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ROCK WOOL

OPPORTUNITIES FOR MANUFACTURING

IN

GEORGIA

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OPPORTUNITIES FOR ROCK WOOL MANUFACTURE IN GEORGIA

Rock wool is a heat insulation product which is usually prepared from impure limestone.

No rock wool is manufactured at present in the Southeastern States. Tennessee and Alabama produce some slag wool, but there are no plants of any kind manufacturing insulating wool in Georgia, Florida, Louisiana, Mississippi, South Carolina, and North Carolina. Georgia's geographic position gives her rare market opportunities. In the following pages we wish to show that Georgia has a great cpportunity for rock wool manufacture; that she has ample rock wool resources; and that costs of plant construction and labor are reasonable in this State.

THE OPPORTUNITY

The market territory for a mineral or rock wool plant in Georgia is probably the states of Georgia, North Carolina, South Carolina, Florida, Alabama, Tennessee, Mississippi, and possibly Louisiana. At the present time the state of Georgia, North Carolina, and Tennessee are the best markets, South Carolina and Alabama the next best, and Florida the least developed.

Much rock wool, or mineral wool, is being used at present in Georgia and other Southeastern States. All of this material must be brought in from a considerable distances so that the consumer pays more for his product, yet this additional cost to the consumer does not benefit the manufacturer. Florida is not favorably situated for the manufacture of rock wool because the necessary materials for its manufacture are not easily obtained there, and Florida is far removed from fuels. Atlanta is one of the best markets in the southeast and is a city particularly favorable to the building trade. This is also true of other large cities, such as Columbus, Rome, Brunswick, Macon, Augusta, Savannah, etc. Our warm climate is popolarizing air-conditioning throughout this region. Thus, when we see that no mineral wool is manufacturer in other adjecent states it is obvious that we have an open market for such products in these states.

Between 1,000 and 1,500 tons of mineral or rock wool are sold yearly in the Southeast territory outlined above. At the present time, this market is being supplied largely from the states of Indiana, Ohio, New Jersey, and other states in the Middle West and East. The freight rate to the Southeast territory amounts to between $12\frac{1}{2}\%$ and 17% of the cost of wool to the distributors. The leading brands of blowing-wool sell to the distributors in Atlanta at about $53.00 per ton, although a few of the "independents" sell it as low as $35.00 per ton. Batts cost the distributors $4\frac{1}{2}$¢ to $6\frac{1}{2}$¢ per square foot.

At the present time, about 60% of the use of mineral wool for home construction in the southeast is in new homes (largely batts), and about 40% in insulating old construction (blowing wool). About 75% of the new homes costing $6,000 and over are being insulated. The saturation point of insulating previously constructed homes has by no means been reached, thus the market for mineral wool in the Southeast territory is steadily growing. The greater part of the home insulation in the Southeast is of the ceiling only. The quantity of wool consumed per house could and should be increased by the use of 2-inch batts in the walls, the use for fire-proofing attached garages, and the use under the floors in small but modern homes without a basement. The industrial use of mineral wool could be increased if the manufacturers would put out a 1-inch blanket for wrapping air ducts in air-conditioning installations.

The conclusions from numerous interviews with companies selling this type of insulation in Atlanta is that a mineral wool plant in Georgia would succeed, provided: (1) It was carefully located in reference to raw materials and distribution facilities; (2) Careful chemical control under an experienced operator is used so as to produce wool that is equal in quality to the standard brands in use today. Particular attention should be paid to the quality of the batts, as this use is growing and the installing companies demand batts that are strong and easy to handle; (3) The company must be adequately financed so as to be able to stand the period of getting their product adopted by the distributors of the Southeast. The few plants now in the Southeast apparently make a product that does not quite come up to the quality of the "standard brands" and have a very small capacity compared to the present and future market. The freight rate differential of the others offers a decided inducement to locate a progressive mineral wool plant in Georgia.

ROCK WOOL RESOURCES

Wool rock, the ordinary source of rock wool, is an impure or siliceous limestone. Wool rocks are recognized by their chemical composition; careful blowing tests should be made, however, before constructing a plant near a deposit.

