

MICA SCHIST PROGRAM

July 1966 Progress Report  
Minerals Research Laboratory

Lab. Nos. 3009, 3010, 3022, 3023, 3025, 3073 - Book 211, p. 18-44

by

Robert M. Lewis

Object

This is a continuation of the mica schist evaluation program which was reported in the April 1965 Progress Report. Mica schist samples from various localities throughout the State have been beneficiated by a standardized procedure. The purpose of this program is to locate large ore bodies from which marketable mica products can be produced. The geologists of the Division of Mineral Resources have been cooperative in providing samples. Samples have also been processed for other interested parties.

Because of the lack of firm specifications for mica, which are usually worked out between seller and purchaser, the density and colors of a minus 325 mesh, marketed mica product (Lab. No. 2023-B) are used as a standard. The standard is as follows:

<u>Density lbs/cu.ft.</u>	<u>Colors by Photovolt Meter</u>		
	Green	Amber	Blue
12.8	74	75	66

Procedure

The mica is floated by either of two methods; an amine float in an acid circuit, or the Bureau of Mines amine-fatty acid float in a basic circuit. The mica concentrate is leached with hot  $H_2SO_4$  to improve color and is then ground in a pebble mill to product size specifications. The pebble mill grind was standardized by grinding a mica concentrate, furnished by a mica producer, in a pebble mill until it met his product specifications. The grinding time, charge, mill speed, etc. were noted.

Details of the flotation, leaching and grinding methods are as follows:

Float - Grind 500-gram sample four minutes at 25 percent solids in a rod mill with 10 rods and 1.0 pound per ton of NaOH. Screen rod mill discharge to obtain plus 28 mesh mica product. Deslime minus 28 mesh two times on 325 mesh. Scrub 10 minutes at 65 percent solids with 2.0 pounds per ton NaOH. Deslime two times on 325 mesh. Condition three

minutes at 45 percent solids with either of the following sets of reagents:

<u>Basic Circuit</u>		<u>Acid Circuit</u>	
3.4 lbs/ton	Goulac	2.0 lbs/ton	H <sub>2</sub> SO <sub>4</sub>
0.5 lbs/ton	DLR	1.5 lbs/ton	F.O.

Add to cell and condition one minute at 25 percent solids with:

0.2 lbs/ton	Armac-T (amine acetate)	0.5 lbs/ton	Armac-T
0.25 lb/ton	MIBC (frother)	0.25 lbs/ton	MIBC

Float mica, then clean one time. Combine plus 28 mesh mica (screened out before flotation) with flotation mica (approximately 150 grams).

Leach - Approximately 150 grams of mica leached in 1000 ml. beaker at 25 percent solids with 10 percent H<sub>2</sub>SO<sub>4</sub> for one hour at 95 to 100°C. Stir continuously with mechanical stirrer. Filter hot on Buchner filter using No. 4 filter paper. Spray wash twice with 250 ml. of water. Gravity wash five minutes with 500 ml. of water and 10 ml. of two and one-half percent NaOH. Dry sample and determine weight, color and bulk density. Record loss due to leaching (approximately five percent).

Grind - Approximately 150 grams of leached mica ground in pebble mill at 60 rpm for 45 minutes at 65 percent solids with 4000 grams of one-half-inch alumina balls (one-half mill volume) and 10 pounds per ton (based on flotation head feed) of tetrasodium pyrophosphate. Settle mill discharge in full bucket of water for one hour. Siphon off water and suspended solids. These suspended solids contain clay, iron oxides and altered mica and they are considered to be waste. Dry settled mica, weigh and calculate grinding recovery assuming no loss in mica will occur in further grinding of oversize. Screen settled mica on 325 mesh and return oversize to pebble mill for additional one and one-half-hour grind at 65 percent solids without reagents. Dry all of mill discharge and screen on 325 mesh. Combine minus 325 mesh fractions from both grinds, obtain colors and density and record as finished product specifications. Percent mica recovery is recorded by taking into account the flotation, leaching and grinding recoveries. The yield is recorded as weight of product recovered expressed as percent of ore.

### Results

The results of the most promising ore samples are shown in the attached summary with data on individual samples being shown separately.

