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# THE TALC, SOAPSTONE AND ASBESTOS DEPOSITS OF MASSACHUSETTS

by

Newton E. Chute



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## Abstract

Several talc and soapstone deposits were worked in Massachusetts from about 1810 to 1922. Most of these deposits are in the Chester Amphibolite, or in serpentine lenses in or adjacent to the amphibolite along a belt that extends north-south across the State from Rowe to West Granville; it appears to be a continuation of the Vermont talc belt. The only deposits outside of this belt that have been worked are a talc and soapstone deposit in the northwest corner of Hinsdale and soapstone deposits on the east side of Soapstone Hill in the western part of Petersham.

Very little asbestos has been produced in Massachusetts. A small amount of anthophyllite asbestos was obtained from the deposit in Hinsdale, and from a deposit in southwestern Pelham.

The talc and soapstone deposits of Massachusetts were formed from serpentine and possibly from amphibolite, schist, and dolomitic limestone. Those formed from serpentine are mainly at the ends of the serpentine bodies, and those that appear to have been formed from amphibolite or schist are on faults and folds.

The talc and soapstone deposits show many similarities regardless of the kind of rock from which they were formed. All the deposits, except the Osborn soapstone deposit, contain the carbonate minerals dolomite or ankerite as disseminated grains, grain clusters, and veinlets. Other common impurities are chlorite and magnetite. The Osborn soapstone deposit, unlike the other deposits, contains considerable anthophyllite and no carbonate.

The purity and grain size of the talc and soapstone differ not only in different deposits but also within individual deposits. The grain size depends in part upon the amount of shearing; some deposits have not been sheared and are massive, and others are partly or wholly sheared and foliated.

All of the deposits are bordered by a layer of chlorite a few inches to a few feet thick that commonly contains actinolite or tremolite and more rarely biotite.

Little is known about the quantity and quality of the talc left in the underground workings. All the deposits worked by open quarry methods are comparatively small, and the talc in them is of poor quality because of impurities.

## Introduction

A brief examination of the talc, soapstone, and asbestos deposits of Massachusetts was made for this report in July 1944. Many people assisted the writer in locating the deposits and in providing historical information. This assistance is gratefully acknowledged throughout the report.

Gillson (1937, p. 874) defined soapstone as "An impure talc rock that is sufficiently massive to be quarried in large pieces, but is too low in grade to produce a marketable talc." In this report the term soapstone is applied to those deposits that were worked for soapstone, and talc to those that were

worked for ground talc. The distinction is not satisfactory, however, as some of the deposits worked for soapstone are very similar to those worked for talc. Two of the deposits originally worked for soapstone were subsequently worked for ground talc, and the deposit in the northwestern part of Hinsdale was worked for both at the same time.

Soapstone was first quarried commercially in Middlefield, Massachusetts, in 1811 or 1812. This operation lasted only 2 or 3 years, but the quarries were reopened in 1853 and worked for several more years. These quarries have had the largest total production of soapstone in Massachusetts. The next largest producers were the Osborn soapstone quarry in Blandford which was opened about 1830 and worked intermittently until about 1903 and the Soapstone Hill quarries in Petersham worked from 1878 to about 1882. A small amount was produced from the Hoosac Tunnel soapstone quarry and from the quarries in the northwestern corner of Hinsdale. No soapstone has been produced in Massachusetts since 1906, when the quarries in Hinsdale were closed.

Talc was produced from several mines in Massachusetts at different times between 1898 and 1922. The most important were the mine operated by the Massachusetts Talc Company from about 1901 to 1912, and the mine operated by the Foliated Talc Company from 1905 to 1922. Small amounts of talc were also produced from a quarry operated by the Berkshire Talc Manufacturing Company in Hinsdale from about 1898 to 1906 and the Ley talc mine in Savoy from about 1909 to 1912. The other talc mines had only a very small production.

## General description of the talc and soapstone deposits

Most of the talc and soapstone deposits occur in or along the Chester Amphibolite and appear to be a continuation of the Vermont talc belt. The Chester Amphibolite extends across the western part of Massachusetts as a narrow discontinuous outcrop belt from Rowe to West Granville. Outside of this belt the only deposits that have been worked commercially were one in the northwest corner of Hinsdale formerly worked by the Berkshire Talc Manufacturing Company, and two deposits on the east side of Soapstone Hill in Petersham (pl. 1).

The Chester Amphibolite was described by Emerson (1917, p. 41-42) as follows: "It crosses the State in a narrow interrupted band, with very steep bedding, and continues far into Vermont and Connecticut. It is 500 feet wide in its northern part, widens to 3,200 feet in Chester, and is 1,200 feet wide where it crosses the State line. In its northern part it is a dark-green to black foliated or ligniform epidotic quartz-hornblende schist apparently of sedimentary origin. At several places in this part of its course it is associated along its eastern (formerly the upper) border with lenticular masses of serpentine of igneous origin."

In many places the Chester Amphibolite is not a single layer of amphibolite but consists of several layers separated by mica schist. Emerson's geologic map of Massachusetts shows that between Rowe and Blandford the Chester Amphibolite is bordered on the west by the older Rowe quartz-muscovite schist and on the east by the younger Savoy muscovite schist. According to Emerson (1917, p. 41-42) these formations were originally sedimentary rocks of Ordovician age that have been folded and metamorphosed.

The talc and soapstone deposits appear to have been formed mainly by the alteration of magnesium-rich rocks, especially serpentine and probably also amphibolite, mica schist, and dolomitic limestone, by solutions from intrusive igneous bodies. Gillson (1927, p. 274) thought some of the deposits were formed from schist and amphibolite; he wrote, "Talc occurs in serpentine rocks, and in a quartz-muscovite-chlorite schist, and a quartz-mica-amphibole gneiss, in a north-south belt extending at least from Broughton, Quebec, to Blandford, Mass."

Many of the Massachusetts deposits are not exposed well enough to determine the origin of the talc with certainty. The talc deposits at the north and south prospect shafts in Florida, at the Middlefield soapstone quarries, and the Osborn soapstone deposit in Blandford appear to have been formed from serpentine. The soapstone at the ends of the small body of serpentine 500 feet southwest of the Massachusetts Talc Company mine in Rowe (pl. 4) is so well exposed there is little doubt that it was formed from serpentine.

Deposits where no serpentine is known to occur may have formed from amphibolite, schist, or both, but for the most part the exposures are not good enough to definitely prove that the deposits were not formed from serpentine. The talc deposit worked by the Foliated Talc Company at Rowe (pl. 2) lies between mica schist and amphibolite (Ladoo, 1923) and, as there is no indication of serpentine at the mine, the talc may have formed by alteration of the amphibolite or schist. Similar conditions exist at the deposit worked by the Massachusetts Talc Company mine in Rowe where only schist and amphibolite crop out near the mine shaft (pl. 3). Other deposits that may have formed from amphibolite or schist include the talc mines in Windsor and Savoy, the soapstone deposit southeast of the Hoosac Tunnel, and the Bartholomew soapstone deposit in North Blandford.

Nearly conclusive evidence that some talc was formed solely from mica schist occurs in a small prospect on the W. M. Tefts farm in Middlefield. The talc deposit exposed at the west end of the southernmost trench (pl. 6, fig. 2) is bordered on all sides by schist. The schist adjacent to the deposit has been altered to chlorite, indicating the schist was first chloritized and then the chlorite was changed to talc. The same relations appear to exist at the prospect shaft 250 feet northeast.

