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I N F O R M A T I O N C I R C U L A R

PRODUCTION OF MICA IN NORTH CAROLINA

A memorial

By
T. G. Murdock

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INFORMATION CIRCULAR

NORTH CAROLINA DEPARTMENT OF CONSERVATION AND DEVELOPMENT
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PRODUCTION OF MICA IN NORTH CAROLINA

By T. G. Murdock*

For the last 25 years 75% of the world's supply of mica has come from India. Due to recent events in the Pacific which have deprived the United States of that source of supply and to the increasing demand for sheet mica of high quality for radios, spark plugs, transformers and generators, the strategic position of mica in the United States has become quite pronounced.

In view of the fact that North Carolina has produced 60 per cent of the domestic sheet mica of the United States, for 25 years, the importance of the State in the war effort, in this respect, is quite apparent. The possible contribution of North Carolina mica has been recognized 1/ and during 1940 the United States Geological Survey carried out examination work in the Spruce Pine area, as a part of its general investigation of domestic deposits of strategic minerals. This project was continued during 1941, as a cooperative project between the above-named agency and the North Carolina Department of Conservation and Development, to study in detail the "Economic Geology of the Pegmatites". Plans have been made for the continuance of this project during the 1942 field season, with special emphasis on the mica.

In view of the widespread interest in North Carolina mica, and in response to numerous inquiries for information, this summary of the mica industry has been prepared to acquaint persons who have had no previous experience in that field with the more general factors to be considered.

The War Production Board has expressed a desire for an increased mica production in North Carolina, but no definite plans have been announced. It is believed that any efforts made to increase production will be directed more towards increasing output from active mines, the opening of prospects about which information is already available and the reopening of inactive mines which have a record of past production of a suitable product, rather than the prospecting for new deposits where no work has ever been done, or in those areas where there has been little or no production. It appears that the needed production may be possible without recourse to the latter procedure. Much information is already available about mines that were formerly in operation and several publications 2/ describe these in some detail. It is obviously impossible for a geological examination to be made immediately of each mica occurrence which is reported. All areas where there is a possibility of the development of commercial de-

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1/ References are at the end of circular.

posits will be investigated when conditions permit. It is certainly more practical to undertake an investigation of an entire area as a unit, rather than of isolated occurrences as they are reported.

Mineralogy of Mica:

Chemically, the micas are highly complex silicates of aluminum and one or more bases, the specific characteristics of the mineral being determined by the variable second base metal in the composition. The leasing mica of commerce is the potash mica, muscovite, or white mica, while the second in importance is the magnesium mica, phlogopite, or amber mica. These two cover the bulk of the commercial mica mined, although small amounts of other varieties are sometimes used. Muscovite is found in a number of localities, but phlogopite comes entirely from Canada and Madagascar. Muscovite is the common variety in North Carolina although biotite does occur in a few deposits in moderate quantity, and smaller amounts in many others. Biotite is usually dark green or black in color, has less flexibility and is less resistant to weathering than muscovite; it has a very limited application as an industrial mineral. Mica crystallizes in the monoclinic system, commonly showing rhombic or hexagonal outlines. Because of its eminent basal cleavage it is easily split into thin sheets or films. Among its physical properties it possesses transparency, toughness, flexibility, resonance, resistance to heat, and a remarkably high dielectric strength.

Mica-Bearing Areas in North Carolina:

3/ The mica producing areas of North Carolina may be grouped in three major fields. Two of these lie close to the Blue Ridge Range, while the third is southeast of the mountains in the foothills and Piedmont area. In the southwestern part of the State, the mica mines in Macon, Jackson and Haywood counties constitute one field. Eighty miles to the northeast, paralleling the trend of the mountains, there is another mica producing area, in the counties of Yancey, Mitchell and Avery. This field really extends northeastward, into Watauga and Ashe counties, where numerous dikes of economic value occur. The Piedmont field is confined principally to parts of Rutherford, Cleveland, and Lincoln counties. Regarding each of the three fields designated, it should be said that there are many commercial occurrences of mica outside of the counties mentioned above. In fact 20 counties in the State have reported a production of mica during recent years.

