Data documentation for size distribution measurements of amosite, crocidolite, chrysotile, and nonfibrous tremolite

Title
Size distribution measurements of amosite, crocidolite, chrysotile, and nonfibrous tremolite.

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Data Files
The csv versions contain the same data as the corresponding xlsx files, but the structure has been modified to make well-formed csv. The csv file is provided as a software-

independent alternative to the xlsx format.	
Amosite	1. wylie_amosite_niehs_sa.xlsx 2. wylie_amosite_niehs_sa.csv
Crocidolite	1. wylie_crocidolite_niehs_sa.xlsx 2. wylie_crocidolite_niehs_sa.csv
Chrysotile	1. wylie_short_chrysotile_coalinga_ca.xlsx 2. wylie_short_chrysotile_coalinga_ca.csv 3. wylie_long_chrysotile_jeffrey_canada.xlsx 4. wylie_long_chrysotile_jeffrey_canada.csv
Tremolite	1. wylie_tremolite_niehs_sa.xlsx 2. wylie_tremolite_niehs_sa.csv

Temporal Extent

Samples obtained and measured ca. 1976.

Spatial Extent

1. Amosite mined near Penge, Limpopo, South Africa.
2. Crocidolite mined in the Asbestos Mountains (Kuruman Hills), Northern Cape, South Africa.
3. Short-fiber chrysotile mined at the New Idria serpentinite mass in the southern part of the Diablo Range in southwestern San Benito and western Fresno Counties of California. Long-fiber chrysotile mined at the Johns-Manville Jeffrey mine, Asbestos, Quebec, Canada.
4. Tremolite mined at an R.T. Vanderbilt Company mine near Balmat, New York.

Abstract

Amosite	Size distribution measurements of South African amosite by scanning electron microscopy. This material was characterized by the University of Maryland, College Park, as part of a project undertaken by the US Bureau of Mines on behalf of the National Institute of Environmental Health Sciences (NIEHS) which used the material in an animal oral ingestion study. This material is from a mine in the area known as Penge, the Transvaal, South Africa. This material is composed primarily of grunerite asbestos, with a minor amount of actinolite asbestos. The minerals that make up the fibers contained in this data set are 95% grunerite asbestos and 5% actinolite asbestos. In addition, there are minor amounts of biotite, siderite, plagioclase, zoisite, glass, opaques, and quartz. 'Amosite' is a commercial term and the mineral content may vary somewhat depending on location, although in all cases grunerite asbestos is the most abundant mineral. 4000 lbs. of the material was sent to the Bureau of Mines. Prior to characterization, the amosite was air jet milled to break up bundles. The data contained in this file were derived by combining analyses from many sub samples which were taken from the single large shipment. Sample preparation included dispersal in water and deposition on 0.1µm Nucleopore filters. A portion of the filters was copper coated and examined by SEM equipped with EDXA. Measurements of width were made at 20,000X and lengths at 10,000 to 15,000. 1.099 latex spheres co-mounted on the SEM stubs were used to calibrate measurements. Particles to be measured were chosen by moving the specimen tab in increments and recording the length and width of the particle whose center fell closest to the center of the field of view. Precision is estimated as ± 0.06 µm.

Crocidolite	Size distribution measurements of South African crocidolite by scanning electron microscopy. This material was characterized by the University of Maryland, College Park, as part of a project undertaken by the US Bureau of Mines on behalf of the National Institute of Environmental Health Sciences (NIEHS) which used the material in an animal oral ingestion study. The crocidolite was mined in the Asbestos Mountains (Kuruman Hills) of Northern Cape, South Africa, from a mine located near the Kalahari Desert. The mineral that make up the fibers contained in this data set is 99% crocidolite (asbestiform riebeckite). In addition, there are minor amounts of biotite, quartz, opaques, feldspar, glass. 6000 lbs. of the material was sent to the Bureau of Mines. Prior to characterization, the crocidolite was air jet milled twice to break up bundles. The data contained in this file were derived by combining analyses of many sub samples that were taken from the single large shipment. Sample preparation included dispersal in water and deposition on 0.1µm Nucleopore filters. A portion of the filter was copper coated and examined by SEM equipped with EDXA. Measurements of width were made at 20,000X and lengths at 10,000 to 15,000. 1.099 latex spheres co-mounted on the SEM stubs were used to calibrate measurements. Particles to be measured were chosen by moving the specimen tab in increments and recording the length and width of the particle whose center fell closest to the center of the field of view. Precision is estimated as ± 0.06 µm.