Talc is exposed in outcrops of the metamorphosed Coles Brook Limestone, below the bridge over the Housatonic Branch of the Housatonic River, 2 miles southeast of Hinsdale. Emerson (1917, p. 21) thought the talc and soapstone deposit in northwestern Hinsdale near Wahkonah Falls (Windsor Falls) was also formed from the Coles Brook Limestone.

The deposits are usually at the ends of serpentine lenses or on faults or sharp folds in amphibolite or schist. Most of the serpentine bodies are lens-shaped in ground plan and the lenses parallel the foliation of the schist and amphibolite. The deposits that appear to have formed from amphibolite or schist are located at sharp folds or faults or both, probably because these structures provided channelways for solutions that formed the talc. The map of the Foliated Talc Company mine (pl. 2) shows that the talc deposit is located where the schist and amphibolite are faulted and folded. Similar conditions probably exist at the Massachusetts Talc Company mine a mile and a half to the southwest. The Bartholomew soapstone quarry in North Blandford (pl. 7) is located at a fault or fold in the amphibolite and schist, and the soapstone prospects 1,000 feet southeast of the Middlefield soapstone quarries (pl. 6) afford small but good examples of soapstone deposits localized by sharp folds in schist.

The talc and soapstone deposits are almost invariably enclosed in a sheath of chlorite a few inches to a few feet thick which commonly contains actinolite. The chlorite and actinolite commonly show partial alteration to talc. Biotite may be present in the marginal zones, but it is much less common than chlorite.

Dolomite or ankerite is the most common impurity in the deposits. The carbonate forms disseminated grains, grain clusters, and veinlets in the talc. All the deposits except the Osborn soapstone deposit at Blandford have carbonate. Other impurities present in sufficient quantity to be observed with the unaided eye are chlorite, serpentine, actinolite, tremolite, anthophyllite, and magnetite.

Hess (1933, p. 636) determined the order of mineral formation in the talc deposits of Vermont to be as follows:

Hornblende (oldest)
Actinolite
Chlorite
Talc
Carbonate (youngest)

This order of mineral formation applies to the Massachusetts deposits except that biotite appears to take the place of hornblende. Some of the deposits were sheared after the carbonate was deposited; talc flakes wrap around the carbonate grains, and the grains have been elongated by the shearing.

## Talc and soapstone mines, prospects, and quarries

### Foliated Talc Company mine

#### Location

The talc mine operated by the Foliated Talc Company is about 1 3/4 miles north of Rowe on a farm owned by J. H. Williams. The mine may be reached by following the abandoned mine road northward about three-quarters of a mile (pl. 1) from the Williams' house.

#### History

P. W. Brown (1935, p. 6) said the Foliated Talc Company was incorporated in 1905 and ceased operations in 1922. The talc was hauled in wagons from the mine to the company's mill in Rowe. Water power for the mill was supplied by a flume from the pond connected with the village sawmill.

#### Geology

The exposures are too small for much to be learned about the talc deposit by an examination of the surface at the mine and the mine workings are filled with water and are, thus, inaccessible. Mica schist and fine-grained Chester Amphibolite crop out on the southeast side of the talc body (pl. 2). The schist may be the Savoy Schist or it may be schist included within the Chester Amphibolite. In the vicinity of the shaft the foliation of the two formations strikes N. 42° - 57° E. and dips 60° - 80° S.E.

The amphibolite occurs as a layer a few feet thick between the talc and the mica schist. It is traceable for about 110 feet northeast of the shaft. The only exposure of talc is about 50 feet northeast of the shaft at the northwest side of a large outcrop. A prospect trench 45 feet farther northeast has some impure talc on the adjacent dump but none is exposed in place. In both of these occurrences

the talc contains considerable iron-bearing carbonate in disseminated grains. Between the talc and the amphibolite is a layer of chlorite a few inches to a foot thick which contains scattered actinolite. These relations suggest the amphibolite was hydrothermally altered to actinolite, chlorite, and, finally, talc in fractured or crumpled zones.

Southwest of the shaft are outcrops of mica schist and amphibolite in which the foliation strikes N. 5° - 22° W. and dips 80° - 85° E. Although the beds may not correlate with those exposed northeast of the shaft, the variation in the strike of the foliation indicates the talc body may have been localized by folds or faults.

Some details concerning the talc deposit are given by Ladoo (1923): "The talc vein strikes about NE. and SW. and dips about 65° SE.; it is 55 to 65 feet thick, with no core of rock, between a hanging wall of chlorite schist and a footwall of fine-grained hornblende schist. The talc ranges from foliated to massive and from white through greenish gray to dark gray".

Mining method

Ladoo (1923) described the mining method as follows: "An inclined shaft has been sunk in the vein at a dip of 65 degrees to a depth of 240 feet, measured on the incline. At 100 feet and 200 feet below the collar of the shaft drifts are turned off in each direction along the strike and within the talc body. The lower 40 feet of the shaft is used as a sump. At frequent but irregular intervals along both sides of the drift stopes are started and carried upward in a series of benches, leaving pillars for support where necessary. No timber is used. A main track runs down the center of each drift and spurs are laid to the foot of each stope. Talc in cars, trammed by hand along the levels, is dumped into skips at the shaft and hoisted to the surface. The mine equipment consists of a steam pump at the second level, and an air compressor, hoist, and boiler at the surface."

## Mill

The mill of the Foliated Talc Company formerly opposite the school in Rowe, was torn down after the mine ceased operations. According to Ladoo (1923) the mill had a capacity of 12 to 15 tons per 10-hour day. A description of the milling machinery and power is given in the report by Ladoo.

## Marketing

The Foliated Talc Company sold only ground talc. Percy Salisbury of Rowe, who operated the mill, said the company produced three grades of talc called coarse, medium, and fine. The output was sold chiefly to roofing and paper companies including the Bird and Sons Roofing Company of East Walpole, Massachusetts and Hamilton, Ontario; the Holyoke Paper Company and the Glassine Paper Company. The ground talc was hauled four miles to the railroad at Zoar for shipment.

## Appraisal

Persons acquainted with the mine believe it was not worked out when it was abandoned. The amount and quality of the talc left in the deposit cannot be determined, however, except by underground exploration.

The mine was not timbered and inadequate support was left for the stopes; as a result the workings caved in and formed the pit now filled with water 80 feet southwest of the shaft.

## Massachusetts Talc Company mine

### Location

The mine of the Massachusetts Talc Company is 2 miles by road northwest of Rowe and a mile and a half southwest of the Foliated Talc Company mine. It is on the east side of the road to Monroe Bridge on the farm owned by the Hal Sibley estate (pl. 1).

### History

The mine was started in 1901 or 1902 and was operated until 1912 when the company's mill burned down.

### Geology

Only amphibolite and mica schist are exposed in the vicinity of the mine shaft (pl. 3); no talc is visible. The amphibolite belongs to the Chester Amphibolite; several layers of amphibolite are separated by layers of mica schist.

The amphibolite is fine to medium grained and is distinctly banded parallel to its contacts. Some quartz stringers are present parallel to the foliation and moderate amounts of epidote are scattered throughout the amphibolite. The schist contains muscovite and quartz with moderate amounts of biotite, chlorite, garnet, and magnetite. Much of the quartz occurs in augen-like lenses. Red garnet is rare in outcrops of schist near the shaft. Magnetite crystals one-sixteenth to one-eighth of an inch in diameter, are abundantly disseminated through most of the schist.

The talc deposit may have been formed by alteration of the amphibolite; the outcrops are not exposed well enough for this to be verified. In the vicinity of the talc deposit the schist and the amphibolite have been considerably contorted by folding which may have been an important factor in the localization of the deposit.