4/ The area embracing Yancey, Mitchell and Avery counties is commonly known as the Spruce Pine district, where mica and feldspar have been mined from more than 500 pegmatite bodies, some of which are more than a hundred feet thick, closely associated with a variety of granite known as alaskite and occur both in the alaskite and in adjacent metamorphic rocks. At least 16,600,000 pounds of sheet and punch mica have been shipped from the district since 1868, when mica mining began. It is estimated that the part of this output classed as domestic clear sheet mica averaged 45,000 pounds per year during the period 1924-40. Analysis of the recorded past and present output of 131 mines indicates that a considerable proportion of the mica probably was equivalent for commercial purposes to the higher grades of imported mica, although it is impossible to trace all uses to which mica from the Spruce Pine district has been put.

Geology and Occurrence of Mica:

The mica deposits of North Carolina have been found in highly metamorphic rocks, probably all of Archaen age. These rocks are mica, garnet, kyanite, staurolite, hornblende, and granite gneisses and schists. Other rocks occurring in the region, also of Archaen age, are granites, diorites, peridotites, serpentines and soapstones. Younger granites, volcanic rocks, diabase, and sediments occur in parts of the region. The folding, faulting, mashing and recrystallization of the gneisses and schists have been so extreme that it is often difficult to determine the original igneous or sedimentary nature of the formations.

Mica deposits of commercial value in the State are confined to pegmatites. These rocks vary considerably in form, some being typically lenticular in shape and others more or less persistent in length. The lens-shaped bodies are generally conformable with the schistosity of the enclosing rock. They may lie in the same line of bedding or schistosity and be connected by smaller streaks or stringers of pegmatites, or by mere seams in the rock. Many of them, on the other hand, lie in planes of schistosity more or less separated from one another and form parallel or overlapping bodies. In cross section some of these lenses are short and bulky, with a length only two or three times their thickness; others are long and tapering and may constitute simply a bulge in a sheet of pegmatite.

Pegmatites range from a fraction of an inch up to many yards in thickness. The limit of size below which they cannot be profitably worked for mica might be placed arbitrarily at 1 to 2 feet for rich and regular "veins". In the very large pegmatites the mica is not, in general, evenly distributed through the mass, but is richer in one portion than another, so that the entire bulk of the rock does not have to be removed in mining. Horses or inclusions of wall rock, are common in pegmatites and range from an inch or two up to several feet in thickness.

Pegmatite is closely allied to granite in composition. As in granite, the essential constituents are feldspar and quartz, with more or less mica and other accessory minerals. The feldspar occurs in masses and rough crystals, some of them with a diameter of several feet. Although muscovite large enough for use as sheet mica occurs only in pegmatites, some pegmatites contain no mica whatever or many contain no mica that can be used commercially. Even when the mica crystals are large enough to yield good-sized sheets, they may be so distorted or imperfect that pieces 1 by 1 inch cannot be produced free from cracks, rulings, waviness or other structural defects. Although pegmatites may be 1 mile or more long and 100 to 300 feet wide, they may be streaks a few feet or even inches in length and width. Notwithstanding their deep-seated origin, they may pinch out in depth as well as laterally. No hard-and-fast rules seem to be recognized, but the mica crystals in a given pegmatite usually follow along the walls or accompany a quartzose band in the middle of the pegmatite. Good mica books or crystals often appear in the country rock short distances beyond the wall of the pegmatite.

"Mica capping" is a miner's term for an aggregation of mica and quartz, with or without other minerals, in which the mica is small and occurs in distorted crystals so as to be of small commercial value. The idea conveyed, that the mica forms a capping to a regular "vein" below or near by, is not necessarily true, for some such deposits carry nothing but "mica capping".

A large number of minerals have been found associated with mica in pegmatite. Some of these have commercial value in manufacturing industries, or as gems and specimens.

Quality of Domestic Mica: 6/

There is no geologic or mineralogic reason why domestic mica should differ from Indian mica of similar chemical composition and physical appearance, yet the claim has been made that domestic muscovite is inferior to Bengal ruby in its essential and other physical properties and that it cannot be employed for making condensers or for other uses requiring high-grade mica. Much domestic mica has, admittedly, been ill prepared; however, it would be unduly wasteful of a valuable national resource if domestic mica were as closely trimmed as Indian mica, because such trimming would eliminate material that can be utilized as sheet mica.

The United States Geological Survey has reported 4/ that the National Bureau of Standards made careful measurements of the power factors of 196 samples of sheet mica obtained by the Geological Survey from 109 mica mines and 15 feldspar mines. Samples from 71 mines in the group were found to have power factors within the limits allowed for mica used in radio-transmitter condensers. Samples from 10 mica mines in North Carolina, 6 of them from mines in the Spruce Pine district, were submitted to two commercial users to determine their utility in condensers. The tests showed that the mica in 8 of the 10 samples was suitable for use in condensers. These tests indicate that selected mica from North Carolina mines is equal in quality to the best imported mica.

