U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Reported Historic Asbestos Mines, Historic Asbestos Prospects, and Natural Asbestos Occurrences in the Eastern United States

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Introduction

This map and the accompanying dataset (*asbestos_sites.xls*) provide information for 331 natural asbestos occurrences of many sizes in the Eastern United States (U.S.), using descriptions found in the geologic literature. These asbestos occurrences range in size from small veins to large ore bodies once mined for commercial and industrial uses. Data on location, mineralogy, geology, and relevant literature for each asbestos site are provided in the aforementioned digital file. Using the map and digital data in this report, the user can examine the distribution of previously reported asbestos occurrences and their characteristics in the Eastern U.S. This report is intended to provide State and local government agencies and other stakeholders with geologic information on natural occurrences of asbestos.

The file *asbestos_sites.xls* was compiled through a systematic State-by-State search of the geologic literature. An asbestos site was included only when the literature source specifically mentioned asbestos and (or) described the commonly regulated asbestos minerals as occurring in the asbestiform crystal morphology. No attempt was made to interpret the presence of asbestos from the context of the geology-mineralogy description if asbestos was not explicitly described. The user should refer to the references cited with each asbestos site entry for descriptions of these occurrences. Note that these site descriptions apply to the time of that report's publication. No field verification of the sites was performed, nor were evaluations of potential exposure made at these sites. Many of the sites are likely to have been subsequently modified by human activities since their description, sometimes substantially. For example, since the time that the source literature was published there may have been remediation of the site or it may have been either exposed or covered by more recent development.

Although this asbestos dataset represents a thorough study of the published literature, it can not be construed as a complete list. The dataset includes the largest known asbestos deposits of this region.

What is Asbestos?

The history of asbestos discovery and usage is at least 5,000 years old, extending back to the ancient civilizations in Greece and what is now Italy (see Ross and Nolan, 2003). Historically, asbestos is a generic commercial-industrial term used to describe a group of specific silicate minerals that form as long, very thin mineral fibers, which combine to form bundles. When handled or crushed, asbestos bundles readily separate into individual mineral fibers. The special properties of commercial-grade asbestos—long, thin, durable mineral fibers and fiber bundles with high tensile strength, flexibility, and resistance to heat, chemicals, and electricity—have made it well suited for a number of commercial applications in the past and present (Ross, 1981; Zoltai, 1981; Cossette, 1984; Ross and others, 1984; Skinner and others, 1988). Asbestos has been especially used for its insulating and fire-resistant properties in many types of products (see Virta and Mann, 1994; Ross and Virta, 2001).

Asbestos is most commonly defined as the asbestiform variety of several specific, naturally occurring, hydrated silicate minerals. Asbestos typically includes chrysotile, the asbestiform member of the serpentine group, and several members of the amphibole mineral group, including, but not limited to, the asbestiform varieties of (1) riebeckite (commercially called crocidolite), (2) cummingtonite-grunerite (commercially called amosite), (3) anthophyllite (anthophyllite asbestos), (4) actinolite (actinolite asbestos), and (5) tremolite (tremolite asbestos). Other amphiboles are known to occur in the fibrous or asbestiform habit (Skinner and others, 1988), such as winchite, richterite (Meeker and others, 2003), and fluoro-edenite (Gianfagna and Oberti, 2001; Gianfagna and others, 2003), but usually they have not been specifically listed in the asbestos regulations. The many different ways that asbestos and asbestiform and other related terms have been described are summarized in Lowers and Meeker (2002).

Asbestos Production

Historically, chrysotile has accounted for more than 90 percent of the world's asbestos production, and it presently accounts for over 99 percent of the world production (Ross and Virta, 2001; Virta, 2002). Mining of crocidolite (asbestiform riebeckite) and amosite (asbestiform cummingtonite-grunerite) deposits accounts for most of the other asbestos production, and small amounts of anthophyllite asbestos have been mined in Finland (Ross and Virta, 2001). Asbestos is no longer mined in the United States. The last U.S. asbestos operation mined chrysotile deposits in California; this mine closed in 2002.

The map shows that 60 asbestos mines once operated in the Eastern U.S.; these mines varied widely in size and were active during many different time periods. The first large-scale production of asbestos in the Eastern U.S. began in 1894 at the Sall Mountain area of Georgia (anthophyllite asbestos) (McCallie, 1910). Anthophyllite asbestos was mined at various times in Georgia, North Carolina, Virginia, Maryland, Connecticut, and Massachusetts. Pennsylvania saw some small-scale mining of "amphibole asbestos" (unspecified type) in the early 1900s. The last asbestos mining in the Eastern U.S. was of chrysotile deposits at the Eden and Lowell quarries on Belvidere Mountain, north-central Vermont. The Lowell (chrysotile) quarry was the last asbestos mine to operate in the Eastern U.S., closing in 1993 (Van Baalen and others, 1999).