According to E. B. Sibley, the talc body is about 20 feet thick and has branch veins from it which extend 15 to 20 feet into the footwall and hanging wall. These branch veins contain some of the purest talc.

Waste rock on the mine dump contains a small amount of biotite, much chlorite, and considerable actinolite mixed with the talc. Fragments of both white and colorless quartz veins are common. The talc has been sheared to a schist and contains carbonate, chlorite, and a small amount of disseminated pyrite as the principal impurities.

Mine workings

E. B. Sibley told the writer the main shaft is inclined about 60 to 70 degrees eastward and is about 200 feet deep as measured on the incline. Drifts extend 100 feet or so toward the northeast; they do not extend very far southeast. J. S. Diller (1912, p. 1149) stated the mine "is opened by an incline more than 200 feet in length and developed recently for the most part on the 50-foot and 100-foot levels".

Mill

The mill built by the Massachusetts Talc Company at Zoar in 1911 was destroyed by fire June 18, 1912 (Diller, 1912, p. 1149). The company had plans for a new mill but it was never built. The mill stood between the railroad and the highway, about one-fifth of a mile west of the Zoar railroad station. More talc can be found at the millsite than on the mine dump.

Marketing

The talc sold by the Massachusetts Talc Company was marketed as ground talc, much of which is said to have been sold to paper companies for $4 to $6 per ton.

Appraisal

Persons acquainted with the mine believe that it was not worked out when abandoned. Because there are no exposures of the talc deposit at the surface, the quantity and quality of the talc remaining cannot be determined except by underground exploration.

### Undeveloped soapstone deposit near the Massachusetts Talc Company mine

A small body of serpentine, altered to soapstone at both ends, is exposed 500 feet southwest of the Massachusetts Talc Company's mine (pl. 4). The serpentine body, including the soapstone, has an exposed length of 225 feet and a maximum width of 80 feet. It forms a knob that stands 10 to 15 feet above its surroundings. The country rock does not crop out near the body and, thus, contacts cannot be accurately located. The body may not be much larger than its exposed area.

The serpentine is massive and light greenish gray on weathered surfaces to dark green on fresh surfaces. Disseminated grains of carbonate occur in the soapstone.

The ends of the serpentine lens have been altered to soapstone which is light gray on both weathered and fresh surfaces. The soapstone is relatively fine grained. It contains a small amount of chlorite and 10 to 30 percent carbonate in narrow veinlets and disseminated grains from one-sixteenth to one-half an inch in diameter. At the surface, the soapstone is cut by irregular fractures spaced a few inches to two feet apart.

At the northeast end of the serpentine body the soapstone has a maximum exposed width of 50 feet, and at its southwest end it has a maximum exposed width of 25 feet. The soapstone may extend toward the northeast and the southwest beyond the present exposure, but the only suggestion of this is the presence of several blocks of soapstone in the glacial till a short distance to the northeast.

## Hoosac Tunnel soapstone quarry

### Location

This soapstone quarry is in Rowe on the north side of the Deerfield River, 1.4 miles southeast of the east end of the Hoosac Tunnel. The quarry may be reached by taking the old road east from the Hoosac Tunnel railroad station about three-quarters of a mile; there the road turns sharply up the steep mountain slope. The quarry is about 500 feet east of this bend at the inner edge of the river terrace. The foundation of the soapstone mill and a pile of unused soapstone blocks are nearby on the outer edge of the terrace.

### History

A.W.F. Newman of the village of Hoosac Tunnel told the writer that the quarry was worked for soapstone sometime between 1885 and 1895. A mill and several houses were built at the quarry but, judging by the size of the quarry, the production was small. P. W. Brown (1935, p. 7) stated that the soapstone was used to make stoves and bed warmers.

The soapstone deposit was reopened about 1909 and worked for ground talc. According to Mr. Newman an adit was driven into the bottom of the quarry and four or five carloads of broken soapstone were shipped before operations were suspended.

### Geology

The soapstone deposit is bordered on the west by the Chester Amphibolite. There are no outcrops to locate the eastern contact of the deposit, but the east-west width of the deposit is estimated to be about 60 feet.

The quarry extends into the side of the mountain and has a length of about 50 feet, a width of 40 feet, and a depth of 15 feet. Soapstone is exposed along outcrops 40 feet north of the quarry; the full extent of the deposit northward along the line of strike could not be determined.

A large outcrop of well banded, partly chloritized amphibolite lies 50 to 60 feet north of the northwest corner of the quarry. The foliation of the amphibolite strikes N. 0° - 15° E. and dips 75° - 85° E. The soapstone may have formed by alteration of the amphibolite; a small exposure of the contact shows talc that has replaced chloritized amphibolite. The amphibolite has an apparent thickness in outcrop of 24 feet and an estimated total thickness of 65 feet. On the west side of the amphibolite is a lens of serpentine with an east-west thickness of 145 feet. It is bordered on the west by more amphibolite. The two amphibolite bands converge toward each other about 100 feet northwest of the soapstone quarry, indicating that the serpentine body pinches out in that vicinity. A layer of talc 2 to 4 feet thick was found on the west border of the serpentine body near its north end. Because the north end of the serpentine body was covered, it was impossible to tell how much more talc or soapstone is present.

The soapstone exposed in the quarry is massive except adjacent to shear fractures where it is thinly foliated. Shear fractures and joints are spaced 2 to 6 feet apart enabling large blocks of soapstone to be easily quarried.

The soapstone contains 10 to 40 percent carbonate in narrow veinlets and disseminated grains that range from one-sixteenth to one-half inch in diameter. A few scattered grains of pyrite were observed in the soapstone, and several large blocks of soapstone containing a green mineral resembling serpentine were seen near the millsite. The adit driven into the soapstone deposit at the quarry was half filled with water at the time of the writer's visit and could not be examined.

Appraisal

This soapstone deposit was favorably located close to a railroad and at one time it had a sidetrack to the mill. Considerable soapstone remains in the deposit, much of which can be quarried. The majority of the soapstone, however, may be too fine-grained to be suitable for the manufacture of roofing granules and may contain too much carbonate to be useable as finely ground talc.

## Florida talc prospects

Location

The two talc prospect shafts in the town of Florida are about 1 1/4 miles south of the east end of the Hoosac Tunnel, and one-half of a mile north of the Drury post office on Route 2. The north prospect shaft is on an abandoned woods road, about 1850 feet west of the sharp bend in the road between the village of Hoosac Tunnel and Drury post office. The road bend where the woods road originates is a little over half way up the mountain side at an altitude of about 1330 feet. The south shaft is 700 to 800 feet up the side of the mountain S. 25° W. of the north shaft.

History

Mrs. Jerome Brown of Drury said the shafts were sunk about 1900 by a mining promoter named McKinney. Work continued for a year or two and three or four carloads of talc were shipped. McKinney then sold the property to some New York men. They planned to build an aerial tramway from the shafts to the railroad in the bottom of the valley, but the project was dropped and nothing more was done.

Geology of the north prospect

The north shaft is filled with water and nothing is known of the depth or extent of the underground workings. The outcrops in the vicinity of the shaft

are all serpentine; one 60 feet north of the shaft contains a small amount of soapstone (pl. 5, fig. 1). Serpentine crops out at intervals up slope to the south shaft. The talc probably formed by alteration of the serpentine near the eastern contact with mica schist.

The dump of the north shaft contains fragments of serpentine, chlorite, and a little tremolite. Considerable good quality talc was found on the dump. All the dump talc is fine grained and pale greenish gray. It contains very little carbonate in contrast to most of the other talc and soapstone deposits; the principal impurity appears to be a small amount of chlorite.