Uses of Mica: 7/

Its unique combination of physical properties make mica so exceptionally well adapted for certain uses that it is practically indispensable, while for others it is employed simply because it is at the same time the best and cheapest available material, although others may be substituted. The chief uses for mica center around its high insulating and dielectric properties, inertness to high temperatures, low heat conductivity, flexibility, cleavage toughness, and transparency. While there are some places where it is used for its mechanical properties alone, probably 90 per cent of the modern uses of sheet and punch mica are in the electrical industry; as an insulator against high voltages, especially at high temperatures, there has been no known substitute for mica.

The purely mechanical uses include lamp chimneys and shades, windows or peep-holes in ovens, furnaces, stoves and stereopticons, eye protectors, gas masks, and other similar uses where transparency is required in combination with resistance to heat and shock. Mica diaphragms have been used in phonograph reproducers and telephone headsets, but these are now usually of metal. The major electrical uses require flat insulation in a wide variety of shapes and sizes, both as straight insulation, such as separators for commutator bars, discs, washers, and bushings, and as a form on which to wind heating elements of irons, toasters, and numerous other items of domestic and industrial heating equipment. The small shapes are made from punch mica, and the larger ones from sheet. Formed insulation may be made from sheets if the shape is not too large or complicated and the cost is justified, but a large proportion of the special shapes, such as plates, tubes, rods, cones and large bushings, are formed by cementing splittings together under pressure, making a product known as micanite. In this way all

sorts of complicated shapes may be formed, with results not greatly inferior to sheet mica, and at a much reduced cost. Another important electrical use of mica, of a slightly different character, is as a separator between the leaves of an electrical condenser; this requires an exceptionally high quality of mica, absolutely without flaws, but makes a condenser with better characteristics than any other dielectric. The development of the radio and of the internal combustion engine for the automobile and airplane have made an enormous increase in the demand for condensers. High grade mica is also used as a support for the elements in certain types of radio tubes.

There are no specific military uses for mica, but war demand will greatly increase the ordinary electrical uses; many military requirements are identical with specific industrial requirements, as for example, radio sending and receiving sets, airplane spark plugs, motors and generators; and the Army and Navy carry large stocks of mica of both the natural sheet and the micanite type, in addition to hundreds of cut-to-shape parts, all furnished to them under very strict specifications.

North Carolina Production: 5/

The following tabulation gives the details as to production of uncut sheet mica in North Carolina for the period of 1936-40 inclusive:

	Uncut Punch and Circle Mica		Uncut Mica Larger than Punch and Circle		Total Uncut Sheet Mica	
Year	Lbs. Produced	Value	Lbs. Produced	Value	Lbs. Produced	Value
1936	575,915	$29,105	154,531	$90,548	730,446	$119,653
1937	795,684	46,688	248,644	171,488	1,044,328	218,176
1938	552,471	35,885	80,175	51,994	632,646	87,879
1939	320,616	18,629	80,554	50,715	401,170	69,344
1940	348,663	78,214	153,983	139,940	1,002,646	218,154

Mining Methods: 8/

Methods of mining mica are usually of a primitive nature. Much of the mica production of this country is from open cuts, many of them comparatively shallow surface pits. While some underground work is carried out, it is a rare occurrence when a mica mine is developed by modern underground mining methods in the sense that there are applied to metal mining. Only rarely are mica-mining operations undertaken with the investment of an important amount of capital for plant, and mining usually proceeds in a fortuitously progressive, and often intermittent manner, depending on the success attending initial surface operations in finding of bodies rich enough to follow to depth.

Blocking out of mica-bearing ground ahead of production is generally impractical, so reserves are a matter of chance except in unusually rich and well defined deposits. When mining is carried much below the surface, the workings seldom are planned but simply follow the shoots or individual crystals or bunches of crystals. This often results in a series of quite irregular drifts and stopes. In exceptionally wide pegmatites, the workings may sometimes later be glory-holed, subsequent mining being conducted by open-pit methods. As a general rule hoisting equipment at mica mines is kept to a minimum and no more ground is broken than is absolutely necessary.