Impure limestones or calcareous shales which contain around 40 to 65 per cent calcium carbonate or calcium magnesium carbonate and the balance, chiefly silica or silica and alumina, will make rock wool. Experiments also indicate that rocks which contain between 20 and 30 per cent carbon dioxide will make rock wool. It is obvious from the above remarks that such products as limestone and sandstone, limestone and shale or slate, etc., may be blended to form a suitable mix.

Possibilities for rock wool manufacture occur in many sections of northwest Georgia. From Cartersville and Rome, northward, the Knox dolomite (a cherty dolomite) is a wide-spread formation over this ares. The percentage of silica varies with locality but analyses in our files show that this formation would be suitable locally for rock wool manufacture. Another formation common to the area is called the Fort Payne chert. This formation ranges from nearly pure chert to a cherty limestone, the latter locally suitable for rock wool manufacture. These formations and others of this section have been described and their outcrops have been mapped.

Silurian shales adjacent to the red iron deposits of Dade County contain considerable lime. Many are accessible to the Southern Railway in Lookout Valley. Near these shales are outcrops of Mississippian limestones, As an example of this type of deposit, excellent outcrops of calcareous shales occur on Shinbone Ridge, east of Trenton.

The following are some typical sections and analyses of wool rock and sub-wool rock in the Paleozoic area of northwest Georgia:

Big Cedar Creek Exposure Floyd County[1]. Limestone of the Connasauga is exposed over a thickness of about 30 feet about one mile northwest of Vans Valley, along the north side of Big Cedar Creek. The lower 10 feet of the exposure consists of light bluish-gray limestone resenbling in lithologic character the Knox dolomite; this 10 feet is wool rock, as illustrated by its analysis below. Immediately above this unit lies 10 feet of cherty limestone which, in places, might be termed a calcareous shale. Analysis 77 of this unit shows it to be a sub-wool rock. At the top of the exposure, the rock is a dolomitic limestone which resembles the Knox dolomite. It seems likely, therefore, that the entire section might be used in rock wool manufacture.

Analyses of Limestone from Big Cedar Creek Exposure

	76	77
Lime (CaO)......................	15.40	14.18
Magnesia (MgO)..................	10.96	3.20
Ferric oxide (Fe_2O_3)	1.76	4.18
Sulphur trioxide (S_2O_3)	tr.	tr.
Phosphorus pentoxide (P_2O_5) ...	.02	.04
Silica (SiO_2)	30.24	31.95
Potash (K_2O)	3.41	4.48
Soda (Na_2O)	.31	.35
Clay bases	10.73	12.68
Loss on ignition................	27.17	28.94
	100.00	100.00
Carbon dioxide (CO_2) cal.	24.04	14.62

[1] Maynard, Poole T., A report on the limestones and cement materials of north Georgia, Georgia Geol. Survey Bulletin 27, pp. 166-167, 1912

Cartersville District: Rock wool may be manufactured in and near the Cartersville district - in Bartow and Gordon counties north of Cartersville. In that section, both limestone and slate compose the Connasauga formation. The limestones range in chemical composition form high-calcium limestone to dolomite and they grade from pure limestone to dolomite through argillaceous limestone to calcareous shale. (These rocks will make rock wool.)

There are numberous localities where the limestone is immediately adjacent to the slate. This district has been famous for its slate quarries for much green slate was quarried in the past. Analyses of the slate and the limestones show that the slate waste could be readily combined with the limestone to produce rock wool; thus the slate could be quarried as a by-product. Although, in recent years, tile and other types of roofing materials have cut into our slate markets, there should be ample sale for this handsome slate for use where dwellings are being constructed at a cost of from twenty to twenty-five thousand dollars. Indeed, it would seem that the same salesman might successfully sell both products at the same time. Railroad and highway facilities are excellent in this part of the State. The Louisville and Nashville railroad practically follows the outcrop of the formation as well as does the new National Highway No. 411 from Cartersville to Chatsworth. The slates and associated limestones are described in Bulletin 34 of the Geological Survey of Georgia. Description and analyses may be found in Bulletin 27 of the Georgia Geological Survey, entitled, "A Report on the Limestones and Cement Materials of North Georgia".

