ATTACHMENT A

Description of Modified Method to Revise Proposed Section 121.2006(c)(2)

Determine the Nz of the talc. Place 1 milligram of talc on a slide. Mix talc with refractive index liquid which has an Nd value most nearly equal to Nz of talc (liquid should be equal to or slightly less than Nz in talc). Spread particles evenly and place a cover glass (ca. 18 mm square) on the sample. Fibers counted by this method should meet the following criteria. (1) Length to width ratio of 3 or greater; (2) length of 5 μm or greater; (3) width of 5 μm or less. Count and record the number of asbestos fibers found in the 1 milligram sample as determined from a scan with a polarizing microscope at a magnification of approximately 400x. Chrysotile fibers will have indices less than the liquid in both extinction positions. Amphiboles will have indices greater than the liquid in both extinction positions. Check the extinction and sign of elongation for tentative identification. For specific identification of asbestos fibers, make additional mounts in appropriate refractive index liquids, and refer to the optical crystallographic data in the table. A count of not more than 1000 amphibole types of asbestos fibers and not more than 100 chrysotile asbestos fibers per milligram-slide constitutes the maximum limit for the presence of these asbestos fibers in talc. These limits assure a purity of talc at least 99.9 percent free of amphibole types of asbestos fibers and at least 99.99 percent free of chrysotile asbestos fibers.

If 100 or more chrysotile fibers are counted, the 2V of talc should be determined from the interference figure. If this value exceeds 10^{o} there is a possibility that talc is being counted as chrysotile. In this case, the sample should be remeasured according to the above procedure in 1.574 refractive index liquid. Chrysotile fibers will have indices less than the liquid in both extinction positions.

ATTACHMENT B

Optical Data for Chlorites

Chlorites are 14Å layer-silicates with a wide range of chemical compositions and an equally wide range of optical propterties. The hypothetical formula would be $Mg_6(OH)_8Si_4O_{10}$. Aluminium replaces silicon and magnesium. Ferric and ferrous iron replace magnesium.

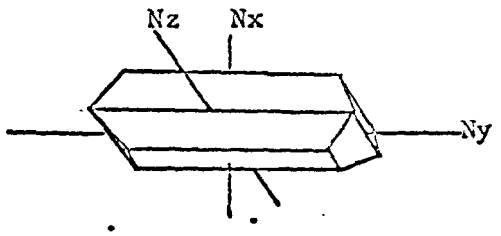
Nx	Ny	Nz	Nx	Ny	Nz
1.606	-	1.615	1.670	-	1.685
1.641	-	1.643	-	-	1.664
-	1.662	1.662	-	-	1.620
-	1.658	1.658	<1.63	-	>1.650
1.570	-	-	1.600	1.603	1.610
-	1.661	-	1.578	1.580	1.586
1.580	1.581	1.589	1.660	1.660	1.606
1.618	1.618	1.621	1.619	-	1.623
1.622	1.622	1.626	-	-	1.625
1.637	-	1.642	1.646	1.646	1.655
1.658	-	1.667	1.572	1.572	1.575
1.581	1.581	1.586	-	1.595	-
-	1.607	-	1.620	1.621	1.625

Extinction-parallel or inclined; elongation - positive or negative. Data from W.A. Deer, R.A. Howie and J. Zussman, 1965, Rock-Forming Minerals, Longmans, London.

Optical Data For the Epidote Minerals

The indices, birefringence, and optic angle vary rapidly with composition. There is a continuous series from $Ca_2Al_3(OH)Si_3O_{12}$ (clinozoisite) to about 40 mol. % $Ca_2Fe_3(OH)Si_3O_{12}$ (pistacite).

Nx	Ny	Nz
1.718	1.720	1.723
1.712	1.723	1.735
1.722	1.742	1.750
1.722	1.743	1.760
1.729	1.763	1.780
1.754	1.772	1.795
1.739	1.765	1.800
1.756	1.789	1.829



Epidote crystals have the Ny coinciding with the long direction, thus the needles will appear to have positive or negative elongation depending upon which side they are resting. They will have parallel extinction.