Geology of the south prospect

The south shaft is filled with water and no information is available as to the extent of the underground workings. The dump is small, however, indicating that the shaft is not very deep (pl. 5, fig. 2).

The shaft is on the west side of the talc body on the contact with mica schist. Sheared talc containing 15 to 40 percent iron-bearing carbonate is exposed in the walls of the eastern half of the shaft and the full length of the trench extending 30 feet southeast of the shaft. The eastern end of the trench is probably near the east contact of the talc deposit; if this is so, the deposit would have a width of about 35 feet near the shaft.

Sixty feet south of the shaft is another prospect trench. It is between two outcrops of impure talc with an estimated 20 to 25 percent carbonate. The trench is partly filled and the west side of the talc body could not be located, but the width of the deposit here is judged to be about 30 feet. No other outcrops of the talc were found; the extent of the talc body north and south of the exposures is not known.

Serpentine crops out about 40 feet east and about 200 feet northeast of the shaft. It is probable that the talc was formed by alteration of the serpentine.

Chlorite was observed in the waste rock on the dump; no actinolite or tremolite were seen. A small amount of talc found on the dump was foliated and comparatively free of carbonate.

Appraisal

The exposures at the north shaft are inadequate to permit any estimate of the size and quality of the talc deposit. Good quality talc was found on the dump, but there is no indication as to how much more may be available.

An exposure of the deposit at the south shaft has a width of 30 to 35 feet and a length of at least 80 feet. Most of this exposed talc is estimated to contain 15 to 40 percent carbonate.

Ley talc mine

Location

The Ley talc mine is about 1000 feet north of the fork in the road to West Cummington 2 1/2 miles southeast of the village of Savoy. The mine is near the brow of the ridge in an abandoned field and, although it is partly overgrown with trees, it can be located by means of its large dump.

History

Mitchell Ducharme of Windsor, who worked in the mine, told the writer the mine was opened about 1909 or 1910 by Mr. McKinney. About 6 months after the mine was started it was taken over by Fred T. Ley, a contractor from Springfield, Massachusetts, who worked the mine for about 2 1/2 years. For about a year the mine was operated day and night using five men on the day shift and four on the night shift. The talc was hauled to the railroad at Charlemont for shipment.

Geology

The geology of this deposit is obscure because the talc is not exposed at the surface and there are no outcrops near the shaft. Amphibolite crops out about 150 feet N. 15° W. of the shaft and its foliation is N. 15° W. with a dip of 70° W. Chloritic mica schist crops out several hundred feet east of the shaft, and mica schist and amphibolite crop out northwest and southwest of the shaft. Although the outcrops are too far from the shaft for accurate determination of the occurrence of the talc deposit, the talc is probably at the east contact of an amphibolite layer.

The mine dump is about 235 feet long, 35 to 40 feet wide at the base, and 15 feet high. Most dump material is impure, sheared talc, which contains carbonate as the principal impurity. However, some light gray, fine-grained talc with relatively little impurity was also found. According to M. Ducharme, much of the talc mined contained disseminated carbonate.

Mine workings

M. Ducharme informed the writer that the mine has one shaft 210 feet long as measured along its incline of 60° E. The bottom 10 feet of the shaft was used for a sump. At the bottom of the shaft is a stope 40 to 50 feet wide and 20 to 25 feet high that extends about 100 feet north of the shaft. Only a moderate amount of water had to be pumped from the workings when the mine was in operation.

Appraisal

No information is available as to the quantity and quality of the talc remaining in this deposit. According to M. Ducharme much good talc remained in the mine when it was closed. The talc was hauled by wagon 12 to 15 miles to the railroad at Charlemont for shipment. Three or four wagons were kept busy hauling the talc all one winter, but there is no information as to how much talc was shipped. Mr. Ley said the mine closed because the cost of hauling the ore to the railroad was too great.

Northampton Talc Company mine

Location

This mine is about 2 miles northwest of West Cummington in the town of Windsor. The road northwest from West Cummington forks about 2 miles from West Cummington. The mine is about 200 feet north of the west fork of the road about 800 feet west of the road junction.

History

The mine was started as a copper prospect by Mr. McKinney, who opened other talc mines in this region; the talc deposit was unexpectedly discovered. The Northampton Talc Company was organized with William H. Smith of Northampton the president. A. E. Addis of Northampton, who was treasurer of the company, said the mine was opened in 1905 and was worked for two or three years.

About 750 feet north northwest of the mine is a shaft that was sunk in search of copper after the Northampton Talc Company mine was abandoned. Talc was evidently found in this prospect also because some talc of dark-green color and poor quality was on the dump.

Between these shafts at the foot of the cliff of amphibolite, are a half dozen or more shallow prospect holes and trenches. The amphibolite in them has showings of pyrite.

Geology

The shaft of the Northampton Talc Company is on the west side of a prominent outcrop of Chester Amphibolite, The foliation of the Amphibolite strikes N. 15° W. and dips 65° to 75° N.E. No talc is exposed at the surface in this area.

According to Mr. Addis talc was discovered in the shaft more than 100 feet below the surface. The best quality talc was found in a layer 10 to 12 feet thick but of short extent. The remainder of the talc contained a large amount of impurity. The talc on the dump is strongly sheared and most of it contains considerable carbonate in disseminated grains one-sixteenth to one-eighth of an inch in diameter. A few pieces of light grayish green talc comparatively free of carbonate were found.

Mine Workings

The shaft is said to be inclined about 75 degrees and to be 160 to 180 feet deep measured on the incline. One drift about 150 feet long extends towards the south from the bottom of the shaft. No drifts were driven northward.

Mill

The talc from this mine was crushed at the mine and hauled to Northampton for fine grinding in a mill owned by William Smith, the president of the company.

Appraisal

A. E. Addis said the company sold one carload of talc which was of poor color. Experiments made to remove the impurities were not successful.

## Middlefield soapstone quarries

Location

The two Middlefield soapstone quarries are located from 2 to 2 1/2 miles northeast of Middlefield on a farm owned by Reed Haseltine of West Springfield,

Mass. (pl. 1). The main quarry is in the woods about 300 feet north of Cone Road; the smaller quarry is 160 feet farther north (pl. 6, fig. 1).

History

An historical account of the soapstone quarries in Middlefield is given in the history of the town of Middlefield (Smith and Smith, 1924, p. 106-107 and p. 171). "About the beginning of the century a large deposit of fine quality soapstone was discovered at the top of Smith Hollow Hill on the land owned by William Ingham and William Skinner Jr. The property was purchased by Barnabas Billings who sold it to three Northampton men by the name of Shepard.... The Middlefield Free Stone Corporation was formed, the members of which were Boston men who had purchased the property of the Shepards for $10,000. The stone was quarried and shipped in a rough state to the metropolis where it was manufactured into the different materials for building. The annual amount of this business in 1813 is reported as $12,000. During this year, however, the company seems to have been in financial difficulties as the directors petitioned the General Court for permission to conduct a lottery to raise additional funds for carrying on the work.

"The quarrying of this stone was made possible only by the construction of the county road from Chester to West Worthington through Smith Hollow in 1811. This road furnished a comparatively level route through Huntington and Westfield to Hartford where the soapstone was undoubtedly shipped to Boston by water.

"Some local use was made of the soapstone for door steps and fireplaces in the old homesteads, but this was negligible. Nothing further is heard of the operations of the Free Stone Corporation, and the enterprise was apparently abandoned soon after the war of 1812, when the treasurer, Alden Bradford was

empowered to sell all rights and title to this land to Asa and Oliver Smith of Smith Hollow".....