Walker and Dade Counties: There are many localities in northwest Georgia where it would be possible to blend sandstone and limestone in rock wool manufacture. Carboniferous sandstones and limestones of Lookout Mountain represent an example. Lookout Mountain is capped by thick deposits of sandstone (the Lookout formation and the Walden sandstone). These formations are underlain by the Bangor limestone. On the western side of the mountain, the lower portion of the Bangor limestone contains a considerable amount of chert. The limestone also contains argillaceous and magnesian limestone. In Pigeon Mountain, a spur of Lookout Mountain, the Bangor limestone has an estimated thickness of 900 feet. Here it is directly overlain by the Lookout sandstone and shales.

The coal of Lookout Mountain is coking coal. Birmingham coke may be obtained at reasonable costs and natural gas is locally available. T.V.A. power and Georgia power are also available in northwest Georgia; water power and water are abundant. Railroads and National highways are numerous.

PIEDMONT MARBLE BOLTS: Rock wool could be made from certain rocks in the great belt of crystalline rocks which occurs throughout middle north Georgia. In Hall and Habersham counties, northeast of Atlanta, large deposits of impure marble occur. This marbel belt lies not far from the Southern Railroad and from the U. S. Highway 23, through Gainesville, Baldwin, etc.

Wool rocks occur in the marble belt of Pickens, Cherokee, Gilmer, and Fannin couties in northern Georgia. The Louisville and Nashville Railroad and State Highway No. 5 follow the belt through Keithsburg, Sharp Mountain, Ball Ground, Tate, Ellijay, and Blue Ridge. The famous Georgia marble quarries are located in Tate. Wool rocks probably occur along this entire marble belt. The following analyses (Georgia Geological Survey Bulletin 43, by W. S. Bayley, p. 98) show wool rock at Keithsburgand at Whitestone (Gilmer County):.

ANALYSES OF Blue Gray Marbles from the Keithsburg Belt
Cherokee County, and from Whitestone, Gilmer
County, Georgia
Analyst: Dr. Edgar Everhart

	Keithsburg Belt		Whitestone
	1.	2.	3.
Moisture	.05	.10	.00
Ignition	.54	2.02	1.18
CaO	30.95	32.68	26.72
MgO	2.00	.81	2.12
FeO	2.03	2.03	.23
MnO	...	.00	...
CO_2	25.36	25.36	24.00
Al_2O_3	9.23	10.58	8.11
Fe_2O_3	3.05	3.86	2.65
SO_3	Trace	.00	.00
P_2O_5	.00	.00	.00
TiO_2	.38	.33	1.65
Na_2O	.23	.06	.44
K_2O	.46	.21	.23
SiO_2	26.41	21.37	32.29
	100.69	99.91	99.62

1. Slightly schistose, fine-grained bluish-gray marble. In stream Crossing road $1\frac{1}{4}$ miles southeast of Gover.

2. Bluish-gray, micaceous schistose marble at bridge over Long Swamp Creek, one mile south of east of Nelson.

3. Very fine-grained, platy gray-blue marble. West side of valley, south of road leading to Highway No. 5, Whitestone, Gilmer County.

In the following analyses from Sharp Mountain Creek, in Cherokee County (Bulletin 43, p. 100), No. 4 is a sub-wool rock and No. 5 is a wool rock:

Analyses of Blue-gray Marbles from Sharp Mountain Belt,
Cherokee County, Georgia
Analyst: Dr. Edgar Everhart

	4.	5.
Moisture....................	.04	.06
Ignition....................	.10	2.56
CaO	20.74	32.14
MgO	2.28	1.34
MnO	...	...
FeO	2.11	.39
CO_2 (Calculated).......	17.50	25.90
Al_2O_3....................	16.23	12.13
Fe_2O_3	2.82	4.71
SO_3	.00	...
P_2O_5	.00	.02
TiO_2	.25	.43
Na_2O	.18	.16
K_2O	.63	.59
SiO_2	37.01	19.38
Organic Matter..........	...	.22
TOTAL	99.89	100.03