Naturally Occurring Asbestos

Mounting evidence throughout the 20th century indicated that inhalation of asbestos fibers caused respiratory diseases that have seriously affected many workers in certain asbestos-related occupations (Tweedale and McCulloch, 2004). Exposures to asbestos have been linked to a number of serious health problems and diseases, including asbestosis, lung cancer, and mesothelioma. Additional asbestos information is available online at http://www.epa.gov/asbestos/help.html#Info/ and http://www.atsdr.cdc.gov/toxprofiles/tp61.html/.

Recently, attention has increased towards asbestos that occurs as accessory minerals in some mineral deposits or occurs in its natural state in some rock types. This attention was spurred by the renewed recognition of high incidences of asbestos-related mortality and respiratory disease in vermiculite miners and residents of Libby, Mont. (Peipins and others, 2003). Of significance is the finding that asbestos-type respiratory diseases are noted in some Libby residents who had no apparent link to occupational exposures. Meeker and others (2003) described fibrous and asbestiform amphibole minerals intergrown with the vermiculite mined and milled near the town from 1923 to 1990. Also recently, large areas of exposed ultramafic bedrock in northern California, some now densely populated by housing and infrastructure, have become the focus of attention because they contain chrysotile and tremolite-actinolite asbestos (Churchill and Hill, 2000; Clinkenbeard and others, 2002; Ross and Nolan, 2003; Swayze and others, 2004). Natural asbestos occurrences are of concern due to the potential exposures that may result if the asbestos-bearing rocks are disturbed by natural erosion or human activities. Other examples of occupational and environmental exposures to asbestos are described in Nolan and others (2001) and Ross and Nolan (2003).

Local authorities have instituted ways to reduce exposure to naturally occurring asbestos. For example, the Fairfax County Health Department, Va., developed an asbestos exposure control plan that is mandated for use in construction projects that excavate "asbestos containing material" (ultramafic rock bodies) within the county (Dusek and Yetman, 2002). Information on naturally occurring asbestos and recommendations for reducing asbestos exposures, especially for areas of northern California, are available on a website maintained by El Dorado County, California (http://www.co.el-dorado.ca.us/emd/apcd/asbestos.html/).

The history and study of naturally occurring asbestos and the multiple, complex issues that surround asbestos are discussed in Campbell and others (1977), Ross (1981), Stanton and others (1981), Zoltai (1981), Levadie (1984), Skinner and others (1988), Mossman and others (1990), Occupational Safety and Health Administration (1992), Guthrie and Mossman (1993), van Oss and others (1999), Nolan and others (2001), Virta (2002), and Plumlee and Ziegler (2003). Current federal regulations are provided in the Code of Federal Regulations (available online at http://www.gpoaccess.gov/cfr/). However, these asbestos regulations do not specifically address exposures to natural occurrences of asbestos.

Digital Database

The enclosed asbestos database (***asbestos_sites.xls***) was compiled from information found in 170 geologic references examined by the author. Each asbestos site entry in the database includes the following data fields:

State

The State in which in the asbestos deposit lies, using the two-letter U.S. Postal Service abbreviation.

Historic site name as reported

The name of the asbestos mine, prospect, or occurrence, matching the nomenclature used in the source literature.

Development

This field indicates whether the asbestos site represents a past producer, past prospect, or occurrence. "Past producer" indicates that the deposit was mined and produced asbestos ore for commercial uses in the past. "Past prospect" indicates that the asbestos deposit was prospected (evaluated) for possible commercial use, typically by trenching and (or) drilling, but the deposit was not further developed. "Occurrence" indicates that asbestos was reported at this site. The occurrence category includes (1) sites where asbestos-bearing rock is described in a geologic map or report; and (2) asbestos noted as an accessory mineral or vein deposit within another type of mineral deposit.

Latitude

The latitude of the site's location in decimal degrees, measured using the North American Datum of 1927. The number of significant figures following the decimal point indicates the believed accuracy of the location: (1) two significant figures (for example, 45.13) indicates an approximate location based on a general description; (2) three significant figures (for example, 45.132) indicates a likely good location based on a detailed description or location shown on a small-scale map (1:50,000-scale or smaller); and (3) four significant figures (for example, 45.1327) indicates a precise location based on a detailed description or a location shown on a large-scale map (1:24,000-scale or larger).

Longitude

Calculated along with latitude.

Asbestiform mineral(s) reported

This field identifies the type of asbestos present as described in the source literature.

Associated minerals reported

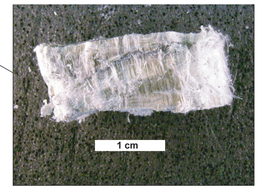
Minerals mentioned in association with the asbestos are listed, as they were described in the source literature. The order in which each mineral is reported listed does not necessarily indicate their relative abundance in the deposit, but rather their order of mention in the source report.