Mica Schist Summary

<u>Lab. No.</u>	<u>Head Feed % Mica</u>	<u>Mica % Recovered</u>	<u>Yield % of Head Feed</u>	<u>Product</u>		<u>Location</u>	<u>Donor</u>	<u>Lithology</u>
				<u>Density lb/cu.ft.</u>	<u>Color Green Filter</u>			
Ref. sample				12.8	74			
2076	48.9	73.7	36.0	15.4	74	Mitchell Co.	J. Conley K. Drummond	Mica schist
2078	53.6	58.2	31.2	13.5	82	Haywood Co.	J. Conley K. Drummond	Muscovite schist
3009	38.2	46.3	17.7	19.8	75	Polk County	K. Drummond R. Lewis	Mica schist
3010	42.9	37.0	15.7	12.5	74	Mitchell County	R. Lewis K. Drummond	Weathered Boonford schist
3022	61.5	70.6	43.5	13.4	67	Cleveland Co.	K. Drummond R. Lewis, J. Bundy	Mica schist
3023	27.1	53.3	14.5	14.1	77	Cleveland Co.	K. Drummond R. Lewis, J. Bundy	Mica sillimanite schist
3025	37.3	84.4	31.5	15.7	68	McDowell Co.	W. T. McDaniel	Mica schist
3073	33.7	74.0	28.6	14.9	82	Clay County	A. F. Alsobrook	Small deposit of weathered granite aplite

N.C. STATE UNIVERSITY MINERALS RESEARCH LABORATORY

ORE DRESSING DATA

Date March 23, 1965

Ore Mica Schist

Engineer \_\_\_\_\_

Sample No. 2076

FLOTATION

Product	Sample Weights			Assays					Mica		
	Grams	Wt. %	Cum. %	% Mica	Dens. #/cu. '	Color with filter			Units	Dist.	Yield
						Green	Amber	Blue			
-28	129.8	25.9		97.0					25.2	51.5	
Mica Conc. (F.P.)	120.2	24.4		89.0	46.2	52	53	51	21.8	44.6	
Cl. Mids (M.D.)	-	-		-					-		
Ro. Tails (M.D.)	208.1	41.8		4.6					1.9		
#1 Slime (-325)	28.5	5.6		-							
#2 Slime (-325)		-									
Losses	13.4	2.3									
Total	500.0	100.0		48.9					48.9	96.1	47.0

  

Process						Reagents (lbs. per ton of feed)				
Equipment	Feed	Time	Solids	pH	rpm	NaOH	H <sub>2</sub> SO <sub>4</sub>	F.O.	Ar-T	MIBC
Rod Mill	500 g	4	25			1.0				
Screen										
No. 1 Deslime										
Scrub		10	65		1200	2.0				
No. 2 Deslime		1								
Mica Cond.		3	45	2.3	700		2.0	1.5		
Mica Float		2	18	3.2	1200				0.5	0.25
Mica Cleaner										

ACID LEACH OF FLOTATION MICA CONCENTRATE

Product	Weights		Assays				Cum. Mica	
	Grams	Dist.	Dens. #/cu. '	Color w/filter			Dist.	Yield
				Green	Amber	Blue		
After leach	144	96.0	26.4	54	59	48	92.2	45.2
Loss	6	4.0						
Before leach	150	100.0	28.9	48	49	46		

GRIND OF LEACHED MICA CONC.

Product	Weights	
	Grams	Dist.
After grind	115	79.8
Loss	29	20.2
Before grind	144	100.0

FINAL MICA PRODUCT					
Dens. #/cu. '	Color with filter			Cum. Mica	
	Green	Amber	Blue	Dist.	Yield
15.4	74	76	75	73.7	36.0

Note: Dist. - Percent of head feed mica recovered in product.  
Yield - Weight of product recovered expressed as percent of ore.

