TALC MINING IN NEW YORK

BY

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MINERAL TECHNOLOGIST
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TALC MINING IN NEW YORK

By Raymond B. La.do (Mineral Technologist, Bureau of Mines).

Importance and Distribution of Talc in New York

Talc mining in the State of New York was first started about 1876, but important production did not start until 1880, when about 4,000 tons were shipped. In 1883 the production was about 6,000 tons valued at $75,000, or an average of $12.50 per ton. From this date the production gradually increased to a peak of 93,236 tons in 1916, valued at $961,510 or about $10.30 per ton. In 1918 the production declined to 71,167 tons valued at $902,100, or about $12.70 per ton. For many years New York was the largest producer in the United States, but in 1917 and 1918 its output was surpassed by Vermont in tonnage though not in value. In June, 1920, there were three companies producing talc in the Gouverneur district, St. Lawrence County, and one near Natural Bridge.

Mode of Occurrence

The geology of the talc deposits of New York has been described in detail by C. H. Smyth, Jr., (N.Y. State Mus. Rept. 47, 1894, pp. 491-515; also N.Y. State Mus. Rept. 49-2, 1898, pp. 661-671) and D. H. Newland, (Bull. Education Dept., N. Y. State Museum, No. 522, 1912, pp. 91-100.) The following brief description is by Newland, (N.Y. State Mus. Bull. 178, 1915, pp. 78-80):

"The Gouverneur talc district consists of a narrow belt, lying to the southeast and east of that village in the towns of Fowler and Edwards, in which the talc occurs in lenticular bodies arranged in series along the strike. The bodies dip uniformly toward the northwest at angles of from 30° to 60°, so that they are all worked by underground methods. The wall rocks are limestone and schist of Precambrian age, a part of the Adirondack crystalline formations. The fibrous talc is an alteration product of tremolite which it resembles in physical development, but the scaly talc apparently is the result of deposition by underground waters. Altogether there are fully fifteen or twenty different deposits, some of which, however, are not profitable under present conditions, and others are being held in reserve. The number of operative mines in recent years has ranged from five to eight or nine . . . .

"A deposit of talc near Natural Bridge has been worked for the last four years, and has supplied a considerable quantity of material which is sold in ground form. This deposit occurs in limestones, but in a separate area from the Gouverneur belt and has a quite different character. The talc lacks any definite structure, except that it shows a granular appearance in places, and is associated with other hydrated silicates of the serpentine and chlorite groups. It appears to be a contact deposit, lying near an intrusion of granite."
The fibrous talc of the Gouverneur district is entirely different in appearance and physical properties from that of the Natural Bridge deposit and from the talcs found in other parts of the country. It is an alteration product of tremolite and often shows the typical tremolite structure. Much of the material mined as talc is probably not talc but tremolite or a product of partial alteration, as it is often 2 to 3½ in hardness (pure talc is 1) and has little slip. The foliated talc found here more closely resembles other talcs but is usually harder and more micaceous. The hardness and fibrous structure make grinding and separation more difficult than in most other districts, but the present practice could probably be improved. For example, the separation of the crude rock into two or more grades and the milling of each by separate processes would doubtless make more uniform products which would be better adapted to certain specific uses.

Economy in the use of power has not been important in the Gouverneur district in the past, but is now becoming a factor, and steps are being taken to devise more economical methods of grinding. It seems probable that in the working out of this problem not only will power consumption be decreased but better products will be obtained.

The ore reserves of the New York districts are probably large although little accurate information is available. The talcose zone in the Gouverneur district is known to be more than a mile wide and numerous deposits have been opened, but prospecting has not been done on a scale adequate to block out large tonnages. Diamond-drilling has been done by one company but this served to locate veins rather than to prove reserves. Sufficient diamond drilling to definitely block out ample reserves would be very beneficial.

The method of mining commonly employed in this district is to sink a shaft on the ore vein, extend levels or drifts in each direction from the shaft along the strike of the vein, and then at intervals, raises are put up, pillars being left between the raises. As a rule, little timbering is needed, except in fractured zones. Formerly, most of the mines in this district had only one opening to the surface, which is not in conformity with the present New York State law, and some difficulty has been experienced for this reason.

DESCRIPTION OF INDIVIDUAL MINES AND PLANTS.