Host rock(s) reported

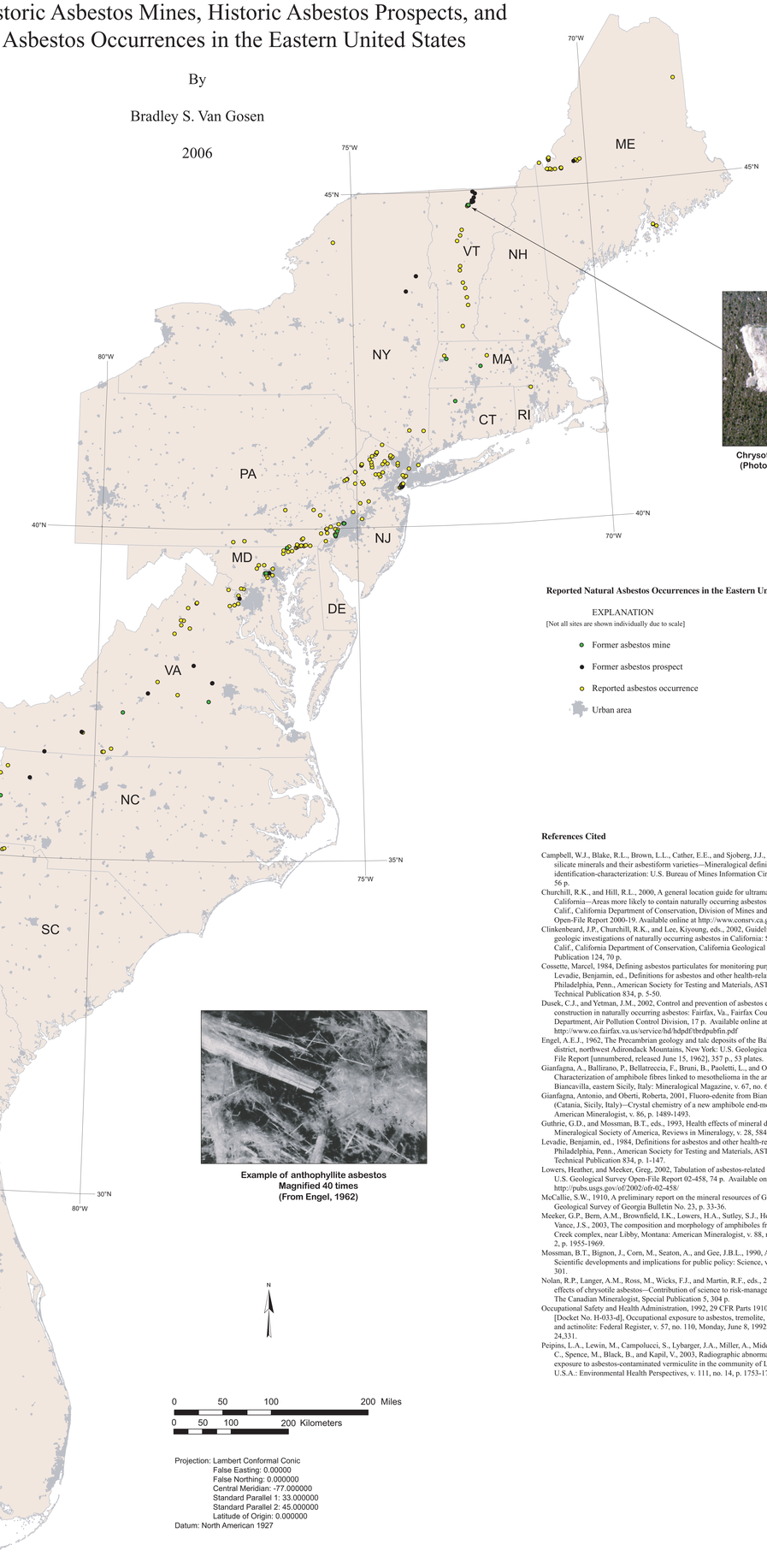
The host rock type(s) for the asbestos is (are) listed when available as described in the source literature.

References

The references used to compile the site information are listed in this field. The full reference citations are provided in the accompanying digital files ***References.pdf*** and ***References.xls.***



Chrysotile from the Lowell quarry, Vermont (Photograph by Bradley Van Gosen, 2005)



Reported Natural Asbestos Occurrences in the Eastern United States

EXPLANATION

[Not all sites are shown individually due to scale]

- Former asbestos mine
- Former asbestos prospect
- Reported asbestos occurrence
- Urban area

Number and Type of Asbestos Sites Reported in the Eastern United States

State	Former asbestos mine	Former asbestos prospect	Asbestos occurrence
Maine	--	1	21
Vermont	3	7	12
Massachusetts	2	--	2
Rhode Island	--	--	1
Connecticut	1	--	--
New York	--	2	21
New Jersey	--	--	38
Pennsylvania	4	--	37
Delaware	--	--	1
Maryland	4	1	17
Virginia	2	7	19
North Carolina	27	10	12
South Carolina	--	2	6
Georgia	17	26	9
Alabama	--	10	9
	60	66	205

Example of anthophyllite asbestos Magnified 40 times (From Engel, 1962)

N

0 50 100 200 Miles

0 50 100 200 Kilometers

Projection: Lambert Conformal Conic
False Easting: 0.00000
False Northing: 0.000000
Central Meridian: -77.000000
Standard Parallel 1: 33.000000
Standard Parallel 2: 45.000000
Latitude of Origin: 0.000000
Datum: North American 1927

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