparation of joint-cement grade mica as previously discussed. It seems likely that this type of raw material would not be suitable for producing paint or rubber grades of mica where color specifications are important.

Sericite from the Mt. Sedgwick area was also attrition-ground using the same procedure employed for the mica flotation concentrates. The ground sericite product was prepared having the average particle-size distribution of the three products tabulated in Table 10. The bulk density of the wet-ground sericite product was 20.2 lb/ft^3 and the product has a deep-gray color. Although there may be some specialized application for such a product, its physical properties are not similar to those specified for existing ground-mica products.

Although dry-ground paint-grade mica was not prepared in the laboratory, this type of product produced from mica obtained from the Petaca district was evaluated. This dry-ground product was made in 1958 in the former Petaca Mill using a commercial fluid-energy grinding unit. The physical properties of the dry-ground product are shown in Table 11. The product color is very good as was observed with ground-mica products made in the laboratory from mica concentrate produced from the Red Mine area sample which also was obtained from the Petaca district.

TABLE 11. DRY-GROUND MICA (325 MESH GRADE)
PRODUCED IN THE PETACA MILL

Particle-Size Distribution	
Mesh	Cum Wt (%) Held
+150	0.8
+200	4.4
+270	8.0
+325	13.2
Bulk Density	12.6 lb/ft^3
color	white

Wallpaper Grade

Wet-ground mica is also used for decorative wallpaper. Specifications for two wallpaper grades are listed in the Appendix (Product Specifications, Wallpaper Grades). These specifications are very similar to wet-ground paint-grade specifications, and again color is a very important property. Wallpaper-grade mica commands the highest selling price of the ground-mica products, but its consumption is only a small fraction of the ground-mica market.

Summary

The three mica-bearing pegmatite samples that were evaluated appear to be satisfactory raw materials for manufacturing roofing and oil-well grades of dry-ground mica. The pegmatite samples from the Altman Peak and Red Mine areas are satisfactory for producing joint-cement, paint, and rubber grades of ground mica. In fact, the quality of these ground products are excellent compared to some existing commercial mica products. The Priest Mine area pegmatite does not appear attractive for producing ground-mica products when the product's color is an important physical property.

Evaluation of the sericite sample from the Mt. Sedgwick area showed that a dry-ground product could be made meeting the specifications for roofing-grade mica schist. When wet ground, the sericite product had a high bulk density and was deep-gray colored. Applications for such a product do not appear attractive in the current mica markets.

In general the local sources of mica examined during this investigation are satisfactory for producing commercial grades of ground mica. It seems reasonable that other mica deposits in New Mexico would yield similar results and New Mexico could become a source of ground-mica products, especially for the western markets, in the future.

Acknowledgments

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Appendix

Product Specifications, Roofing Grades[1]

1. No. 60 Dry Ground

Thru 40 U.S. Standard sieve	85% max.
Thru 100 U.S. Standard sieve	30% max.
Thru 200 U.S. Standard sieve	20% max.
Thru 325 U.S. Standard sieve	15% max.

Loose density 15 to 17 lb/ft^3
Color White (approx.)
Oil or unoiled as specified

2. No. 80 Dry Ground

On 30 U.S. Standard sieve	Trace
Thru 50 U.S. Standard sieve	85% max.
Thru 100 U.S. Standard sieve	45% max.
Thru 200 U.S. Standard sieve	25% max.
Thru 325 U.S. Standard sieve	15% max.

Loose density 17 to 22 lb/ft^3
Color White (approx.)

3. No. 160 Dry Ground

On 30 U.S. Standard sieve	Trace
Thru 70 U.S. Standard sieve	85% max.
Thru 100 U.S. Standard sieve	65% max.
Thru 200 U.S. Standard sieve	30% max.
Thru 325 U.S. Standard sieve	20% max.

Loose density 20 to 25 lb/ft^3
Color White (approx.)

4. Mica Schist

On 30 U.S. Standard sieve	Trace
Thru 70 U.S. Standard sieve	85% max.
Thru 100 U.S. Standard sieve	80% max.
Thru 200 U.S. Standard sieve	55% max.
Thru 325 U.S. Standard sieve	30% max.

Loose density 48 to 52 lb/ft^3
Color White (approx.)

All material to be free of organic matter, clay, and soil.

(1) United States Gypsum Company

Product Specifications, Roofing Grades[1]

Tyler Standard Screens	Weight Per cent Retained Grade #40 (oiled)	Grade #60 (oiled)	Grade #160 (unoiled)
20	5-15	0-1	
28	15-25	5-15	
35	20-30	15-25	0-1
48	15-25	15-25	0-5
65	8-15	13-23	10-17
100	3-13	12-22	20-30
150			15-25
200			5-15
Pan	5-15	5-15	25-35
Bulk density, lb/ft^3	13 to 18	14 to 18	16 to 20

(1) The Philip Carey Manufacturing Company

Product Specifications, Joint-Cement

Grade[1] Dry-Ground Mica Fineness

On 40 U.S. Standard sieve	none
Thru 40 on 100 U.S. Standard sieve	1.0% max.
Thru 325 U.S. Standard sieve	55-70%

Bulk density - Preferably below 14.5 lb/ft^3

Color - No darker than the May 1955 color standard.

