

## ASBESTOS IN WYOMING

By R. H. Beckwith

### INTRODUCTION

During the summers of 1934 and 1935 the Geological Survey of Wyoming carried on an investigation of the asbestos and chromite deposits of the state. The writer spent 7 weeks in the field and was assisted by R. C. Shoemaker and H. H. Olinger. Approximately 8 square miles were mapped on a scale of 1 inch = 1,000 feet or 1 inch = 300 feet. The results of the investigations are in process of preparation for publication. The material below is a statement of some of the generally known facts about asbestos and a resume of the writer's findings on the deposits of Wyoming.

### PROPERTIES

Asbestos is the name given to various fibrous minerals of which the two most important are chrysotile ( $H_4Mg_3Si_2O_{10}$ ), a fibrous variety of serpentine, and anthophyllite ( $(Mg.Fe) SiO_3$ ), a member of the amphibole group. The fiber of certain varieties of chrysotile is long, strong and pliable and, therefore, can be spun. Other varieties in which the magnesium is partly replaced by iron give more brittle and less flexible fiber. The fiber of amphibole asbestos is coarse, brittle, has a low tensile strength and cannot be used for spinning.

### MODE OF OCCURRENCE

All of the deposits examined are of one type associated with ultrabasic igneous rocks of pre-Cambrian age. Both chrysotile and amphibole asbestos occur in fractures from a small fraction of an inch to several inches wide in masses of rock serpentine formed by hydrothermal alteration of ultrabasic igneous rocks, such as peridotite and picrite. Fiber which lies at right angles to the walls of the fracture is called cross-fiber; that which lies parallel to the fracture walls is called slip fiber. Both chrysotile and amphibole are found in some of the deposits in Wyoming, but the second variety is found only in subordinate amounts.

### USES

The principal use of chrysotile fiber which is long and flexible enough to spin is in the manufacture of automobile parts such as brake-band linings and clutch facings. Spinning fiber is also used for the manufacture of asbestos cloth, fire-proof curtains and clothing. Mill fiber, that which is too short or brittle for spinning, is used in the manufacture of shingles, paper, wall-board, pipe and boiler coverings, and for many purposes in chemical laboratories.

### DESCRIPTION OF DEPOSITS

#### Teton County

Berry Creek Deposit.--The claims are located on the head of Berry Creek

approximately 2 miles east of the watershed of the Teton Range and 6 miles south of Yellowstone Park. The nearest rail point is Lamont Siding, Idaho. From here a road extends 10 to 12 miles eastward to the vicinity of the state line. From here to the asbestos deposits, a distance of 16 miles, the road has been washed and obstructed by fallen trees so that it can be travelled only on foot or horseback.

A few hundred feet stratigraphically below the Cambrian sediments is a tabular mass of partially altered peridotite standing on edge and enclosed by granite gneisses. The peridotite mass strikes east, has a maximum width of 50 feet and can be traced along strike about 400 feet. Several fractures in the altered peridotite are occupied by slip-fiber chrysotile and amphibole of fiber length less than 1 inch. Much of the fiber has been destroyed by subsequent replacement by quartz.

Badger Creek Deposit.--The mineral deposit in sec. 5, T. 6 N., R. 117 W., on Badger Creek in the western part of the Teton Range contains a fibrous variety of talc and no asbestos.

#### Fremont County

Fire King Deposit.--The property is located in secs. 22 and 27, T. 30 N., R. 100 W., Atlantic Gold District, near the crest of the southern part of the Wind River Range. The nearest rail point is Lander. From here 9 miles of the road distance to the deposit is over oiled highway. The remaining 20 miles is over poor dirt road with steep grades.

A generally tabular mass of serpentine standing vertically and striking northeast lies between a succession of quartzites, green chlorite schists, and black magnetite schists on the southeast and granite gneisses on the northwest. The mass is widest, about 800 feet, at the southwest end where the serpentine passes under the alluvium of Rock Creek. From here the width decreases northeastward, and the serpentine body pinches out 2,500 feet northeast of Rock Creek. About 100 feet northeast of the thin edge of the main mass is a lens of serpentine 400 feet long and 80 feet wide. The serpentine of the main mass is intimately fractured in a ramifying pattern, principally in a zone extending inward 200 to 300 feet from the northwest contact. The fractures strike generally parallel to the contact, dip steeply to the southeast and are occupied by cross-fiber chrysotile. Most of the fiber over 1/8 inch long occurs in a zone not more than 50 feet wide and 800 feet long lying along the northwest edge of the main mass at the northeast end.

The chrysotile fiber is fine, flexible and strong. Fiber up to 1 1/4 inches long has been taken from the deposit. Most of it is, however, under 1/2 inch in length.

The asbestos-bearing rock has been mined from an open cut and a cross-cut tunnel and shaft. On the property there is a mill, now largely dismantled, for separation of the shorter lengths of fiber from the rock. Hand-cobbed crude fiber was produced and shipped from Lander during the World War. The property has not been worked in the last ten years.