Data from Alexander N. Winchell and Horace Winchell, 1964, Elements of Optical Mineralogy, Part II, John Wiley & Sons, New York.

Optical Properties of Kaolinite and Chrysotile

Kaolinite

Kaolinite is a 7A layer-silicate with the formula $Al_4(OH)_8Si_4O_{10}$. The composition is subject to little variation but water adsorbed between the layers affects the optical properties.

Nx	Ny	Nz	Extinction	Elongation
1.560	1.565	1.566	Parallel	Positive
1.553-1.563	1.559-1.569	1.560-1.570	or Inclined	
*1.562	1.566	1.568	1-3°	
*1.553-1.565	1.559-1.569	1.560-1.570		
**1.553-1.563 (more water)	--	1.560-1.570		
1.526		1.543		

Chrysotile

1.542	1.543	1.55	Parallel	Positive
***1.493	1.504	1.517		
***1.508	1.512	1.522		
***1.528-1.559	1.530-1.564	1.537-1.567		
***1.53-1.54		1.54-1.55		
***1.542		1.555		
***1.542	1.543 (calc.)	1.555		

Nx	Ny	Nz	Extinction	Elongation
***1.546	1.550	1.557		
***1.546	1.557	1.557		
***1.548	1.560	1.560		

Data from:

N. Winchell and Horace Winchell, (1964), Elements of Optical Mineralogy, John Wiley & Sons, Inc., New York.

*W.A. Deer, R.A. Howie, and J. Zussman, 1965, Rock-Forming Minerals, Longmans, London.

**Ralph E. Grim, 1968, Clay Mineralogy, McGraw-Hill Book Co., New York.

***Federal Register, Vol. 38, No. 188.

INVESTIGATION OF THE WINTERBORO TALC DEPOSITS, TALLADEGA COUNTY, ALA.

by

Avery H. Reed, Jr. 1/

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ILLUSTRATIONS

1/ Mining engineer, Bureau of Mines, Tuscaloosa Branch.

Report of Investigations 4661

CHARACTER OF THE ORE

The talc is not homogeneous for any area nor for any sample. In general, the deposits consist of massive talc that contains varying amounts of red or yellow clay intimately mixed with it. An average section through the deposit shows, from the surface down, red and yellow clay, red and yellow clay with fragments of talc, talc with red or yellow clay relatively pure talc, brown clay, and dolomite. These units are gradational, with no sharp contacts to distinguish them; the contact between talc with clay and relatively pure talc is especially irregular.

The talc is quite soft and is intensely fractured. None of it appears to be suitable for crayons or other uses that require strength. The talc from the south deposit is harder and less fractured than that from the north deposit.

The talc ranges in color from white and cream to yellow, gray, and blue. No appreciable amount of white talc is present, and an average sample from any large area grinds to a light cream color. The specific gravity of a representative sample of the north deposit was determined as 2.63, crushed and dried, by B. H. Clemmons, metallurgist, Southern Experiment Station, Tuscaloosa, Ala.

Few minerals other than talc and clay minerals are present. Occasional quartz stringers and limonite grains are found, especially near the edges of the deposits.

SAMPLING AND ANALYSIS

Overburden was fishtailed and carefully logged; when fragments of talc were found, coring was started immediately and continued through the talc section. Holes with low talc recovery were redrilled.

Cores that contained talc from holes that showed 5 feet or more of talc were carefully cleaned and analyzed for talc, Fe_2O_3, Al_2O_3, and CaO. Sample intervals from the cores were selected so as to determine the maximum amount of high-grade talc present in each core.