St. Lawrence Talc Co. (Carbola Chemical Co.) Natural Bridge, N.Y.

The mine and mill of the St. Lawrence Talc Co. or its successor, the Carbola Chemical Co., are located about 1½ miles from Natural Bridge station, near the line between Lewis and Jefferson Counties, New York. A railroad spur about ½ mile long connects the mill with the Carthage and Adirondack Branch of the New York Central R. R.
Mining.

The talc deposit here appears to be a replacement of very irregular size and shape. Its strike appears to be nearly North and South, but its dip cannot be determined. Dillor (U.S. Geol. Survey, Min. Res. 1912, p. 25.) says of this deposit: "The talc is associated with serpentine and limestone. Near by are highly crystalline, for the most part gneissoid rocks. The talc where opened to view lacks distinct schistosity or fibrous structure, and is rather massive. The sides of the talc body are very irregular . . . . Although in general the talc is highly magnesian, some of it, as shown by laboratory tests with nitrate of cobalt, contains much alumina suggesting pyrophyllite." The deposit has been traced along its outcrop for a mile north from the shaft and is a maximum of 90 feet in width in the present workings. Between the foot and hanging-walls proper, large "bowlders" of limestone are often encountered. Usually these may be left as waste pillars but sometimes they must be shot out and either stowed away underground or hoisted to the surface. In addition to the limestone "bowlders", nodules of quartz and limestone, and small particles of pyrite and graphite are common. A great many varieties of talc are encountered. No development work by drilling has been done and, due to the great irregularity of the deposit, no close estimation of reserves may be made; but it seems probable that there is a large tonnage still available.

The mine is opened by a 10' x 12' single-compartment inclined shaft dipping at an angle of 57° for the first 45 feet and 60° below that point. Three levels have been opened, the first at 100 feet, the second at 147 feet, and the third at 302 feet vertically below the surface. The first level, the only one which has been developed extensively, has been opened for a total length of 600 feet, mainly to the north of the shaft. Drifts have been cut along the foot and hanging walls, outlining the ore body, and connected at frequent intervals by crosscuts. Both the ore and the walls are badly fractured in places so that it is not always safe or advisable to follow the walls closely. Thus in places the drifts are not on the walls but in solid ore near the walls. The presence of limestone boulders and fractured zones in the ore govern the location of cross cuts, resulting in their location at irregular intervals. Little timber is needed in the mine except where the openings break into a fractured zone.

Although the mine has been worked for a number of years, little real mining has been done, most of the ore used in the mill coming from the network of development openings on the first level. No systematic method of mining has been devised, but it is planned to continue the present method of development to the limits of the ore body or until the workings get too far from the shaft. Then raises will be put up, beginning farthest from the shaft and taking advantage of the fractured zones. In places a single shot will start a run of broken ore which will last for days. Stoping will therefore be inexpensive but probably admixture with waste will prevent recovery of all the ore.

The problem of drainage has always been a severe one, as the fractured condition of the ore and walls permits much surface water to get into the mine. The mine has been "drowned" several times in the past, but, profiting by this experience, adequate pumping capacity is now available and there should be no further trouble. All pumps are electrically driven by 220-volt, 3-phase, 60-cycle alternating current. One pump is located on the first level and four pumps with a large sump in the second level. In addition to the sump an old section of the
mine has been sealed off with a concrete bulkhead provided with two 4-inch valves. In this way a very large flow can be cut off for as long as a week, in case of accident to the pumps. Separate discharge lines are run to the surface for each pump. The total pumping capacity installed is 1350 gallons per minute driven by a total of 175 horsepower. The maximum flow of water has been 850 gal. per min., but in the summer it is not over 250 to 275 gal. per min. All pumps are run part of each day to keep them in working condition.

The drilling equipment now in use consists of three compressed-air drills of the jackhammer type and three of the stoper type. The former are often used attached to a light column. The ore drills easily and shoots well, 35% gelatin explosive being used.

The ore broken in development work is shoveled into one-ton, 24" gage, steel cars, trammed by hand to the shaft, dumped directly into a one-ton, 30" gage, steel, self-dumping skip and hoisted to the surface. At the surface the skip is hoisted up a wooden trestle 450 feet long, set at an inclination of about 180°, to the top of the rock house.