N.C. STATE UNIVERSITY MINERALS RESEARCH LABORATORY

ORE DRESSING DATA

Date March 23, 1965

Ore Mica Schist

Engineer \_\_\_\_\_

Sample No. 2078

FLOTATION

Product	Sample Weights			Assays					Mica		
	Grams	Wt. %	Cum. %	% Mica	Dens. #/cu.'	Color with filter			Units	Dist.	Yield
						Green	Amber	Blue			
+28	28.9	5.8		100.0					5.8	10.8	
Mica Conc. (F.P.)	213.7	42.6		88.3	51.2	45	50	42	37.6	70.1	
Cl. Mids (M.D.)	44.8	9.0		50.0					4.5		
Ro. Tails (M.D.)	120.3	24.1		23.6					5.7		
#1 Slime (-325)	75.0	15.0									
#2 Slime (-325)	-	-									
Losses	17.3	3.5									
Total	500.0	100.0		53.6					53.6	80.9	43.4

  

Process						Reagents (lbs. per ton of feed)					
Equipment	Feed	Time	Solids	pH	rpm	NaOH	DLR	Goulac	Ar-T	MIBC	
Rod Mill	500 g	4	25			1.0					
Screen											
No. 1 Deslime											
Scrub		10	65	10.3	1200	2.0					
No. 2 Deslime		1									
Mica Cond.		3	45	7.6	700		0.5	2.0			
Mica Float		2	18	7.5	1200				0.2	0.25	
Mica Cleaner		2	18	7.2							

ACID LEACH OF FLOTATION MICA CONCENTRATE

Product	Weights		Assays				Cum. Mica	
	Grams	Dist.	Dens. #/cu.'	Color w/filter			Dist.	Yield
				Green	Amber	Blue		
After leach	143	95.3	45.7	55	59	51	77.0	41.4
Loss	7	4.7						
Before leach	150	100.0	51.2	45	50	42		

GRIND OF LEACHED MICA CONC.

Product	Weights	
	Grams	Dist.
After grind	108	75.5
Loss	35	24.5
Before grind	143	100.0

FINAL MICA PRODUCT					
Dens. #/cu.'	Color with filter			Cum. Mica	
	Green	Amber	Blue	Dist.	Yield
13.5	82	83	80	58.2	31.2

Note: Dist. - Percent of head feed mica recovered in product.  
Yield - Weight of product recovered expressed as percent of ore.

N.C. STATE UNIVERSITY MINERALS RESEARCH LABORATORY

ORE DRESSING DATA

Date March 17, 1966

Ore Mica Schist

Engineer \_\_\_\_\_

Sample No. 3009

FLOTATION

Product	Sample Weights			Assays					Mica		
	Grams	Wt. %	Cum. %	%	Dens.	Color with filter			Units	Dist.	Yield
				Mica	#/cu.'	Green	Amber	Blue			
-28	18.3	3.7		99.0					3.66	9.6	
Mica Conc. (F.P.)	207.9	41.6		76.0	55.8	33	33	23	31.60	82.8	
Cl. Mids (M.D.)	50.4	10.1		17.5					1.77		
Ro. Tails (M.D.)	171.5	34.3		3.3					1.13		
#1 Slime (-325)	30.5	6.1									
#2 Slime (-325)	15.9	3.1									
Losses	5.5	1.1									
Total	500.0	100.0		38.2					38.16	92.4	35.2

  

Process						Reagents (lbs. per ton of feed)						
Equipment	Feed	Time	Solids	pH	rpm	NaOH	DLR	Goulac	Ar-T	MIBC		
Rod Mill	500 g	4	25			1.0						
Screen												
No. 1 Deslime		1										
Scrub		10	65	11.4	1200	2.0						
No. 2 Deslime		1										
Mica Cond.		3		7.7	700		0.5	2.0				
Mica Float		2			1200				0.2	0.25		
Mica Cleaner		2										

ACID LEACH OF FLOTATION MICA CONCENTRATE

Product	Weights		Assays				Cum. Mica	
	Grams	Dist.	Dens.	Color w/filter			Dist.	Yield
			#/cu.'	Green	Amber	Blue		
After leach	131.0	87.4	50.2	43	45	35	80.5	30.8
Loss	19.0	12.6						
Before leach	150.0	100.0		33	33	23		

GRIND OF LEACHED MICA CONC.