4. Schistose, gray-blue, fine-grained micaceous marble, 2 miles northwest of Gober, where road crosses Murphy Creek

5. Gray and blue-gray, fine-grained micaceous marble, 2 miles west of Ball Ground on Sharp Mountain Creek.

It should be noted here that marble waste from the quarries at Tate could be mixed with the sub-wo ol rocks to form a suitable product. The combined carbonate content of the marbles quarried at Marble Hill is very high, composing 97 to 99 per cent of the rock.

APPROXIMATE MINERAL COMPOSITIONS CALCULATED FROM ABOVE ANALYSES FROM KEITHSBURG BELT, WHITESTONE, AND SHARP MOUNTAIN CREEK BELT

Analysis No.	1	2	4	5
$CaCO_3$	53.15	53.80	34.40	56.10
$MgCO_3$	3.76	1.68	4.53	2.50
$CaCO_3$: $MgCO_3$	14.1:1	32:1	7.5:1	22.5:1
Soluble constituents other than carbonates	6.78	3.32	13.70	8.66
Kaolin	2.25	11.75	11.50	15.20
Epidote	10.35	16.30	4.95	3.15
Feldspars	4.17	1.56	4.91	4.65
Quartz	18.44	8.23	26.40	7.86
Excess H_2O in analyses	.00	.00	.20	.03

Granite Waste: The granite operations of DeKalb County, 12 or 15 miles from Atlanta, have accumulated a large amount of fine granite waste producted in cutting the stone. It might be possible that this granite waste could be combined with marble waste from the Georgia marble quarries in the manufacture of rock wool. Should such a combination prove feasible, that product could be manufactured in Atlanta.

Fullers Earth: Vast deposits of calcareous fullers earth, known as the Twiggs clay, occur in south Georgia. These materials are found in Houston, Twiggs, Wilkinson, and Washington counties. The material is a natural wool rock mixture. Mining costs would be low because the material is soft, and, also, because it could be mined at the surface by the simplest mechanical equipment. Railroads and highways frequently cross the are of outcrop; water and electricity are abundant.

A representative sample of Twiggs clay from a 10-foot bed of calcareous fullers earth in Houston County gave us the following analysis:

Al_2O_3	5.5
Fe_2O_3	3.2
SiO_2	39.8
$CaCO_3$	42.2
$MgCO_3$	6.58
Undetermined	2.78
	100.06
CO_2 (calculated	21.85

The amount of calcium carbonate which this fullers earth contains naturally varies with the locality. This is due to the fact that the Twiggs clay is a facies of the Ocala limestone. It is possible in this part of Georgia to find localities in which the Twiggs clay merges laterally into the Ocala limestone. Such localities would undoubtedly be excellent spots for the mining of wool rock.

<u>South Georgia Limestone:</u> The Ocala limestone is quite extensive in the southwestern portion of the State. It covers wide areas in Randolph, Terrell, Lee, Sumter, Dougherty, Calhoun, Early, Baker, Miller, Siminole, and Decatur counties, where it outcrops at the surface of the ground. On its western boundary there are sands and clays and on its eastern edge are argillaceous limestones. The Ocala is locally quite cherty, but in other places it is very rich in calcium carbonate - sometimes as high as 98% $CaCO_3$. Undoubtedly there are numerous localities in which this limestone occurs where the composition would be suitable to the manufacture of rock wool.

PLANT CONSTRUCTION AND OPERATION

It is comparatively simple to make rock wool from suitable raw materials and with adequate heat, but the quality will vary from day to day unless suitable attention is paid to specifications. The wool rock is melted in a cupola-type furnace; the slag is then drawn off in a thin stream, falling into a high pressure steam, or air blast which disintegrates, or shears, the liquid into minute threads and globules of glass which, when accumulated, have the appearance of fluffy wool. Hence, the name, rock wool.