Abernathy Deposit.--The claims are located in the SE 1/4 sec. 19, T. 30 N., R. 96 W., 38 miles southeast of Lander and 5 miles south of Beaver Hill on the highway from Lander to Rawlins. The area including the claims and the



road to the highway is one of low relief. Most of the quarter section in which the deposits are located is underlain by stratified white volcanic ash of the White River group. In the northwest part of the quarter section the volcanic ash has been eroded, exposing pre-Cambrian granites and gneisses which surround four lenticular masses of serpentine. The largest one is 600 feet long and 250 feet wide. The next in size is 900 feet long and has a maximum width of 130 feet. The two smallest serpentine lenses are less than 300 feet long and 50 feet wide. In a few places the serpentine is cut by fractures, which strike generally parallel to the contact between the granite and serpentine, dip steeply, and are filled with fine, flexible cross-fiber chrysotile. The longest fiber seen in place by the writer was  $\frac{1}{4}$  inch long. The owner reports finding fiber up to  $1\frac{1}{4}$  inch long in one of the prospect trenches.

Granite pegmatite dikes cut the serpentine of the southern part of the longest lens. Two prospect trenches across the contacts of different dikes show that the serpentine has been altered to vermiculite for a distance of at least two feet. Surface cover made it impossible to obtain information on the lengths of the two vermiculite zones parallel to the dike contacts.

#### Natrona County

Casper Mountain.--The area of pre-Cambrian rocks containing serpentine and, in various places chrysotile is located in secs. 16, 17, 18, 19, 20 and 21, T. 32 N.; R. 79 W. There are numerous secondary roads suitable for trucking within the area and from the north edge a county road extends 8 miles north to Casper.

Casper Mountain is an eastward-trending anticline bounded at its northern base by a southward-dipping thrust fault. Both east and west of the area investigated Cambrian and Mississippian sediments cross the axial plane of the anticline. Over the area investigated erosion has removed the sedimentary cover and exposed the pre-Cambrian core of the anticline. The oldest pre-Cambrian rocks are serpentine, talc schists, hornblende schists and metadiabases, which probably represent both intrusive and extrusive phases of a period of basic and ultrabasic igneous activity. The older basic and ultrabasic rocks were invaded by granites and granite pegmatites. Some of the hornblende schists were injected by granitic material and converted to gneisses. Some of the granite pegmatite dikes are several thousand feet long and vary in width up to 200 feet. They consist of quartz and microcline and locally contain muscovite in crystals up to 2 inches across. It is not probable that the pegmatites could be worked profitably for muscovite, but they might possibly be for feldspar.

Nearly half of the pre-Cambrian area is underlain by serpentine. In a belt several thousand feet wide extending northeastward across the northern part of the area in sec. 17 and the NW $\frac{1}{4}$  sec. 16 the serpentine is locally intimately fractured and cross-fiber chrysotile has developed along the fractures. Fiber up to  $1\frac{1}{2}$  inches long is known, although most fiber is much shorter. The Chrysotile is wine yellow in color, and coarser and more brittle than the best grades.

The asbestos belt was thoroughly prospected by trenches and shafts in the early part of the century. In 1910 a mill was built in the NE $\frac{1}{4}$  sec. 17. Since then the mill and most of the claims have been abandoned. A number of



the claims for which private ownership title was acquired during the period of development are now occupied by summer cabins of Casper residents.

Smith Creek.--The deposits are located in secs. 19, 20, 29 and 30, T. 31 N., R. 78 W., 28 miles southeast of Casper. Five miles of the road from Casper is oiled highway, 13 miles is graded county road, and 10 miles is poor secondary road.

Three lenses of serpentine are enclosed in granites and granite gneisses. The dimensions of the lenses are 900 feet by 300 feet, 700 feet by 280 feet, and 600 feet by 180 feet. Surface exposures on the largest lens show no asbestos. The two smaller serpentine lenses are cut by fractures with a general westward strike. Some of the fractures are occupied by cross-fiber chrysotile. Along others the serpentine has been replaced by a black metallic mineral, probably magnetite. The longest fiber seen was  $3/4$  inch long. The chrysotile is of a variety closely similar to that found on Casper Mountain and is coarser and more brittle than the best varieties.

The two smaller serpentine lenses have been thoroughly prospected by shallow trenches and shafts, and a trench 50 feet long and 20 feet deep at the deeper end is cut into a hillside along one of the larger fracture zones. Near the large trench is a three-story mill reported by local residents as having been built in 1906. A small conical tailing pile 15 feet high and 30 feet in diameter indicates that only a small tonnage of asbestos-bearing rock was milled up to the time of abandonment of the property. Much of the milling machinery has been removed, and the building and remaining machinery are of little or no value.