Chrysotile	Size distribution measurements of North American chrysotile by scanning electron and transmission electron microscopy. This material was characterized by the University of Maryland, College Park, as part of a project undertaken by the US Bureau of Mines on behalf of the National Institute of Environmental Health Sciences (NIEHS) which used the material in an animal oral ingestion study. The short-fiber chrysotile was mined at the New Idria serpentinite mass located in the southern part of the Diablo Range in southwestern San Benito and western Fresno Counties of California. It is greater than 96% chrysotile with minor amounts of calcite, brucite, talc, feldspar, quartz, and opaques. The long-fiber chrysotile was mined at the Johns-Manville Jeffrey mine, Asbestos, Quebec, Canada. It is greater than 96% chrysotile with minor amounts of platy serpentine, calcite, brucite, pyroxene, talc, magnetite, and other opaques. The short-fiber chrysotile was measured on the TEM. Three-millimeter-diameter copper grids of 200 mesh were coated with a collodion film in the following manner: Nine or ten copper grids were placed on a 2- by 5-inch screen with the edges turned up about 0.5 inch. The screen and grids were placed on the bottom of a petri dish filled with filtered distilled water. A dilute solution of 5-percent collodion in amyl acetate was carefully placed with an eyedropper into the petri dish, forming a film on the surface of the water. The petri dish was left undisturbed for 10 min to allow the collodion film to distribute evenly. Then, lifting it by the edges, the screen was carefully removed from the petri dish. The copper grids on the screen were coated with the collodion as they were lifted through the collodion film on the water. The collodion was allowed to dry for at least 1 hour before the grids were removed from the screen with forceps. Approximately 0.5 mg of short-fiber chrysotile was added to 10 ml of distilled water in a 20-ml glass jar and stirred vigorously with a clean metal rod for several seconds. The jar was covered with a plastic lid and placed in an ultrasonic disperser for approximately 10 min. While working in a fume hood, the dry collodion-coated grids were placed on petrographic slides that had been cleaned in filtered distilled water. Several drops of the water and chrysotile mixture were dropped onto a labeled grid with a clean eyedropper. Because the grids were hydrophobic, the liquid did not readily cover the grid surface. The copper grid was held down with forceps, and the liquid was forced over it manually with a clean steel probe until the grid remained submerged. The grids dried undisturbed in the fume hood, or they were placed on a warm hotplate. After evaporation of the water,

	an even distribution of particles adhered to the collodion as a result of static charge. The grids coated with sample were placed in a labeled grid storage box until TEM examination. Precision of width is +/- 0.005 um The long-fiber chrysotile was measure on the SEM. Sample preparation included dispersal in water and deposition on 0.1µm Nucleopore filters. A portion of the filter was copper coated and examined by SEM equipped with EDXA. Measurements of width were made at 20,000X and lengths at 10,000 to 15,000. 1.099 latex spheres co-mounted on the SEM stubs were used to calibrate measurements. Particles to be measured were chosen by moving the specimen tab in increments and recording the length and width of the particle whose center fell closest to the center of the field of view. Precision is estimated as ± 0.06 µm.
Tremolite	Size distribution measurements of New York tremolite by scanning electron microscopy. This material was characterized by the University of Maryland as part of a project undertaken by the US Bureau of Mines on behalf of the National Institute of Environmental Health Sciences (NIEHS) which used the material in an animal oral ingestion study. The tremolite came from tremolite veins at two levels in the R.T. Vanderbilt mine, Balmat, New York. The material was composed of about 74% tremolite and 25% serpentine. In addition, there are minor amounts of talc, calcite, phlogopite, and anthophyllite. It is prismatic and brittle. It is not asbestos and the particles derived from it by crushing are properly referred to as cleavage fragments. 1200 lbs. of the material was milled by Vanderbilt to minus 325 mesh in a Wheeler mill. The material from the two veins were blended and sent to the Bureau of Mines. The data contained in this file was derived by combining analyses from many sub samples which were taken from the single large shipment. Every particle whose measurements of length and width are contained in this file had straight parallel sides and were determined to be tremolite by using EDXA prior to analysis. Sample preparation included dispersal in water and deposition on 0.1µm Nucleopore filters. A portion of the filters was copper coated and examined by SEM equipped with EDXA. Measurements of width were made at 20,000X and lengths at 10,000 to 15,000. 1.099 latex spheres co-mounted on the SEM stubs were used to calibrate measurements. Particles to be measured were