On level or sloping ground, a series of small pits is often opened along the strike of a pegmatite outcrop, and these may be joined later into a single large open cut. Where a vertical dike outcrops in the side of a steep ridge, mining is sometimes conducted from one or more drifts driven in along the strike at different elevations, and the mica-bearing ground between taken down by stoping methods. In flatly dipping pegmatites, the richer concentrations of mica are not uncommonly found to follow one or more of the contact zones, and the usual practice is to put down inclined drifts following the dip, which later may be joined by lateral galleries.

Little timbering is required in the average mica mine, except in lagging the collars of hoist openings and manways. For shallow workings, derrick hoists are commonly employed, replaced by drum hoists when depth is reached. The motive power for both hoist and air compressor used is generally a light, portable, gasoline-driven unit. Electric power is available in the general regions of mica mining but due to the intermittent nature of the operations and the outlay necessary for original installation, the cost of current is generally prohibitive.

The value of mica being essentially dependent on its physical perfection, care must be exercised in blasting, to ensure the least possible damage to the crystals, the object being to break the rock without shattering it. This is also required in mucking. The mica is carefully sorted out from the broken rock in the pit and placed in boxes for conveyance to the cobbing benches where adhering rock is removed and the crystals are broken into slabs or sections thin enough to be handled by the trimmers.

A report of the United States Bureau of Mines,[3] published ten years ago, gives an analysis of costs and recoveries at two North Carolina mica mines. In one of these, the value of the rock broken, in block mica per ton, was found to be $3.46; with scrap mica and marketable feldspar added, $3.93. In the other mine, where no scrap or feldspar was produced, the recoverable value was $2.55 per ton. These values show that even when a pegmatite is considered rich enough to be worked, the recoverable mica per ton of rock broken is low. Against these values it was found that mining and trimming costs totaled $2.75 and $2.23 per ton of rock, respectively.

The sales value of mica rises rapidly with increase in the size of the trimmed sheet yielded by crystals, and the profitable operation of a mine is therefore essentially dependent on the average size of the mica crystals. This is a highly variable factor, and at the two mines included in the analysis mentioned, the proportion of sheets grading 3 by 5 in. and up in one was 24 per cent of the total mica produced and in the other was less than 1 per cent.

A more recent publication of the United States Bureau of Mines [5] has called attention to the fact that inexperienced persons often expect to produce feldspar and mica as joint products of a mining operation. "Most mica mines, however, are in pegmatites that contain little or no commercial spar, and even mines that have yielded both mica and spar seldom produce both simultaneously....Mining methods are dictated by the irregular boundaries of pegmatites and the erratic occurrence of sizable mica in the pegmatites themselves. As it is virtually impossible to determine in advance of mining either the quantity or the quality of mica in a deposit, the industry is characterized by numerous small operations. Surface outcrops are gophered out, and search for new deposits or extensions is conducted through narrow, crooked workings. In some of the older districts this complicates reopening

of abandoned mines, particularly where the workings are in weathered rock, or soil may cause the mine to be abandoned as unsafe even when good mica is still being produced".

Preparation for Market:[8/]

The crude mica crystals, known as "books", taken from the mine are first of all given a preliminary cobbing, in which operation the adhering rock is hammered off and the crystals are divided into slabs or sections of a convenient weight and thickness to be worked by the trimmers. A preliminary classification is also made of marketable sheet from scrap material, the latter being sent to the scrap-storage pile for shipment to a grinding plant. In more remote localities, this scrap may not be worth its transport, and it therefore goes to the rock dump. The cobbing operation may be carried out in the open or more generally in sheds furnished with benches at which the workers sit. At small mines, rough-cobbing may be the only operation effected in the preparation of the rough run-of-mine product to marketable mica, the material being sold in that form to dealers that execute the other operations at centrally located "mica sheds or shops". The preparation of mica for the market is a highly skilled operation calling for experience in determining quality, as decided by color, inclusions, ease of splitting and freedom from cracks, flaws and imperfections of the crystals, and in determination of the maximum surface area that can be obtained from a given sheet by trimming; considerable manual skill is essential, also, in the actual operations of splitting and trimming. Unskilled labor may easily cause an unnecessary waste and unsatisfactory trimming and grading. It often pays the smaller mine operators to leave these operations to the regular dealers who employ labor qualified for the work.