Deer Creek.--The deposits are located in sec. 23, T. 31 N., R. 78 W. southeast of Casper. The road distance to Casper is 30 miles. At least half of the road is poor secondary road with steep grades.

A lenticular mass of serpentine 1800 feet long and 800 feet wide is enclosed in massive granites enclosing xenoliths of metadiabase. The serpentine is intimately jointed. The predominant strike of joints is northeast parallel to the longer sides of the lens. Along some of the joints the serpentine has been replaced by a black mineral, probably magnetite. Over most of the area there is no chrysotile exposed at the surface. Two shallow trenches in the southwest part of the mass near several pegmatite dikes expose a vein-like body of slip-fiber chrysotile one inch across. The fiber is coarser and more brittle than the best grades of chrysotile.

#### Washakie County

Canyon Creek.--The claims are located on Canyon Creek in the higher part of the Bighorn Range in sec. 25, T. 48 N., R. 86 W., a few hundred feet west of the west boundary of Johnson County. The nearest town is Buffalo. From here the road distance is 42 miles on U. S. Highway 16 and 7 miles over poor secondary road.

The claims are on highly folded metadiabases, gray phyllites, and greenstones forming a northward trending band about 3,000 feet wide lying between granite injection gneisses. At the time of the writer's visit in 1934 ten or twelve men were putting down a shaft in the SE $\frac{1}{4}$  sec. 25 on property of the Wyoming Asbestos Mining Company. The shaft had reached a depth of 25 feet. No chrysotile had been encountered. The only fibrous minerals exposed were minor seams of fibrous talc and amphibole.



## ASBESTOS

During the summers of 1934 and 1935 the Geological Survey made a detailed field study of all the known occurrences of asbestos in the state. These studies included the Casper Mountain, Smith Creek and Deer Creek occurrences in Natrona County; the Fire King and Abernathy deposits in Fremont County; the Berry Creek and Badger Creek deposits in Teton County and the Canyon Creek deposit in Washakie County. A summary description of these deposits is included in this report. A detailed report will be available in the near future.

A recent brief description of the occurrence of asbestos in Wyoming appearing in "Asbestos" by Olive Bowles, U. S. Bureau of Mines Bulletin No. 403, p. 25, 1937, follows:

"A small production of chrysotile was reported from Wyoming in 1892 and from 1906 to 1912. Asbestos occurs in a serpentine area of approximately  $4\frac{1}{2}$  square miles on Casper Mountain about 8 miles south of Casper and in the Smith Creek area of about 7 square miles 20 miles southeast of Casper, both in Natrona County. The mineral occurs principally as cross-fiber veins, few of which are more than an inch across, but a minor quantity of slip fiber appears in places. In 1910, the Wyoming Consolidated Co. operated a small mill in the Smith Creek area, handling about 30 tons of ore a day. A mill was built on Casper Mountain in 1911. Very little fiber has been produced in either locality, but the Patee Asbestos Shingle Co. reported production of 200 tons in 1934 from its Casper Mountain property.

"Occurrences of spinning-grade asbestos near Lander and Atlantic City, Fremont County, were reported in 1919, but the properties have not been developed. A small quantity was obtained at Wheatland, Platte County, in 1920. Chrysotile has been found in several other places, but most of the occurrences throughout the state are relatively low-grade, short fibers."

The 200 tons of asbestos reported to have been produced by the Patee Asbestos Shingle Company in 1934 was serpentine rock rather than chrysotile asbestos. It was mined for use in the manufacture of chimney building blocks.

## VARIETIES OF ASBESTOS

In a discussion of asbestos it should be born in mind that "asbestos is a name applied to several different minerals. Chrysotile is a hydrous magnesium silicate ( $H_4Mg_3Si_2O_9$ ), a fibrous serpentine. The strength and flexibility of the longer fibers are such that it can be spun. Chrysotile constitutes the bulk of the world's production of asbestos. The Wyoming occurrences are for the most part of this variety.

Anthophyllite ( $(Fe,Mg) SiO_3$ ) is a variety of asbestos belonging to the amphibole group of minerals. Usually it is brittle and of low tensile strength. No extensive deposits of anthophyllite in Wyoming are known to the Geological Survey.

Mountain Wood is a mineral which is frequently mistaken for asbestos. It is a compact fibrous amphibole. The fibers are brittle and cannot be readily separated. It has no known commercial value. It occurs extensively at various localities in Wyoming.

There are several other varieties which occur elsewhere, chiefly in Africa and Italy.

Domestic production of asbestos in 1937 was 13,284 short tons of chrysotile and  $6\frac{1}{2}$  short tons of amphibole. The average value of domestic asbestos sold or used by producers in 1937 was approximately \$29.00 a short ton. Imports for 1937 were 307,188 short tons, with Canada supplying 227,078 tons, Africa 5,345 tons and Russia 6,422 tons.