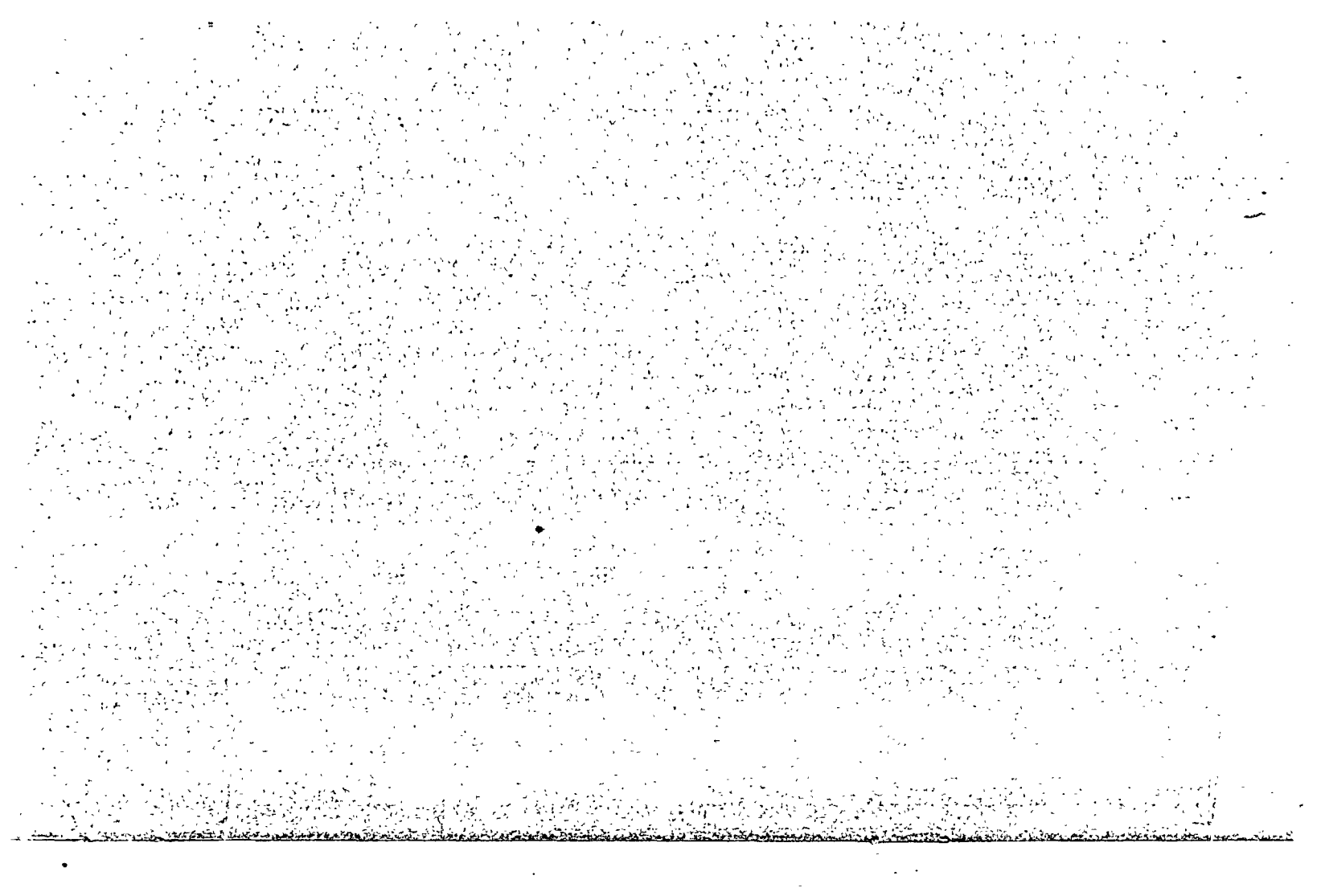
Talc cores from holes that showed less than 5 feet of talc or from isolated situations were not analyzed. The talc from these holes was generally low-grade and thoroughly mixed with clay.

Twenty-seven samples from 12 holes were assayed. Of the 75 holes drilled, 41 penetrated talc or talc fragments.

WORK DONE BY THE BUREAU OF MINES

The Bureau of Mines investigated the Winterboro talc deposits by drilling 75 holes totaling 3370.4 feet.