Mica is quite apt to have certain imperfections of structure; in fact deposits are often found in which the large bulk of the crystals is practically worthless for sheet mica. Mica whose quality is seriously impaired by crystallographic disturbance is described by such terms as "tangle-sheet", "herringbone", "A-mica", and the like. "Wedge" crystals are those thicker on one side than the other and thus producing sheets of unequal thickness. The term "ruled mica" is applied to sheets which have developed a parallel fracturing, resulting in their breaking into narrow strips when split. The mica crystals are sometimes distorted, due to squeezing or crushing due to rock movement. This condition is common and results in increased or wavy sheets. In addition, the outer portions of mica crystals are often hard and brittle, owing to the presence of intergrown foreign mineral substances and the sheets exhibit cracks and flaws around their edges. It is thus quite apparent that the securing of sound, perfect mica, especially of the larger sizes, free from all flaws and imperfections, is attended by a large amount of waste, and, as a matter of fact, the percentage of marketable sheet mica yielded by a deposit is often a small fraction of the run-of-mine production.

Once cobbed, the mica is ready for rough-splitting and trimming. The former operation is known as "rifting" and consists of splitting the rough slabs to a thickness of 1/16 in. or less, a thickness at which the mica can be readily cut with a knife. The rifting operation is a manual one; the operator first using a light hammer to loosen the laminae on one side of a crystal and then inserting between them the point of a stout, short, two-edged mica knife, specially made for the purpose. During this operation, a further discarding of unsound mica takes place, any buckled or crushed material and portion of crystals which will not split because of crystal imperfections or to the presence of included foreign mineral matter passes to the scrap dump.

After this preliminary rough-splitting or rifting, the sheets go to the trimming shed, where other operators remove all edge waste and any unsound mica within the sheets. The smaller sizes known as punch or washer stock and used for the die-punching of small washers, discs and segments, are often left untrimmed. Trimming may be rough or close, depending on the care given to the operation. Trimmed sheet mica has irregular outline, the size and shape of the sheets being merely the result of the waste removed, and is commonly termed "block", "uncut", or "unmanufactured" mica, to distinguish it from "slab" mica, which indicates sheets cut to specified, rectangular dimensions.

The trimming operation may be done with a small hand knife, which is used to give a bevel or bias slice, the resulting bevel edge aiding in further splitting of the trimmed sheets or a pair of shears may be used and the product thus has straight, unbeveled edges. In trimming mica, a wide range of sizes of sheet is produced. For marketing, the sheets are graded both for size and quality. Probably no other mineral product is as difficult to classify as mica or is so variable in quality on account of the wide range of sizes and grades produced.

In this country sheet mica is graded into three principal classes according to quality: (1) clear, (2) slightly stained or spotted, and (3) heavily stained or spotted. The size classification is: "punch", yielding a circle 1-1/4 to 1-1/2 in. in diameter; "circle", yielding discs up to 2 in. in diameter, followed by a series of dimensional grades ranging from 1-1/2 by 2 in. to 8 by 10 in. and over.

The larger sizes of trimmed mica are marketed for various uses in the sheet or block form, but the smaller sizes, which represent by far the larger part of the production, are utilized mainly for the making of splitting. "Splittings" are an intermediate size, at least 3/4 sq. in. in area and 0.001-0.0012 in. in thickness. These are mainly split from material too small to make the smallest standard sheet, or from waste and scrap, although small amounts are obtained in the course of the removal of flaws from larger sheets. They are used in built-up material, using a cement to hold the splittings together, thus making it possible to build up sheets of any desired size or thickness, as well as a wide variety of special shapes.

Marketing:[3/]

The marketing of sheet mica is often an involved process, and the product generally passes through a number of hands before reaching the consumer, because of the many small mines contributing to the supply, the operators of which are not familiar with trade requirements and lack the capital to do much more than take the mica out of the ground and roughly cob or trim it. They sell it in this form to local jobbers or dealers who often buy the output from a number of mines, and run a central mica shop, employing the necessary skilled labor to trim and grade the rough sheets, reselling the product to larger dealers who then, in turn, resell to mica brokers, or consign, on order, lots of specified sizes to the actual consumers. There is probably no other mineral product that passes through as many channels between mine and user as does mica. The small producer is often inclined to regard the middleman in the industry as an unnecessary evil, who takes an undue share of the profits, but the actual miner seldom has the necessary capital to maintain adequate stocks from which he can fill orders for any specified grade or size at short notice, and he may not have the requisite knowledge of trade standards and specifications or of demand and cost trends, so that the dealer forms a useful link between miner and ultimate

consumer. The larger, steady producer is in a different position and often ships direct to consumers familiar with the quality of his mica, thus netting a greater share of the profit.