The surface equipment at the mine consists of a single-stage, 14" x 16", 480 cu.ft. air compressor belted to a 150-h.p., 2200-volt induction motor, and a machine shop. The present shop is fairly well equipped but a new shop is being built, which will house a lathe, drill press, pipe machine, and drill sharpener. The hoist, which is located in the rock house at the mill, is a 3-ton hoist geared to a 50-h.p., 220-volt, A.C. motor.

Milling.

At the top of the trestle connecting the mine and the mill are two dumping places at either of which a trip may be set to dump the skip automatically. In this way the crude storage bin may be filled to hold 400 tons without shoveling. At the bottom of the bin the ore is shoveled into a 12" x 28" jaw crusher, large blocks being sledged by hand. From here the progress of the ore through the mill may be followed on the appended flow sheet. The tube mills are of the trunnion type, belt driven by individual 150 hp., 2200-volt, 3-phase, 60-cycle induction motors. These mills use 106 to 108 hp. each when in motion under full load. Two mills are lined with silex and one with porcelain brick. Each uses a 12-ton charge of flint pebbles, about 300 lb. being added every three months to compensate for wear. A second set of three mills is held in reserve. The mill capacity is about two tons per hour for the tube mills and one ton per hour for the Raymond mill.

The finished talc is packed in 50-lb. paper, 50-lb. cloth, 100-lb. cloth, or 200-lb. burlap sacks and either trucked directly to cars or to a storage house. The storage of talc in paper sacks has not been found very desirable due to breakage and waste in handling, and the erection of large bins for the storage of finished talc before bagging has been considered. The present storage capacity for bagged talc is about 2500 tons. Most of the electric current for the mine and mill is purchased from a local power company, but a hydro-electric plant owned by the company, synchronized with the public service power, is capable of furnishing about 150 kw. at high water.
FLOW SHEET OF MILL OF THE ST. LAWRENCE TALC CO., NATURAL BRIDGE, N. Y.

Mine skip
400-ton bin
  Shoe feed
12" x 28" jaw crushe (to 2")
  Elevator
Two bins (50 and 60 ton)
  Two spreaders
Disk feeder
Conveyor (16" x 82' centers)
Hammer mill (to 1/3" - 1/4")
  Elevator
Screw conveyor
  Newage screen (12-mesh)
  Oversize
  Elevator
  40-ton steel bin (cone bottom)
  24" x 6' Hardinge mill
  30" x 8' Hardinge mill (reserve)
  Elevator
  Conveyor
  80-ton bin (wood)
  Two mechanical packers

Belt conveyor
  200-ton bin
  One Raymond (high side)
  5-roller mill
  Fan
  6' centrifugal air separator
  Product
  Return air
  50-ton bin
  One mechanical packer
  Product bagged.

Capacity: 72 tons per 24-hr. day. Product bagged.

June 4, 1920.
Uniform Fibrous Talc Co., Talcville, New York.

The mine and mill of the uniform Fibrous Talc Co., are at Talcville, St. Lawrence County, New York, on the Edwards branch of the New York Central R. R. about eleven miles from Gouverneur. Production from the original mine began in 1911 and continued in increasing quantity until 1919 when cave-ins compelled the closing of the old mine. Immediately diamond drilling was started and several new veins a short distance to the west of the old workings were discovered. A new vertical shaft, 7' x 9', has been sunk, to cut the new veins, to a depth of 140 feet. The first 40 feet of this shaft cut water-bearing strata and the water was sealed off by cement grouting under pressure. This section was then lined with concrete. The shaft is divided into two compartments, a skip way and a ladderway with sills or landings at 15-foot intervals.

In order to obtain immediate production a small vein, encountered in the shaft, has been opened at the 120-foot level. A winze is now being sunk in this vein and the shaft will be deepened to at least 200 feet by raising from below, thus enabling production to be continued while deepening the shaft. From the bottom of the shaft crosscuts will be driven not only to develop the new veins but also to reopen the old mine and recover the remaining talc.

As the old workings were inaccessible at the time of the inspection (June, 1920) and the new mine was not extensively developed, the method of mining which will be followed had not been decided upon.