Uniformity within a single shipment

The following limits of fineness and density are to be observed in a single shipment, or identified section in a single shipment. A sample from one bag shall not vary more than 1.5 lb/ft^3 in density above or below the average for the shipment; and in per cent passing 325 mesh not more than 10% above or below the average percentage passing 325 mesh for the shipment.

(1) United States Gypsum Company

Product Specifications, Oil-Well Grades[1]

The specifications have been set largely by experience and the approximate screen size are:

Screen Size (U.S. Standard)	Weight Per cent Held Coarse Grade	Fine Grade
+6	2	
6x8	22	
8x12	28	
12x16	20	
16x20	15	
20x40	9	
40x50	4	
+60		3
60x100		24
-100		73
	100	100

There are no standard tests for mica as sealing agents, but there are generally accepted test methods, such as the ability of the proposed agent to seal either paralleled or wedge shaped slots.

(1) Gulf Oil Corporation

Product Specifications, Paint (Pigment) Grades[1]

Grade	No. 6251	No. 6253	No. 6252
Grinding	Wet	Wet	Dry
Oil Absorption	28 approx.	42-46	43-53
Loss on Ignition	5.0% max.	5.0% max.	Combined
Moisture	0.5% max.	0.5% max.	water 15% max.
Silica	48.0% min.	45.2% min.	---
Alumina	31.0% min.	38.0% min.	---
Potassium Oxide	7.5% min.	11.0% min.	---
Spec. Resistance, ohms	10,000	10,000	10,000
Bulk, Gal/100 lb.	4.26 (approx)	4.24 (approx)	4.37 (approx)
Bulk Density, lb/ft^3	12.1	12.2	11.8
pH	---	6.5-7.9	7.9
Fineness			
On 325 mesh screen	10.0% max.	10.0% max.	12% max.
On 200 mesh screen	1.0% max.	1.0% max.	---
On 100 mesh screen	0.0% max.	0.0% max.	---

(a) The Sherwin-Williams Company

Product Specifications, Paint (Pigment)

Grades Paint (Pigment) Grade[(1)] Mica,

Code 111

Oil Absorption	60 to 66
Weight/Gal.	23. 60 lb
Bulk Density	12.2 lb/ft^3
Grit	0. 5% max.
Ignition Loss	5. 0% max.
Moisture	0. 5% max.

Fineness

On 140 mesh U. S. Standard sieve	0. 1% max.
On 325 mesh U. S. Standard sieve	7. 0% max.

Paint (Pigment) Grade[(2)]

Waterground, 325 mesh

Made from high grade muscovite mica scrap by wet-grinding processes designed to give a product of high sheen and brillance, light color, and low density.

Fineness	Average	Specification
On 100 mesh	0.0%	0.0%
Thru 100 mesh on 200 mesh	0.3%	3. 0% max.
Thru 200 mesh on 325 mesh	14. 7%	17. 0% max.
Thru 325 mesh	85.0%	80. 0% min.

Density, lb/ft^3	10 to 13 loose, dry material
Color	To be no darker than the May 1955 color standard.

(1) Pittsburgh Plate Glass Company
(2) United States Gypsum Company

Product Specifications, Rubber Grades

Rubber Grade[1] No. 279 Mica, Water Ground

A wet-ground mica of high quality for the rubber industry.

Color: off-white
Bulk Density: 12.44 lb/ft^3
Specific Gravity: 2.8 to 3.0
Reflectance: Green stim. filter 74.5
Oil Absorption (rub-out) 50
pH: 7 to 9

Fineness:

Thru 200 mesh	95-97%
Thru 325 mesh	80-85%

Chemical Composition (Typical):

Silica	SiO_2	45.2%
Alumina	Al_2O_3	38.5%
Potash	K_2O	11.8%
Loss on Ignition		4.5%

Rubber Grades[2]

Code No.	4	41
Description:	Pigment Mica Water-Ground	Pigment Biotite Mica Water-Ground
Appearance:	White to light gray flakes, same as type sample	Greenish-gray to brown powder, same as type sample
Specific Gravity	2.82	2.70
Chemical:		
Heat Loss	0.25% max.	0.8% max.
Ignition Loss	4.0-5.0%	4.0-5.0%
Physical:		
On U.S. 140 mesh	0.5% max	0.5% max.
On U.S. 200 mesh	1.0-5.0%	1.0-6.0%

(1) Whittaker, Clark & Daniels, Inc.
(2) The B. F. Goodrich Company

Product Specifications, Wallpaper Grades[1]

Standard brands of wet-ground mica for use in decorating wallpaper:

Screen Analyses	Brand 1	Brand 2
Thru U.S. 60 mesh	100%	100%
Thru U.S. 80 mesh	99. 5%	99. 9%
Thru U.S. 100 mesh	99. 0%	99.7%
Thru U.S. 140 mesh	98. 2%	97.5%
Thru U.S. 200 mesh	97. 2%	94. 0%
Thru U.S. 325 mesh	87. 7%	76. 3%
Bulk Density, lb/ft^3	14	15.5

(1) Horton, 1935 (see references)

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