Product	Weights	
	Grams	Dist.
After grind	77	57.5
Loss	52	42.5
Before grind	134	100.0

FINAL MICA PRODUCT					
Dens.	Color with filter			Cum. Mica	
#/cu.'	Green	Amber	Blue	Dist.	Yield
19.8	75	76	67	46.3	17.7

Note: Dist. - Percent of head feed mica recovered in product.  
Yield - Weight of product recovered expressed as percent of ore.

N.C. STATE UNIVERSITY MINERALS RESEARCH LABORATORY

ORE DRESSING DATA

Date March 30, 1966

Ore Mica Schist

Engineer \_\_\_\_\_

Sample No. 3010

FLOTATION

Product	Sample Weights			Assays					Mica		
	Grams	Wt. %	Cum. %	% Mica	Dens. #/cu.'	Color with filter			Units	Dist.	Yield
-28	49.0	9.8		100.0					9.8	22.8	
Mica Conc. (F.P.)	88.0	17.6		90.5	34.9	35	36	29	15.9	37.0	
Cl. Mids (M.D.)	56.5	11.3		53.8					6.1		
Ro. Tails (M.D.)	221.5	44.3		25.0					11.1		
#1 Slime (-325)	53.5	10.7									
#2 Slime (-325)	17.0	3.4									
Losses	14.5	2.9									
Total	500.0	100.0		42.9					42.9	59.8	25.6

  

Process						Reagents (lbs. per ton of feed)					
Equipment	Feed	Time	Solids	pH	rpm	NaOH	H <sub>2</sub> SO <sub>4</sub>	F.O.	Ar-T	MIBC	
Rod Mill	500 g	4	25			1.0					
Screen											
No. 1 Deslime		1									
Scrub		10	65	11.0	1200	2.0					
No. 2 Deslime		1									
Mica Cond.		3	45	2.2	700		2.0	1.5			
Mica Float		2	18	3.1	1200				0.5	0.25	
Mica Cleaner		2	18				1.0				

ACID LEACH OF FLOTATION MICA CONCENTRATE

Product	Weights		Assays				Cum. Mica	
	Grams	Dist.	Dens. #/cu.'	Color w/filter			Dist.	Yield
After leach	117	85.5	29.8	56	50	41	51.1	21.9
Loss	29	14.5						
Before leach	137	100.0		35	36	29		

GRIND OF LEACHED MICA CONC.

Product	Weights	
	Grams	Dist.
After grind	84	71.8
Loss	33	28.2
Before grind	117	100.0

FINAL MICA PRODUCT					
Dens. #/cu.'	Color with filter			Cum. Mica	
	Green	Amber	Blue	Dist.	Yield
12.5	74	76	70	37.0	15.7

Note: Dist. - Percent of head feed mica recovered in product.  
 Yield - Weight of product recovered expressed as percent of ore.

N.C. STATE UNIVERSITY MINERALS RESEARCH LABORATORY

ORE DRESSING DATA

Date March 22, 1966

Ore Mica Schist

Engineer \_\_\_\_\_

Sample No. 3022

FLOTATION

Product	Sample Weights			Assays					Mica		
	Grams	Wt. %	Cum. %	% Mica	Dens. #/cu. '	Color with filter			Units	Dist.	Yield
						Green	Amber	Blue			
<del>28</del>	56.8	11.4		100.0					11.40	18.6	
Mica Conc. (F.P.)	232.0	46.3		100.0	42.6	32	32	25	46.30	75.3	
Cl. Mids (M.D.)	37.4	7.5		39.7					2.98		
Ro. Tails (M.D.)	91.5	19.3		4.0					0.77		
#1 Slime (-325)	37.1	7.4									
#2 Slime (-325)	26.3	5.3									
Losses	13.9	2.8									
Total	500.0	100.0		61.5					61.45	93.9	57.7

  

Process						Reagents (lbs. per ton of feed)					
Equipment	Feed	Time	Solids	pH	rpm	NaOH	H <sub>2</sub> SO <sub>4</sub>	F.O.	Ar-T	MIBC	
Rod Mill	500 g	4	25			1.0					
Screen											
No. 1 Deslime		1									
Scrub		10	65	11.0	1200	2.0					
No. 2 Deslime		1									
Mica Cond.		3	45	3.0	700		2.0	1.5			
Mica Float		2	18	4.2	1200				0.5	0.25	
Mica Cleaner		2	18				1.0				

ACID LEACH OF FLOTATION MICA CONCENTRATE

Product	Weights		Assays				Cum. Mica	
	Grams	Dist.	Dens. #/cu. '	Color w/filter			Dist.	Yield
				Green	Amber	Blue		
After leach	133	88.6	40.1	40	40	31	83.1	51.2
Loss	17	11.4						
Before leach	150	100.0	42.6	32	32	25		

GRIND OF LEACHED MICA CONC.