"The coming of the railroad brought about a revival of the activity in quarrying soapstone. In 1853 the quarries at the top of Smith Hollow Hill were taken over by the Metropolitan Soapstone Company of New York City, which was incorporated with a capital of $200,000, a sum which was soon increased to $300,000. Two mills were established for sawing the stone into slabs which were used either for fire stones for furnaces or for facing buildings. Some of the stone was also ground to powder to be used with oil as a lubricant or as a basis of soap to remove grease from cloth. In 1853 1,000 tons were quarried and shipped to the New York yard of the company where it brought about $12 a ton. The following year the output was increased to 1,200 tons, requiring a maximum of forty men to carry on the work. The distance of the quarry from the railroad station and the steep hills between eventually caused the expense to exceed the returns and the operations were brought to an end by the time of the Civil War".

Geology

The soapstone deposits are bordered on the east by mica schist and on the west by serpentine and amphibolite (pl. 6, fig. 1). Three small outcrops of serpentine were found on the west side of the larger quarry, and several were found near the south end of the smaller quarry. The serpentine is massive and is dark green on fresh surfaces and light grayish green on weathered surfaces. The fact that the foliation of the schist and the amphibolite wrap around the soapstone deposit, particularly near the south end of the larger quarry, suggests that the serpentine forms a lens-shaped body intruded along the contact of the schist and the amphibolite. After the body had been changed to serpentine, it was partly altered to impure talc.

The amphibolite layer on the west side of the talc deposits is about 325 feet thick. East of this layer are three other amphibolite layers interlayered with mica schist, each a few tens of feet thick. South of the quarries these layers crop out in the pasture south of Cone Road. All of these layers of amphibolite belong to the Chester Amphibolite formation as described by B. K Emerson (1898, p. 155).

The larger quarry is about 160 feet long and has a maximum width of about 55 feet. Only a small part of the surface area of the soapstone was left unquarried. The east side of the deposit was quarried to or nearly to the mica schist and only 5 to 10 feet of soapstone were left on the west side of the quarry. The soapstone probably pinches out a short distance southeast of the south end of the quarry; schist and amphibolite outcrops are within 24 feet of each other 80 feet southeast of the quarry. At the north end of the main quarry the soapstone deposit narrows to only a few feet; apparently this narrow band continues along the serpentine contact and connects with the soapstone deposit of the smaller quarry. The deposit at the smaller quarry is about 35 feet thick and contains soapstone similar to that in the main quarry. The deposit probably is an extension of the original serpentine body. There are no soapstone outcrops more than 50 feet north of the quarry.

The soapstone in the two quarries is estimated to contain 10 to 40 percent carbonate in disseminated grains and grain aggregates partly drawn out by shearing. The soapstone is distinctly sheared and in general the foliation is parallel to the foliation of the schist and the amphibolite.

Appraisal

More soapstone is available in the Middlefield soapstone quarries, but the soapstone now exposed probably contains too much carbonate impurity for use as soapstone or ground talc.

## Middlefield soapstone prospects

About 1000 feet south of the main Middlefield soapstone quarry are a shallow soapstone prospect shaft 10 feet wide and 35 feet long and two prospect trenches (pl. 6, fig 2). These soapstone deposits are several hundred feet east of the large amphibolite layer bordering the soapstone deposits to the north

Except for one small doubtful outcrop of amphibolite 40 feet south of the prospect shaft, only mica schist crops out in the vicinity of the shaft and trenches. The large outcrop of schist west of the shaft shows that the soapstone deposit is in the center of a drag fold and that the schist bordering the deposit is chloritized. At the southernmost trench is a small body of soapstone about 5 feet wide and 15 feet long that is surrounded by mica schist. Here also the schist has drag folds and has been chloritized along the contact with talc. All evidence indicates the soapstone was formed by alteration of the schist and not by the alteration of amphibolite or serpentine. The soapstone deposits exposed by these prospects are too small to be of commercial value. The soapstone on the dump of the prospect pit contains 10 to 30 percent dolomite and is similar to the soapstone of the main quarry.

## Bartholomew soapstone quarry

### Location

The Bartholomew soapstone quarry is about 2.7 miles north of North Blandford and 125 feet west of the old road to Chester.

### History

The Bartholomew soapstone deposit is shown in the Atlas of Hampden County by F W. Beers dated 1870. Nothing is known of the history of the quarry operations.

Geology

Only mica schist and amphibolite are exposed in the vicinity of the soapstone quarry (pl. 7). Except at the quarry the foliation of the schist and amphibolite strikes N. 5° - 15° W. and dips from 80° E. to 85° W. The schist in the quarry strikes N. 5° - 30° E. and dips 75° - 80° N.W. Exposures are inadequate to determine the structural relations, but the soapstone deposit is probably situated on a small fold or fault that locally interrupts the regional trend.

The small exposure of soapstone in the quarry does not reveal whether the soapstone was formed by the alteration of the schist or the amphibolite. Emerson was able to observe the occurrence of the soapstone more fully than is now possible; he stated (1898, p. 86), "Northwest of S. A. Bartholomew's house, at his soapstone quarry, some layers of mica schist are intercalated in the amphibolite. The quarry, from which much soapstone has been taken for grinding, is inclosed in walls of chloritic mica-schist, and lies in the prolongation of a bed of ordinary amphibolite, which is exposed just north of the opening.

"There is exposed in the north end of the excavation allayer 1 foot thick, of light green talc, with scattered needles of actinolite, and east of this, one (the same thickness) of a green soft, scaly chlorite, with here and there larger plates of clinochlore with very divergent optical axes, and magnetite octahedra. Further south, in the bottom of the quarry, it can be seen that the steatite bed widens rapidly southward to 10 feet, and a mass of light-green fibrous actinolite appears, from which the whole steatite mass seems to have been derived, as it still retains the radiated and matted acicular structure of the actinolite.".

Appraisal

The soapstone quarry is only 60 feet long, 30 feet wide and 10 to 15 feet deep indicating that relatively little soapstone was quarried. Present exposures are inadequate to permit an evaluation.

## Osborn soapstone quarry

Location

The Osborn soapstone quarry is 1.6 miles south of Blandford north of Cobble Mt. Reservoir. The quarry is 250 feet from the reservoir and is on reservoir property owned by the City of Springfield. The old roads to the quarry have been closed in the reservoir area. To reach the quarry it is necessary to walk about three-fourths of a mile south from the F. C. Knittel farm where the present road ends.

History

The Osborn soapstone deposit, originally owned and operated by John Osborn, has been worked at intervals for nearly 100 years. The earliest reference to the deposit found by the writer was by Hitchcock (1833, p. 32), Mrs. Mary Smith of Blandford told the writer that soapstone from the Osborn quarry was used in the construction of the house of her father (John Pebbles) built in 1843.

According to Mrs. F.C. Knittel of Blandford, only a small amount of soapstone was quarried for local use up to 1895. In that year the quarry was taken over by a company and worked on a larger scale for about 3 years (Emerson, 1898, p. 87). The soapstone was hauled by wagon in blocks and slabs 7 miles to the railroad at Russell. Following the termination of operations, the quarry remained idle for about 3 years, until about 1901, when it was reopened by Louis Grant. Six or eight men were employed and the quarry was worked a year or two. A mill was

constructed at the quarry where the soapstone was sawed into slabs 1 to 2 inches thick, 2 feet wide, and 6 feet long. The sawed blocks were hauled by wagon to the railroad at Russell for shipment. This company is said to have prospected the soapstone deposit by drilling.

On expiration of this latter operation the quarry remained idle until 1917 or 1918 when the Texaco Oil Company is said to have prospected the deposit secretly for about six months. The workmen were not told what they were looking for but F. C. Knittel, who was employed by the company, believes the company was prospecting for asbestos.