Ore from the mine is hoisted to the surface in a one-ton steel skip and thence over an inclined trestle across the railroad siding to the "rock house" in which is located the hoist. The hoist is geared to a 50-hp., 220-volt, 138-ampere, 3-phase, 60-cycle, induction motor. In the power house, close by, is a 2-stage, 14"x9"x10", 200-250 cu.ft. air compressor belted to a 50-hp., 220-volt, 124-ampere, 3-phase, 60-cycle induction motor. Air pressure maintained at the drills is about 80 lb. per square inch.

Milling

The ore skip is dumped automatically in a chute leading to a picking floor at the top of the rock house. Here waste is sorted out, thrown into a chute leading to a waste car and trammed out on the waste dump. The ore is shovelled into a chute leading to a 150-ton rock bin. At the bottom of the bin large lumps are broken down with sledges and the ore is fed by shovel into a 10" x 16" jaw crusher. Progress of the ore through the plant may be followed from the appended flow sheet.

This plant is perhaps typical of the talc plants, using intermittent dump cylinders, or short pebble mills. The cylinders are of steel, 6 foot in diameter by 8 foot long, and are lined with porcelain brick. A charge consisting of one ton of talc and three tons of flint pebbles is revolved at 22½ to 23 revolutions per minute for a period of four to seven hours. The finishing point is determined by visual inspection of the product. When the grinding is completed the charging door
is removed, a grating to hold back the pebbles placed over the opening, and the mill revolved until the talc all flows out into a hopper beneath. At the bottom of each hopper, which serves two mills in parallel, is a screw conveyor which transfers the talc to an elevator, and thence to a 16-mesh revolving screen. This screen is intended to remove broken pebbles, sticks, and coarse impurities. It is estimated that 80% of the finished product is packed in 50-pound paper sacks.

The total horsepower installed at the mine and mill is 500 hp., of which the mill installation is about 375 hp. The mill load is stated to be about 350 hp. Of the total electric power used about 70% is obtained from a hydroelectric plant, owned by the company, on the Oswegatchie River, and the remainder is bought from a public service company.
Mine grip
Sorting floor
Tale
Chute
Taste

15-ton bin
Slag and scrap

10' x 16' jaw crusher (to 1-1/2"

Belt conveyor
14' x 24' rolls (to 1"

Elevator
1' x 6' trolley (1/2" punched plate)

Overhead
Conveyor
Chute

Underhead
Conveyor
Chute

20-ton bin
15-ton bin (emergency)

Chute
Elevator

6' Hardinge mill
43" horizontal burr mill (emergency)

Elevator
Chute

Elevator
Chute

6' Hardinge mill

Bin
Conveyor

Bin
Chute

1-ton charging cars on platform scales

Eight 6' x 8' damp cylinders

Four hoppers
Screw conveyor
Elevator

1' x 6' trolley (16-mesh screen)

Underhead
Screw conveyor
Elevator
Conveyor

Distributing conveyor
15-ton bin

Two mechanical packers

Product bagged.

Capacity: 38 tons per 24-hr. day.

June 9, 1920.

The mines and mills of the International Pulp Co. are located in St. Lawrence County, New York, between Gouverneur and Talcville along the Edwards Branch of the New York Central R. R. This company has been operating for many years and has consolidated with it the properties formerly operated by the Union Talc Co., and the United States Talc. Co. It is stated that the company now owns or leases four mines and operates four mills. Of the mines the No. 2, and No. 4 at Talcville are the only ones on the railroad; of the four mills only two, Nos. 3 and 6, are on the railroad. This arrangement necessitates considerable hauling or double hauling for distances up to 7 miles by wagons in summer or sleds in winter. As the writer was allowed to visit only one mine, the Wight, which has not been in operation for some time, and only one mill, No. 6, the descriptions are incomplete. Some of the information given was obtained from publications, some from personal examination, and some from other sources.

Mining.

The mining method here described refers only to the Wight mine, but it is said to be typical of the other mines of the company. The vein worked at the Wight mine varies from 5 feet to 25 feet thick and has an average dip of 35°. The mine is opened by an inclined shaft driven in the vein to a depth of 350 feet. At intervals of 50 feet vertically, drifts or levels are driven in the vein in each direction from the shaft. These drifts are cut about 20 feet high and 20 feet wide, or the width of the vein where it is less than 20 feet and are arched at the top. After leaving a shaft pillar, raises are driven about 20 feet wide and the thickness of the vein, to the level above. Pillars about 30 feet wide are left between raises. There is practically no timber used in the mine. Ore from the raises rolls down the slope to the drift, where it is shovelled into cars, trammed by hand to the shaft, and dumped directly into the skip. It is stated that about 60% of the ore is removed in the first mining.