Product	Weights	
	Grams	Dist.
After grind	113	85.0
Loss	20	15.0
Before grind	133	100.0

FINAL MICA PRODUCT					
Dens. #/cu. '	Color with filter			Cum. Mica	
	Green	Amber	Blue	Dist.	Yield
13.4	67	70	59	70.6	43.5

Note: Dist. - Percent of head feed mica recovered in product.  
Yield - Weight of product recovered expressed as percent of ore.



N.C. STATE UNIVERSITY MINERALS RESEARCH LABORATORY

ORE DRESSING DATA

Date March 24, 1966

Ore Mica Schist

Engineer \_\_\_\_\_

Sample No. 3023

FLOTATION

Product	Sample Weights			Assays					Mica		
	Grams	Wt. %	Cum. %	% Mica	Dens. #/cu.'	Color with filter			Units	Dist.	Yield
-28	17.0	3.4		100.0					3.40	12.5	
Mica Conc. (F.P.)*	115.0	23.0		83.4	39.2	42	43	32	19.20	70.8	
Cl. Mids (M.D.)	60.2	12.0		30.0					3.60		
Ro. Tails (M.D.)	149.5	29.9		3.0					0.90		
#1 Slime (-325)	111.0	22.2									
#2 Slime (-325)	35.8	7.2									
Losses	11.5	2.3									
Total	500.0	100.0		27.1					27.10	83.3	22.6

\* Long fiber-like (sillimanite) material in mica conc.

Process						Reagents (lbs. per ton of feed)						
Equipment	Feed	Time	Solids	pH	rpm	NaOH	H <sub>2</sub> SO <sub>4</sub>	F.O.	Ar-T	MIBC		
Rod Mill	500 g	4	25			1.0						
Screen												
No. 1 Deslime		1										
Scrub		10	65	11.0	1200	2.0						
No. 2 Deslime		1										
Mica Cond.		3	45	2.2	700		2.0	1.5				
Mica Float		2	18	3.0	1200				0.5	0.25		
Mica Cleaner		2	18	2.2	1200		1.0					

ACID LEACH OF FLOTATION MICA CONCENTRATE

Product	Weights		Assays				Cum. Mica	
	Grams	Dist.	Dens. #/cu.'	Color w/filter			Dist.	Yield
After leach	120	93.8	40.4	54	55	38	78.0	21.2
Loss	8	6.2						
Before leach	128	100.0	39.2	42	43	32		

GRIND OF LEACHED MICA CONC.

Product	Weights	
	Grams	Dist.
After grind	82	68.3
Loss	38	31.7
Before grind	120	100.0

FINAL MICA PRODUCT					
Dens. #/cu.'	Color with filter			Cum. Mica	
	Green	Amber	Blue	Dist.	Yield
14.1	77	79	75	53.3	14.5

Note: Dist. - Percent of head feed mica recovered in product.  
Yield - Weight of product recovered expressed as percent of ore.

ORE DRESSING DATA

Date May 23, 1966

Ore Mica Schist

Engineer \_\_\_\_\_

Sample No. 3025

FLOTATION

Product	Sample Weights			Assays					Mica		
	Grams	Wt. %	Cum. %	% Mica	Dens. #/cu.'	Color with filter			Units	Dist.	Yield
<u>728</u>	55.1	11.0		100.0					11.00	29.5	
Mica Conc. (F.P.)	145.2	29.0		86.6	50.3	39	40	30	25.10	67.3	
Cl. Mids (M.D.)	30.0	6.0		16.4					0.98		
Ro. Tails (M.D.)	190.2	38.1		0.5					0.19		
#1 Slime (-325)	35.1	7.0									
#2 Slime (-325)	44.4	8.9									
Losses	0.0	0.0									
Total	500.0	100.0		37.3					37.27	96.8	36.1