The soapstone quarry has not been worked since the conclusion of the prospecting in 1917 or 1918. Because the deposit is now included in the Cobble Mountain Reservoir area, further development cannot take place.

Geology

The soapstone deposit has an exposed length of 210 feet and a maximum width of 40 feet (pl. 8). The quarry is 125 feet long and is at the north end of the deposit. The convergence of the amphibolite and the schist at the north end of the quarry and the presence of chlorite in the soapstone, indicate that the soapstone deposit ends at the north end of the quarry. The southeast end of the deposit is less clearly defined. The absence of outcrops along the strike of the deposit beyond the large outcrop of soapstone shown on plate 8 prevents determination of the full extent of the deposit in this direction.

The soapstone deposit is elongated parallel to the enclosing formations. It strikes northwest and dips steeply northeast in accordance with the regional trend of the formations except at the northern end where it strikes north. The soapstone is bordered on the northeast by mica schist and on the southwest by a narrow layer of Chester Amphibolite.

The 10 foot deep drainage trench affords a continuous exposure of the formations for about 70 feet southwest of the quarry. The trench exposes four pegmatite dikes, the largest of which is 8 feet thick, separated by muscovite-biotite schist. At the southwest end of the exposure is a layer of amphibolite about 4 feet thick bordered on both sides by muscovite-biotite schist. Farther southwest scattered exposures indicate predominately mica schist except 175 to 200 feet southwest of the quarry where there is a large outcrop of serpentine. Emerson (1898, p. 88) says this serpentine contains much altered sahlite (hedenbergite) and is shot full of small radiating aggregates of tremolite crystals. Both the sahlite and the tremolite (or anthophyllite?) are distinctly visible in hand specimen, and the sahlite appears to constitute a large percentage of the rock.

The soapstone deposit apparently formed from serpentine largely altered to anthophyllite. Small residual masses of black serpentine were found in the soapstone southeast of the quarry (pl. 8) and serpentine crops out in two places on strike with the soapstone deposit southeast of the deposit. The large outcrop of serpentine at the southeastern corner of the mapped area is similar to the residual bodies of serpentine in the soapstone. The serpentine in both occurrences is black and contains much talc in radiating aggregates of slender prismatic crystals that were originally anthophyllite. Emerson (1898, p. 89) referred to the serpentine in the soapstone deposit as follows: "The central third of the steatite bed consists of black enstatite serpentine, more or less tremolitic and partly changed to steatite, but still quite hard. This is the first bed of this enstatite rock met with, and it becomes increasingly important as the series is traced southward." Emerson (1898, p. 115) thought the serpentine from which the soapstone was derived was formed from magnesian limestone in the Chester Amphibolite.

The Osborn soapstone deposit has two outstanding characteristics which distinguish it from all other known talc and soapstone deposits in Massachusetts. First, it consists largely of anthophyllite in radiating aggregates of slender crystals an inch or more in length. These crystals are partly altered to talc, but they still retain the original form of the anthophyllite crystals. Second, no carbonate mineral was observed in the deposit.

Gillson (1927, p. 277) says the Osborn soapstone deposit contains the following minerals in the order of their formation: amphibole, chlorite, titanite, talc, and magnetite. The biotite that borders both sides of the amphibolite layer exposed near the southern end of the west side of the quarry should be added to this list as one of the earliest minerals formed. Black tourmaline is exposed for a few feet in a layer 10 to 12 inches thick at the southwest side of the soapstone deposit, 20 feet southeast of the south end of the quarry.

The amphibole minerals of the soapstone deposit are actinolite and anthophyllite. The actinolite is a pale green, low iron variety intermediate between actinolite and tremolite. At the extreme southern end of the southernmost soapstone exposure and the south end of the chlorite layer in the soapstone near the east side of the deposit (pl. 8), actinolite occurs in solid matted masses of crystals. Larger crystals of actinolite mixed with chlorite occur at the west side of the quarry. The anthophyllite forms slender prismatic crystals 1/2 to 2 inches in length that form abundant radiating aggregates throughout the soapstone. Much of the original anthophyllite has been altered to talc which has retained the anthophyllite crystal form.

Biotite forms a layer 1 to several inches thick on both sides of the amphibolite at the west side of the quarry; a biotite layer does not occur on the east side. Between the inner biotite layer and the soapstone deposit is a chlorite layer several inches thick which locally has admixed actinolite. This chlorite layer grades into the talc, anthophyllite, and chlorite assemblage which constitutes the main part of the soapstone deposit. A chlorite layer is absent in places near the north end of the east side of the quarry, and anthophyllite partly altered to talc is in contact with the muscovite schist. A chlorite layer or selvage is exposed on the east side of the deposit east of the south end of the quarry (pl. 8).

Appraisal

The Osborn soapstone deposit is well exposed for 200 feet of its length. The deposit appears to end near the north end of the quarry. The southeast end of the deposit was not located, but its extent could be determined by trenching.

The soapstone exposed east of the south end of the quarry contains some small residual masses of serpentine a few feet in diameter (pl. 8). Serpentine is also exposed at the northern tip of the large southernmost outcrop of soapstone; the soapstone is similar to that in the quarry. A few blocks of soapstone were quarried from the southwest side of this exposure.

Because of the presence of anthophyllite, the soapstone of this deposit may have some additional uses to those of the talc and soapstone of the other Massachusetts deposits. It may be suitable for purposes requiring ground talc containing asbestos because the anthophyllite can be crushed into short white fibers of asbestos.

Location

The soapstone and talc deposit formerly worked by the Berkshire Talc Manufacturing Company is in the extreme northwestern corner of the town of Hinsdale about 600 feet upstream from Wahkonah Falls. Wahkonah Falls State park is two-fifths of a mile east of Route 9 on a secondary road that joins Route 9 about 2 1/2 miles northeast of Dalton. From Wahkonah Falls a path can be followed upstream along the north bank of the river to the bend in the river where, except in times of high water, the river can be crossed to the quarries on the south bank.

History

W. F. Booth of Dalton told the writer that the farm where the deposit is located was sold by his father, G. F. Booth, to Theodore Harold who opened up the southwest quarry in about 1884. The talc and soapstone were prepared for market in a mill located a few hundred feet west of the quarry on the bank of the river.

After operations were discontinued, G. F. Booth reassumed ownership of the deposit and with his son W. F. Booth, formed the Berkshire Talc Manufacturing Company. They began operations at the northeast quarry about 1898 and continued work until 1906. The talc and soapstone were carted across the river on a temporary bridge at the quarry and were hauled to the company's mill near the railroad station in Dalton.

The production of asbestos and talc from this deposit are credited by different writers to both Dalton and Hinsdale although no talc or asbestos deposits are known in Dalton.

Geology

The soapstone and talc deposit strikes northeast and dips 35° to 50° S.E. It lies between the Hinsdale Biotite Gneiss on the southeast and the Becket Granite Gneiss on the northwest, both of which were presumed to be of Precambrian age by Emerson (1917). He (1917, p. 21) believed that the deposit was formed from the Coles Brook Limestone shown on his geologic map of the State between the Becket and Hinsdale Formations. Outcrops are lacking for several hundred feet northeast and southwest of the quarries where the limestone is mapped by Emerson, and the writer was unable to find any indication of its presence.

The deposit of soapstone and talc is irregular in width, varying from 10 to 30 feet in the exposed parts of the quarries. The extent of the deposit beyond the quarries is not known due to lack of exposures.