Drilling is done by compressed-air drills of the jackhammer type used either alone or mounted on light columns or tripods. In blasting 40% nitro starch explosive is used. Pumping, which is not an important item, is done by a steam pump on the 250-foot level.

At the surface the skip dumps the talc automatically to the floor of a rock house. Here waste is separated from talc by hand, loaded into cars and trammed out onto a waste dump. The talc is similarly loaded into cars, trammed out on a trestle on the opposite side of the rock house and dumped on a stock pile. When the mine is running, the ore is hauled by wagon to the Columbia No. 3 and No. 5 mills.

Milling.

Of the mills of this company only the No. 6 was examined. This mill, which is their largest and best equipped, was built in 1909. It is located in the village of Hailesboro about two miles from Gouverneur. Ore from the mines is brought into the mill in standard-gage railway cars, and unloaded either into a
large concrete bin or into a chute which leads directly to the primary jaw crusher. Two crushers are in use, a 30" x 36" which is the main crusher, and a 13" x 28" which is held in reserve. The progress of the ore through the mill is approximately as represented on the appended flow sheet. The tube mills used are set in two lines of four each in tandem, each line being driven by shafting as a unit. The discharge from each tube mill is elevated to the top of the building and conveyed by chutes to the next tube mill. The capacity of each line is about two tons per hour which gives a total mill capacity of about four tons per hour. Most of the mills are lined with silex but some are lined with porcelain brick. Each mill requires about 150 hp., giving a total of 1200 hp. for the tube mills alone.

Large storage capacity for crude ore and for finished talc in bags is supplied. On account of loss by breakage in handling talc in paper bags, an effort is made to store most of the finished talc in burlap bags. For normal shipments 50-lb. paper and 100 and 200 lb. cloth bags are used.

Most of the power for this mill is supplied by water from the Oswegatchie River, which flows by the mill. This water-power development furnishes about 1500 hp. to the mill at high water, and some additional electric power is used. Power is distributed to the main shafts of the mill by rope drive. It is stated that the operation of the mill is sometimes hampered by lack of water power.

The other mills of the company were not visited but it is reported that they differ from the No. 6 principally in that they use the intermittent dump cylinders instead of the continuous tube mills. The accompanying approximate flow sheet of No. 3 mill is said to be typical.

The total production of the mills of this company, in June, 1920, probably averaged between 150 and 200 tons per 24-hour day but the capacity is much higher.
FLOW SHEET OF NO. 6 MILL OF THE INTERNATIONAL PULP CO., GOUVERNEUR, NEW YORK.

Standard gauge cars

Chute

30″ x 36″ jaw crusher (2″ to 2-1/2″ size) (has 13″x 28″ auxiliary crushe)

Conveyor

42″ rolls (to 1″)

28″ rolls (to 1/2″)

Elevator

3″ x 10″ trommel (1/2″ punched plate)

Oversize

14″ x 30″ rolls

200-ton bin

Four 6′ x 24′ tube mills in tandem

Undersize

Four 6′ x 24′ tube mills in tandem

Elevator

42″ x 10′ screen (22 mesh)

Oversize

Waste

Undersize

Conveyor

42″ x 10′ screen (22 mesh)

Undersize

Oversize

Waste

11 steel bins (10-20 ton, 1-10 ton)

11 mechanical packers

Product bagged.

Capacity: 100 tons per 24-hr. day.

June 8, 1920.
FLOW SHEET OF NO. 3 MILL OF THE INTERNATIONAL PULP CO., GOUVERNEUR, NEW YORK.