	chosen by moving the specimen tab in increments and recording the length and width of the particle whose center fell closest to the center of the field of view. Precision is estimated as ± 0.06 µm.

Instruments
Scanning Electron Microscopes: Cambridge Mark lla at the Center for Materials Research, University of Maryland, and an AMR 1400 at the Bureau of Mines, Avondale Research Center. Both instruments are equipped with energy dispersive X-ray analyzers (EDXA). Transmission Electron Microscope: Philips EM 100-B TEM

Variables/Parameters	
length	particle length in micrometers- µm
width	particle width in micrometers - µm

Keywords/Topics
Amosite Grunerite Crocidolite Chrysotile Riebeckite Tremolite Asbestos Asbestos industry - health aspects Amphibole group Granulometry

Associated Publications
Details of samples and sample preparation and summary data can be found in: Campbell, W., Huggins, C and Wylie, A., 1980, Chemical and physical characterization of amosite, chrysotile, crocidolite and nonfibrous tremolite for oral ingestion studies by the National Institute of Environmental Health Sciences: Washington, D.C., U.S. Bureau of Mines, Report of Investigation #8452, 63 p. http://catalog.hathitrust.org/Record/005949094 Analysis of these data can be found in the following publications:

Wylie, A.G., 1979, Fiber length and aspect ratio of some selected asbestos samples: Annals of the New York Academy of Sciences, v. 330, p. 605-610, http://dx.doi.org/10.1111/j.1749-6632.1979.tb18766.x

Siegrist, H.G. and Wylie, A.G. 1980, Characterizing and Discriminating the Shape of Asbestos Particles: Environmental Research, v. 23, p. 348-361, http://dx.doi.org/doi:10.1016/0013-9351(80)90070-5

Wylie, A.G., 1988, Relationship between the growth habit of asbestos and the dimensions of asbestos fibers: Mining Engineering, Nov., p. 1036-1040.

Wylie, A.G., 1993, Modeling asbestos populations: A fractal approach: Canadian Mineralogist, v. 30, p. 437-446, http://www.canmin.org/content/31/2/437.full.pdf+html

The widths and thicknesses of same South African amosite described by these data were measured by TEM and SEM. The results of that study are published in the following:

Wyllie, A.G., Shedd, K.B. and Taylor, M.E., 1982, Measurement of the thickness of amphibole asbestos fibers with the scanning electron microscope and the transmission electron microscope, *in* Heinrich, K.F.J., ed., Microbeam Analysis: San Franciso, CA., San Francisco Press, p. 181- 187.

Data Citation

Wylie, A.G., and Virta, R.L., 2016, *Size distribution measurements of amosite, crocidolite, chrysotile, and nonfibrous tremolite*: Digital Repository at the University of Maryland, http://dx.doi.org/10.13016/M2798Z

DOI

10.13016/M2798Z

Data Repository

Digital Repository at the University of Maryland (DRUM)

http://drum.lib.umd.edu
drum-help@umd.edu

Date Released

2015

Availability
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