Both quarries are in the centers of drag folds or bends in the hanging wall gneiss which pitch steeply southeast. The apices of the bends or drag folds in the hanging wall are at the southeast corners of both quarries (the small drag folds shown diagrammatically in plate 10 are not the drag folds referred to here). The solutions that formed the deposits may have been localized by these folds so that little or no talc and soapstone formed in undeformed rocks. If this is true, the talc and soapstone occur in two connecting pipe-shaped bodies that are elongated parallel to the axes of the folds and correspond approximately to the shapes of the quarries.

Little is known concerning the quality and use of the talc and soapstone obtained from the southwest quarry worked by Theodore Harold. The Berkshire Talc Manufacturing Company, when it subsequently took over the deposit, opened up the northeast quarry and worked it selectively. The purer talc was used to make ground talc and the massive more impure talc was quarried in blocks for soapstone. The anthophyllite was sold for asbestos.

The following section was taken across the deposit at the west side of the entrance to the underground portion of the northeast quarry to show the character of the talc composing the deposit.

| Thickness in feet | Description |
|---|---|
| | Einsdale Gneiss (hanging wall) |
| 1 | Chlorite |
| 1 1/2 | Uniform gray massive talc, relatively pure except for some included anthophyllite asbestos in cross-fiber veins now partly altered to talc. |
| 6-7 | Uniform medium to dark gray, slightly schistose talc that contains 10 to 20 percent carbonate in disseminated grains and grain clusters, and in branching veinlets one-eighth to one-half inch thick. Fine talc flakes average about one-twentyfifth to two-twentyfifths of an inch in diameter. |
| 5 | Gray talc schist so fine textured that individual grains are not visible in the hand specimen. This talc contains numerous streaks of minute magnetite grains about one-fiftieth of an inch in diameter. |
| 0-1/2 | Long fiber anthophyllite asbestos mostly altered to talc. |
| Only a few inches exposed, full thickness not known | Chlorite--although the underlying gneiss is not exposed there is little doubt that this is the footwall of the deposit |

Actinolite and biotite were seen in pieces of chlorite on the dump; they probably came from the chlorite border zone. Remnants of the chlorite border zone are visible on much of the hanging wall side of both quarries (pl. 10).

Anthophyllite occurs at the outer edge of the deposit near the chlorite border zone or selvage on both sides of the deposit. The anthophyllite is partly altered to talc although it retains the anthophyllite appearance. It occurs as cross-fiber veins from a fraction of an inch to 6 or more inches thick in which the asbestos has been partly sheared to slip fiber.

A small production of anthophyllite asbestos was reported from this deposit from 1900 to 1906. Diller (1906) said "Massachusetts has been a producer for a number of years at Dalton, but the output in 1906 was considerably less than in 1905. This is due simply to the inequality of the deposit. The asbestos is mined in connection with talc, in which the asbestos forms pockets ranging in quantity from a few pounds to several tons, and the output varies according to the number and size of the asbestos pockets encountered. The asbestos is wholly the form of slip fiber, and according to Dr. F. E. Wright who kindly determined the material for me, is anthophyllite, and not chrysotile, as is generally supposed".

J.H. Pratt (1901) said asbestos was mined in Hinsdale, on the north side of Rocky Rough ravine, near the Berkshire Talc Manufacturing Company's deposit. He also said that the deposit was worked by means of tunnels and a shaft which had been sunk to a depth of 80 feet. The writer tried to locate this mine, but no one in Dalton or Hinsdale had ever heard of it. Presumably the asbestos referred to was that mined by the Berkshire Talc Manufacturing Company.

The remnants of talc now visible in the quarry walls show the variations in the deposits are at least partly due to localized shearing and irregular depositi of the carbonate mineral. The nearly massive carbonate-bearing talc was used fo soapstone, and the purer talc schist was used for the manufacture of ground talc.

W. F. Booth said his company sold the soapstone for boot driers, bed warmers, and foot warmers for sleighs. The ground talc was sold for talcum powder, tires, foundry facings, and other uses.

Mine workings

The quarries connect underground as shown on plate 9, and the lower parts of both quarries are filled with water. W. F. Booth told the writer that the bottom of the northeast quarry is about 20 feet below the surface of the water. The depth of the older southwest quarry is not known.

Appraisal

Nothing is known of the extent of the deposit northeast and southwest of the quarries on strike with the deposit. The soapstone outcrops between the quarries (pl. 9) contain considerable chlorite and carbonate as impurities. The deposit is small and most of it contains carbonate impurity. The anthophyllite asbestos is not abundant. The occurrence of the deposit at prominent drag folds or bends in the hanging wall gneiss suggests that the deposit was localized by them and may not extend laterally.

### River Bend Farm talcose limestone

Emerson (1899, p. 28-29) reported talc in the top of the Coles Brook metamorphosed limestone on the Housatonic Branch of the Housatonic River in the eastern part of Hinsdale. Beds of talcose limestone are exposed at intervals in outcrops for about 100 feet downstream from the road bridge 2 miles southeast of Hinsdale. Talcose limestone is also exposed in two small outcrops near the bridge and 60 feet farther downstream in a layer 15 feet thick separated a few feet from another layer 1 foot thick. The outcrops of limestone still farther downstream do not contain talc. Talc is disseminated through only certain beds of the limestone and does not form more than 50 percent of the rock.

## Soapstone quarries at Soapstone Hill, Petersham

### Location

Soapstone was quarried from two deposits on Soapstone Hill on the east side of the Quabbin Reservoir, 4 miles west of Petersham (pl. 1). The south quarry is at the foot of the southeastern end of Soapstone Hill, about 1350 feet north of an abandoned paved road. The north quarry is about 1900 feet north at the foot of the hill. The location of the deposits is marked on Emerson's geologic map of Massachusetts (1917) by a red dot representing saxonite.

### History

Arthur Stevens of Barre Plains said the quarries were opened about 1878 for 3 or 4 years. The deposits were first worked for soapstone which was used in stoves, sinks shelves, etc. When the demand for soapstone diminished the soapstone was ground for roofing talc. The mill was in North Dana, now submerged under the Quabbin Reservoir.

### South quarry

The soapstone was so completely extracted that only two small exposures of talcose rock remain in the walls of the quarry. One is chloritic soapstone exposed for 3 or 4 feet at the southeast corner of the quarry. East of the soapstone is a layer of hornblende schist 1 to 2 feet thick (pl. 11, fig. 1).

The second exposure is a 3 foot band of talcose chlorite schist at the southwest corner of the quarry. Elsewhere the quarry walls are the Monson Granodiorite Gneiss of Emerson (1917). The soapstone deposit does not extend beyond the limits of the quarry. The west side of the quarry is about 30 feet deep and the east side 10 to 15 feet deep to the pond surface; the depth of the pond is not known.

Emerson (1917, p. 215) described the deposit as follows: "The large steatite (soapstone) bed at the east foot of Soapstone Hill, in North Dana, has been extensively quarried. It is a great round mass, 50 by 150 feet in area, in the Monson Granodiorite. The microscope reveals good evidence of the derivation of the rock from an olivine gabbro, the secondary magnetite grains being arranged in a network of squarish pyroxene crystals or in irregular meshes suggesting olivine, and opaque white areas suggest altered feldspar. The rock is largely changed into a gray, fibrous mineral with the composition of kokscharoffite, which has altered to steatite."

North quarry

The north quarry is 80 feet long and a maximum of 35 feet wide. The west wall of the quarry is 15 feet high; the east wall is 2 to 10 feet high above the pond in the quarry. The pond appears to be only a few feet deep (pl. 11, fig. 2).