Crude ore
  Jaw crusher (to 2"
  14" x 28" rolls
  Rotary crusher (to 3/4" to 1")
  Bin
  Three Griffin mills (about 60% 150 mesh)
  Charging cars
  Three sets of 3 dump cylinders each
  Hoppers
  Conveyors
  Elevator
  42" x 10' screen (20-22 mesh)
  Undersize
    Bin
    Product bagged.
  Oversize
    Waste

June 8, 1920.
The W. H. Loomis Talc Corporation first started operations early in 1919, and as yet has shipped only crude talc. A mill site has been acquired on the Edwards branch of the New York Central Railroad, about six miles from Gouverneur, and a mill is under construction. The company obtains its ore from the Arnold mine which was formerly operated by the Union Talc Co., and the International Pulp Co., in succession.

The Arnold mine is located in the town of Fowler about six miles from Gouverneur and two miles from both the present shipping point and from the site of the new mill. This mine is opened by an inclined shaft in the vein, starting at a dip of 55° and gradually changing to about 62°, to a depth of about 222 feet vertically. Three levels are now open at depths of about 125, 168, and 222 feet vertically. The first or top level has been worked out. Work is now being done only on the bottom level. Drifts, varying in length from 20 to over 400 feet have been driven on each level. The vein or system of veins has a total width, as now exposed (the hanging or foot wall on the fourth level has not been found), of about 146 feet. A typical section from foot wall to hanging wall is: talc 13 feet, waste 2 feet, talc 65 feet, waste 17 feet, talc 7 feet, waste 2 feet, talc 28 feet, waste 1 foot, talc 11 feet, no hanging wall; total 124 feet of talc and 22 feet of waste. The waste is so located that part may be left standing as pillars, part stowed underground, and a small amount hoisted.

An interesting feature of this mine is the numerous varieties of talc found here. Practically all the varieties of fibrous, massive and foliated talc found in the Gouverneur district were observed. In portions of the mine the segregation of varieties is such as to suggest the possibility of mining several grades separately or at least of making such a separation at the surface. Very good specimens of hexagonite, a pink variety of tremolite containing manganese, are also found.

As the present management has devoted most of its time to development work on the fourth level, no method of mining has been adopted. The method formerly followed by previous owners probably was similar to that at the Wight mine of the International Pulp Co., described elsewhere in this report.

Both the ore and the rock are strong and stand well, practically no timber being used. The shaft is 8$\frac{1}{2}$ x 9 ft. in the clear and is timbered only with a few sets at the top. A ladder-way, following down beside the skipway, has sills from 20 to 30 feet apart vertically. Steel cars, holding about 1$\frac{1}{2}$ tons are dumped directly into a skip of the same capacity. Drainage, which is not a serious item, is cared for by a steam pump, having a capacity of 100 gallons per minute which is run 1$\frac{1}{2}$ to 2 hours per day.

At the surface the skip automatically dumps the ore to the floor of a rock house, where the waste is sorted out and trammed to a waste dump. The talc is either dropped through openings in the floor into bins with a total capacity of about 30 tons or trammed out on a stock pile trestle and dumped. The bins are provided with chutes from which wagons are loaded. In the power house are a 15-hp. belt-driven hoist, a 40-b. hp. locomotive-type boiler, and an 8" x 8" single-stage air compressor.

The ore at present is either stocked or hauled to the railroad and shipped in the crude state.
PROPOSED FLOW SHEET OF MILL OF THE
W. H. LOOMIS TALC CORPORATION, EMERYVILLE (6 miles east of Gouverneur) NEW YORK.

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Rock bin
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12" x 18" jaw crusher

Elevator

Small bin

14" x 30" rolls (to 1/8-1/16"

Elevator

Rectangular screen

Oversize

Undersize

Bin

8' x 30" Hardinge mill

Elevator

Screw conveyor

10' air separator

Over 150 mesh

Thru 150 mesh

Elevator

Screw conveyor

6' x 24" tube mill

Elevator

14' air separator

Product

Waste

Elevator

50-ton bin

Finished product bagged.

Theoretical capacity:
30 tons per 24-hr. day.

June 9, 1920.
The mill that will grind this talc is now under construction. The plans may be changed somewhat, but the probable method of milling is shown in the appended flow sheet. This flow sheet is of special interest because it indicates a radical departure from the methods formerly and at present used in this district. By the use of air separators an attempt will be made to eliminate the large amount of waste energy incident to the use of several tube mills in tandem. If this mill is successful it will mark an important step in the progress of talc milling. The enterprise of this company in seeking to devise better methods is to be commended. - U. S. Bureau of Mines, Reports of Investigations.