Holes were drilled within and around the two known deposits, and within the area between these deposits.



GEOLOGICAL SURVEY OF ALABAMA
WALTER B. JONES, STATE GEOLOGIST (ON LEAVE)

CIRCULAR 16

THE TALC DEPOSITS OF TALLADEGA COUNTY, ALABAMA

BY
LYNN McMURRAY
TENNESSEE VALLEY AUTHORITY
AND
EDGAR BOWLES
GEOLOGICAL SURVEY OF ALABAMA

UNIVERSITY, ALABAMA
1941

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Wetumpka, Ala.
1941

LETTER OF TRANSMITTAL

University, Alabama
March 25, 1941

Honorable Frank M. Dixon,

Governor of Alabama,

Montgomery, Alabama.

Sir:

I have the honor to transmit herewith the manuscript of a report entitled "The Talc Deposits of Talladega County, Alabama" by Lynn McMurray of the Tennessee Valley Authority and Edgar Bowles of the Geological Survey of Alabama. It is requested that this be printed as Circular Number 16 of the Geological Survey of Alabama.

Respectfully,

STEWART J. LLOYD,

Asst. State Geologist

BENEFICIATION OF TALC ORE FROM TALLADEGA COUNTY

INTRODUCTION

This report deals with laboratory tests which were made on a talc ore from Talladega County, Alabama. These tests were in connection with an investigation of talc ores in the Tennessee Valley and nearby region in an attempt to prepare products which could be used in the ceramic, textile, paper, cosmetic, and other industries requiring a high grade talc. Initial investigations showed that only some of these ores were amenable to beneficiation methods. The beneficiation methods which proved most applicable were froth flotation and acid leaching. Many of the talc ores were found to contain appreciable percentages of serpentine and chlorite, which prevented them from becoming white on acid leaching. The acid leaching removes only the soluble iron from the ore. All of the talc ores, however, could be froth floated to a high purity, but only those which could be acid leached were suitable for refinement to high quality products.

As the Talladega County deposit could be acid leached, it appeared that a laboratory investigation toward the development of a suitable flowsheet would be well warranted.

CHARACTER OF THE ORE

Three samples, totaling 600 pounds, were taken from the deposit so that a reasonable accurate cross-section of the ore body was obtained. The mineralogical and chemical analyses of these samples, shown in Table I, indicate the rather uniform character of the ore body.

TABLE I

Chemical Analysis of Talc Ore from Talladega County, Alabama

Sample No.	MgO	SiO_2	Fe_2O_3	Al_2O_3	CaO	Loss at 900° C
1	31.25	61.74	1.60	0.50	0.22	4.84
2	29.12	60.78	2.12	1.98	0.42	5.41
			Fe_2O_3, Al_2O_3, CaO			
3	31.05	62.50	1.80			3.75

Mineralogical Analysis of Composite Samples Shown Above

Sample No.	Talc	Garnet	Quartz	Iron Oxide	Clay, etc.
Composite (1, 2, and 3)	93%	2%	2%	2%	1%

The talc as it occurs is surprisingly pure, but the presence of small amounts of garnet, quartz, and iron oxide prevents its use as a high grade talc product.

A physical study of the talc ore reveals that the garnet is liberated at 100 mesh and the quartz at a much coarser sizing. The iron occurs in streaks, pockets, and coating on the crude ore lumps. Grinding to 200 mesh is required to liberate this iron so that it will come in contact with the acid during leaching. As essentially all talc products require grinding to minus 200 mesh or less, this offers no additional treatment over that already necessary for marketable products. No serpentine or chlorite or dark colored minerals, other than garnet and iron oxide, occur in the ore.

BENEFICIATION TESTS

The froth flotation problem was the separation of the garnet from the talc. The quartz and appreciable amounts of the iron oxide could be easily depressed in the flotation cell. With any reagent combination used, a small amount of garnet contaminated the concentrates. In the laboratory garnet was removed by a magnetic separator, but the necessary fineness and dry condition are against such treatment in commercial practice. The garnet is