Process						Reagents (lbs. per ton of feed)					
Equipment	Feed	Time	Solids	pH	rpm	NaOH	H <sub>2</sub> SO <sub>4</sub>	F.O.	Ar-T	MIBC	
Rod Mill	500 g	4	25			1.0					
Screen											
No. 1 Deslime		1									
Scrub		10	65	11.0	1200	2.0					
No. 2 Deslime		1									
Mica Cond.		3	45	2.3	700		2.0	1.5			
Mica Float		2	18	3.1	1200				0.5	0.25	
Mica Cleaner		2	18	2.3			1.0				

Note: Graphite float after scrub using 1 drop MIBC  
weight of graphite f.p. = 7.7 gr. and added to slime weight.

ACID LEACH OF FLOTATION MICA CONCENTRATE

Product	Weights		Assays				Cum. Mica	
	Grams	Dist.	Dens. #/cu.'	Color w/filter			Dist.	Yield
After leach	142.0	94.6	40.5	45	50	37	91.6	34.2
Loss	8.0	5.4						
Before leach	150.0	100.0	50.3	39	40	30		

GRIND OF LEACHED MICA CONC.

Product	Weights	
	Grams	Dist.
After grind	122.0	87.1
Loss	18.0	12.9
Before grind	140.0	100.0

FINAL MICA PRODUCT					
Dens. #/cu.'	Color with filter			Cum. Mica	
	Green	Amber	Blue	Dist.	Yield
15.7	68	72	63	84.4	31.5

Note: Dist. - Percent of head feed mica recovered in product.  
Yield - Weight of product recovered expressed as percent of ore.

N.C. STATE UNIVERSITY MINERALS RESEARCH LABORATORY

ORE DRESSING DATA

Date May 25, 1966

Ore Granite Aplite

Engineer \_\_\_\_\_

Sample No. 3073

FLOTATION

Product	Sample Weights			Assays					Mica		
	Grams	Wt. %	Cum. %	% Mica	Dens. #/cu.'	Color with filter Green Amber Blue			Units	Dist.	Yield
728	8.3	1.7		100.0					1.70	4.40	
Mica Conc. (F.P.)	180.8	36.2		98.0	39.2	63	63	57	35.50	91.80	
Cl. Mids (M.D.)	18.5	3.7		40.0					1.48		
Ro. Tails (M.D.)	92.8	18.6		0.0							
#1 Slime (-325)	159.7	31.8									
#2 Slime (-325)	26.5	5.3									
Losses	13.4	2.7									
Total	500.0	100.0		38.7					38.68	96.20	37.2

  

Process						Reagents (lbs. per ton of feed)					
Equipment	Feed	Time	Solids	pH	rpm	NaOH	H <sub>2</sub> SO <sub>4</sub>	F.O.	Ar-T	MIBC	
Rod Mill	500 g	4	25			1.0					
Screen											
No. 1 Deslime		1									
Scrub		10	65	11.8	1200	2.0					
No. 2 Deslime		1									
Mica Cond.		3	45	2.2	700		2.0	1.5			
Mica Float		2	18	3.0	1200				0.5	0.25	
Mica Cleaner		2	18	3.0							

ACID LEACH OF FLOTATION MICA CONCENTRATE

Product	Weights		Assays			Cum. Mica	
	Grams	Dist.	Dens. #/cu.'	Color w/filter Green Amber Blue		Dist.	Yield
After leach							
Loss							
Before leach							

No leaching required

GRIND OF LEACHED MICA CONC.

Product	Weights	
	Grams	Dist.
After grind	115	76.8
Loss	35	23.2
Before grind	150	100.0

FINAL MICA PRODUCT					
Dens. #/cu.'	Color with filter Green Amber Blue			Cum. Mica	
	Green	Amber	Blue	Dist.	Yield
14.9	82	83	78	74.0	28.6

Note: Dist. - Percent of head feed mica recovered in product.  
Yield - Weight of product recovered expressed as percent of ore.