Mica Prices: 8/

The subject of mica prices is difficult to review briefly; it is complicated by the large variety of grades offered, by the passage of the product through successive hands, and by a system of trade discounts. There is no such thing as what might be termed a standard quotation. Purchases are usually made on individual contract by the larger consumers through accredited agents; by dealers, on the basis of samples submitted by producers. Production and trade statistics are of little value as an index of prices, owing to the obvious difficulty of itemizing all of the many grades entering the trade.

The following tabulation shows the trade journal quotations and average sales value of domestic uncut sheet mica per pound for the period indicated. It does not mean that these prices were realized by the miner, for the reasons previously indicated:

Size	Trade-Journal Quotations[a] Dec. 12 1940	February 1942	Average Value 1940[b] Clear	Stained or Spotted
Punch	$0.08-$0.15	----------	$0.087	$0.090
Circle	----------	----------	.109	.100
1-1/2 by 2 inches.	.45-- .60	0.45-0.60	.429	.269
2 by 2 inches....	.60-- .80	0.60-0.85	.780	.275
2 by 3 inches....	.90--1.20	----------	1.182	.577
3 by 3 inches....	1.25--1.50	1.85-2.05	1.582	.721
3 by 4 inches....	1.50--1.75	2.15-2.25	1.925	1.151
3 by 5 inches....	1.75--2.25	2.50-2.75	2.750	1.443
4 by 6 inches....	2.75--3.50	----------	3.372	1.504
6 by 8 inches....	4.25--4.75	----------	4.817	2.012
8 by 10 inches...	8.50--8.75	----------	10.284	2.318

a. Engineering and Mining Journal quotations for No. 1 or No. 2 quality, f.o.b. North Carolina; stained qualities take 25 to 50 per cent discount.
b. From Minerals Yearbook, U. S. Bureau of Mines. 1941.

The value per pound, of North Carolina mica, sold or used by producers in North Carolina, for the five-year period of 1936-1940 inclusive, for the two main size classifications has been reported by the Bureau of Mines as follows:

YEAR	Uncut Punch and Circle Mica	Uncut Mica Larger than Punch and Circle	All Uncut Sheet Mica
1936	$0.051	$0.586	$0.164
1937	0.059	0.690	0.209
1938	0.065	0.649	0.139
1939	0.058	0.630	0.173
1940	0.092	0.909	0.218
Weighed Average	0.067	0.703	0.187

North Carolina Producers:

A recent survey of mica mining activities in North Carolina indicates that over one hundred mica mines have been active during recent years. The majority of these are small intermittent producers, with only some eight or ten of sufficient importance to have been awarded serial numbers for securing priority on mine equipment and supplies.

Mica manufacturing is carried out in North Carolina by the following organizations:

Asheville Mica Company, Biltmore, N. C.
Spruce Pine Mica Company, Spruce Pine, N. C.
Tar Heel Mica Company, Plumtree, N. C.

The first of these has buyers in Spruce Pine and Sylva. Other companies have buyers in the State.

Summary:

Despite the fact that mica mining has to be carried out by small scale operations commonly termed "gopher-holing" or "ground hogging", it appears that more systematic mining might result in greatly increased production. Due to the very nature of the operations the small operator, who in some cases, only mines mica between seasons when he may be farming or engaged in some other industry, it will be extremely difficult for such operations to increase the production appreciably. It appears that the solution lies in the operations of larger companies, with adequate financial backing, proper technical and managerial guidance, entering the field or enlarging their scope if already in existence. They should be in a position to secure the necessary equipment and preferably operate several mines so that a regular production of the different grades may be possible.

In view of the absolute necessity of increasing production, it is believed that some Federal aid should be provided. This would not establish a precedent in view of the steps being taken in other States to increase the production of strategic and even critical or essential materials. However it is believed that such aid should be in a manner which would provide the most effective results. "Mineral relief" or direct subsidy appears highly undesirable. A bonus on production would not provide immediate results. It seems that provision of such mine machinery, as might be applicable to mica mining, might prove of assistance. Naturally such a project should be after investigation of the responsibility of the operators and the technical features of their operations.

It appears that the situation might be summarized as follows: North Carolina mica "has done it before and it can do it again".

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