It is an entirely different matter, however, to produce a wool in which the size (diameter and length) of fibers, the percentage of shot (globules), the resiliency, and brittleness must be carefully controlled to meet specific marketing requirements. There is ample opportunity to improve the quality of rock wool by technical studies. For example, shot will be produced when the molten rock stream is attacked by a blast of steam;

yet it might be possible to eliminate shot completely by blowing the melt from the cupola through very small orifices. Constant technical supervision of all plant phases in the manufacture is absolutely required in order that a constant product of good quality may be maintained; and, also, in order that the company may keep abreast of the general advancement in the industry as a whole. The last item is quite important beaause of the highly competitive nature of the mineral wool business.

J. R. Thoenen of the U. S. Bureau of Mines states that he "believes that the manufacture of mineral wol will continue to be a so-called decentralized industry because of transportation costs and the wide-spread distribution of potential raw materials." Concerning the plants, he says, "they must be highly technical to meet the market demands for specification products. - The manufacture of mineral wool to meet specifications within rapidly narrowing limits is not a simple process and cannot be accomplished without detailed and elaborate technical control." He continues by adding some of the important items which must be considered in plant operations:

"1. Chemical and physical composition of raw materials.

2. Type of melting furnace.

3. Melting and blowing temperature

4. Blowing technique

5. Shot prevention or removal.

6. Consumer's specification requirements."

Consequently, it is our recommendation that the services of an experienced engineer or technician, trained in the construction of rock wool plants, and their operation, be obtained before proceeding further. Expert advice is extremely advisable. The names of such experts can be secured from the U. S. Bureau of Mines, from the manufacturers of rock wool plant furnaces and machinery, or from present operators of rock wool plants. The Geological Surveys of Illinois, Indiana, Ohio, and Kansas may also be sources of information because those states lead in the manufacture of rock wool.

A detailed description of the many factors entering into the operation and maintenance of a rock wool plant has been prepared by J. R. Thoenen in the U. S. Bureau of Mines Circular 6984R, June, 1939. The reader is referred to that paper for additional information of this type.

It is likely that arock wool plant erected in Georgia would use the water-jacketed cupola-type furnace in which to melt the wool rock. Also, it is probable that steam under high pressure would be used to blow the wool. Such an arrangement would therefore permit the erection of a plant by units - additional cupolas being added to the original one as the demand increased. Several advantages are apparent at once in such a set-up.

Most of the machinery used in the plant, excepting the cupola and the packing machines, can generally be assembled from factory equipment manufacturer's suppliesof stock parts. Other pieces of the machinery can be built by a competent mechanic.

Various types of plants, naturally, will range over a wide scale of costs. Therefore, to give the reader some idea of what a good plant will cost, figures have been taken from a paper by Charles F. Fryling, chemist, Illinois Geological Survey, and Orval White, President, Mineral Insulation Company, Chicago Ridge, Ill., read at the Third Mineral Industries Conference of Illinois, Urbana, May 18, 1935, and printed in Rock Products Magazine of January, 1936. This paper states that a plant producing 1,000 lbs of rock wool per hour should cost approximately $38,000. If coke at $4.00 to $5.00 per ton is used, the cost per ton of rock wool should be about $20.00.

A plant of this size - i.e., one producing 12 tons per day - if erected in Georgia, would supply over one-third of the present total consumption of rock wool in the southeastern states. Such a figure seems to be a fair one for a local plant.

The construction of a plant for the production of rock wool is not a difficult problem, but the operation of the plant calls for technical, experienced, and capable men provided with adequate laboratory equipment for control purposes. The plant should be so designed that it can be operated as units, and constructed as units - additional parts being added as increased demands for the product warrant.

A generously financed program for such a business should be the first consideration of any prospective investor. Funds should be provided not only for an efficient plant, but also for a comprehensive sales campaign. That is not to say, however, that the rock wool producer must have financial backing in excessive proportion to other ventures of similar type, but only to point out that a quality product depends entirely on adequate plant facilities for turning it out, and a sales program for getting it to the consumer.