No talc is exposed in the quarry. At the north end of the quarry is a pegmatite dike 2 to 3 feet thick bordered on the east by a 1 to 2 foot layer of hornblende schist that contains some biotite and chlorite. Elsewhere Monson Granodiorite Gneiss forms the walls of the quarry except at the southeast side where no rock is exposed.

Appraisal

These soapstone deposits were exhausted unless additional soapstone exists beneath the ponds and debris.

## Asbestos deposits

No asbestos deposits of importance are known in Massachusetts. A small amount of anthophyllite asbestos was obtained from the talc deposit operated by the Berkshire Talc and Manufacturing Company in Hinsdale and from a deposit in Pelham.

Minor occurrences of asbestos have been reported from Blandford, Chesterffeld, Wilbraham, Shutesbury, Leverett, New Salem, Lee, and Sheffield. The information available indicates that all of these occurrences are either anthophyllite or tremolite asbestos. No deposits of chrysotile asbestos are known in Massachusetts.

The anthophyllite asbestos obtained from the talc deposit in Hinsdale was discussed previously. The Pelham asbestos deposit is discussed below.

## Pelham asbestos quarry

### Location

The Pelham asbestos deposit is 1 1/4 miles west southwest of Mt. Lincoln in the southwest corner of the town of Pelham.on the farm owned by Glen F. Shaw. The deposit is in the Belchertown topographic quadrangle map on the east side of the prominent hill shown at the north end of Smith's Pasture. The deposit is the middle of three red dots on Emerson's geologic map of the State (1917); the dots represent saxonite and periodotite in the Pelham Granite area southeast of Amherst.

### History

The Pelham asbestos deposit was known to mineralogists before it was worked commercially. Adams (1870, p. 272) pointed out the commercial possibilities of the deposit and mentioned some excavations that had been made in search of asbestos.

In the history of Pelham, Parmenter (1898, p. 256) says, "In 1873 James A. Murray and John F. Murray of Boston obtained control of the asbestos lands on Butter Hill, and opened the mine for getting out the asbestos". Mining operations stopped in 1874.

Geology

The anthophyllite asbestos occurs in cross-fiber veins ranging from a fraction of an inch to 12 inches thick that ramify throughoa body of basic igneous rock identified by Emerson (1898, p. 47) as saxonite. The saxonite is surrounded by the Pelham Granite Gneiss. At present only a few small exposures of the saxonite and anthophyllite can be seen in the quarry (pl. 12).

The size of the saxonite body is undertain. The quarry is 100 feet long and 41 feet wide. About 120 feet N. 10° E. of the north end of the quarry is a prospect pit 10 feet square and 2 feet deep in which there is a small exposure of weathered anthophyllite fibers up to 1 inch in length. However, the exposure is not large enough to disclose geological relationships. About 100 feet on strike northeast of this pit is another larger pit that is 30 feet long and 3 feet deep. Weathered anthophyllite is exposed in the south end of this pit, but here also the exposures are too poor to show the amount and occurrence of the anthophyllite.

The partly weathered anthophyllite is softer and more readily separable into fibers than the unweathered anthophyllite and, therefore, is more valuable for use as asbestos. Emerson (1898, p. 48) stated that the deposit was greatly weathered to a depth of 3 to 12 feet and that mining stopped when the fresh rock was reached.

The mineralogy of the deposit has been discussed in detail by Emerson (1898, p. 47-52) and has been reviewed by Shannon (1919).

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This map is preliminary and has not been edited for conformity with Geological Survey format

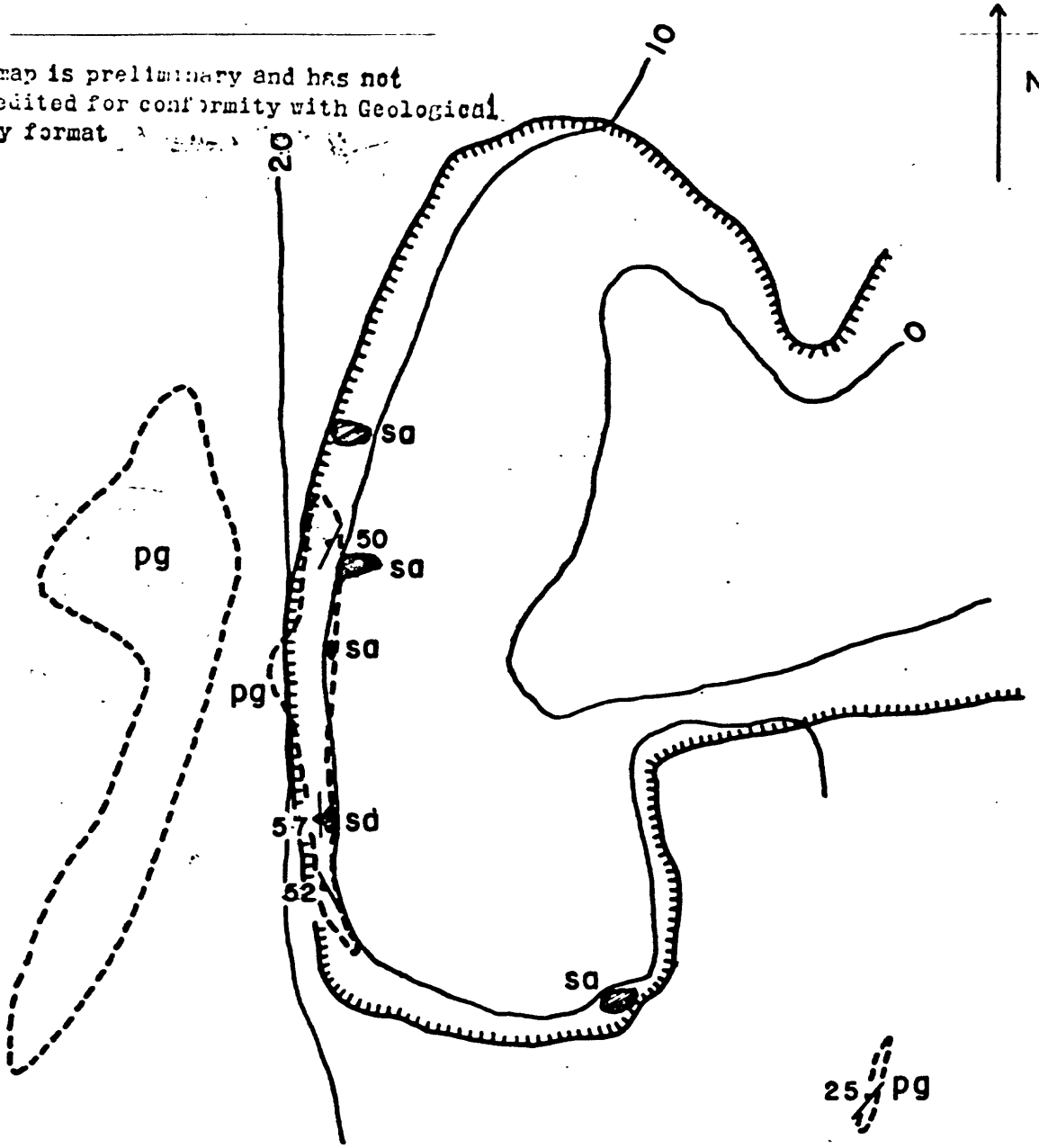


Plate 12

OUTCROP GEOLOGIC MAP OF THE PELHAM ANTHOPHYLLITE ASBESTOS QUARRY, PELHAM, MASSACHUSETTS

Scale

0 20 40 Feet

Contour interval 10 feet

Datum assumed

pg — Pelham granite gneiss

sa — Saxonite with veins of anthophyllite

Edge of asbestos quarry

50 — Strike and dip of foliation