

A S B E S T O S .

For many years the United States has led all other countries in the manufacture of asbestos products, although a very small percentage of the material used is mined in this country. The production is rapidly increasing, and during the past few years has become of importance; but even now it is only 8 per cent of the production of Canada. However, the production of Canada forms so large a part of the world's output that 8 per cent is worthy of more than passing mention.

The total production of the United States during 1911 was 7,604 tons, valued at \$119,935, an increase of 75 per cent in value and 106 per cent in quantity over the production of 1910. Georgia, Vermont, Virginia and Wyoming constitute the producing states, Georgia and Virginia producing the amphibole variety (anthophyllite) only, while Vermont and Wyoming produced the serpentine variety (chrysotile). Vermont ranked first and Georgia second in production.

HISTORY.

The use of asbestos dates far back in ancient history, the Romans, who imagined it to be of vegetable origin, drew

their supplies from the Italian Alps and from the Ural. It was used as cremation cloth, in which dead bodies were wrapped before being cremated. Pliny refers to it as a rare and costly cloth--"linum vivum--the funeral dress of Kings". It would seem that the high cost of manufacturing militated against its general use. In the library of the Vatican is a winding sheet of Italian asbestos which, though coarsely made, is of soft and silky texture. This piece of cloth, together with some ashes, was found in a sarcophagus in the Via Praenestina in 1702, and by the order of Clement XI was placed in the Vatican Library.

In the thirteenth century, when Marco Polo was traveling through Siberia--the Great Empire of Tartary--that was not affected by fire. He learned that it was made of a fibrous mineral--"aminuthus"--which bore a close resemblance to the Italian asbestos.

Plautarch mentions the use of asbestos lamp wicks in ancient times and calls them "perpetual", as they seemed never to wear out. The wicks were made of delicate asbestos fiber and the lamps used principally by the Vestal Virgins.

Pausanian, evidently attributed to the oil what he should have credited to the wick, mentions a lamp which was filled only once a year. He states that the wick was made of "Carpasian" linen, a mineral fibre obtained from Carpasius in Cyprus.

Although asbestos was mined by the ancient Romans, the knowledge of its existence was apparently lost as only a few times is it mentioned in the literature of the middle ages. About the year 1720 asbestos was discovered in the Ural mountains, and forty years later, in the reign of Peter I, the manufacture of asbestos articles was begun near Naviansky. However, the uses were so few, and the demand so limited, that the industry languished and disappeared, to be revived about the middle of the nineteenth century. During the past fifty years the search for asbestos has been untiring; the exploitation and development of the deposits remarkable; and the progress in the methods of preparing and refining the mineral but little short of marvellous.

About the year 1860 asbestos was discovered in the province of Quebec, Canada, and mining operations commenced in 1878, since which time development has been rapid.

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In Wyoming the asbestos deposits on Casper Mountain have been known since about 1876. Samples from the Casper district were exhibited at the World's Fair in Chicago in 1893, and were awarded a diploma, but on account of lack of transportation and distance from market, the deposits were only of scientific interest until within the past three or four years, when active development was commenced. At the present time, in consideration of the quantity and quality of the fibre, and its relation to the markets of the west, the asbestos of the Casper region bids fair to become an important factor in the asbestos industry of the United States.

ASBESTOS MINERALS.

The word "asbestos" is derived from the Greek, signifying "inextinguishable", "unquenchable" or "unconsumable". The Germans know it as "steinflachs" (stone-flax); the Italians call it "amiantho"--from the Greek "aminanthos", meaning "undefiled, pure, incorruptible"; the French-Canadian refers to it as "pierre a cotton" (cotton stone) in allusion to its similarity toⁱⁿ appear- to cotton. It is defined by a French writer as "mineral

filamenteux et incombustible".

The term "asbestos" as generally understood embraces a group of minerals, the characteristic appearance of which, combined with the fibrous, crystalline structure, entirely differentiates them from other minerals. Some varieties possess a fine, silky fibre, such that they can be spun and woven like wool or silk. Owing to this property the mineral has been called a "physical paradox" and a "mineralogical vegetable".

In mineralogy three minerals are included under the term "asbestos"--antophyllite, amphibole, and serpentine. Chemically antophyllite and amphibole closely resemble each other, being silicates of lime and magnesia, and ^{alumina} ~~aluminium~~; while serpentine is a hydrated silicate of magnesia.

Antophyllite is little used commercially, and for that reason further mention of it is not necessary.

Amphibole includes five varieties: Tremolite; Actinolite; Asbestos; Mountain leather, Mountain wood, and Mountain cork; and Crocidolite.

Tremolite is a calcium-magnesium amphibole occurring as long, stout, blade-like crystals, gray in color; and as long

thin fibrous and columnar masses. Its uses are limited. However, it finds some commercial application as a substitute for actinolite in the manufacture of fibrous wall powder and of mineral wool.

Actinolite is a silicate of iron, calcium and magnesium occurring usually in fibrous and radiated masses of a bright green color. The fibrous variety is often mistaken for true asbestos but it has not the same fibrous texture. It is used for giving body to paper, for roofing, and for various forms of adulteration.

Asbestos. Tremolite and actinolite pass into fibrous varieties, the fibres of which are fine, flexible, easily separable, and looking like flax, and sometimes several inches long. These varieties are called "asbestos" "amphibole asbestos" and "hornblende asbestos". They usually are of a dull green color, and occasionally display a pearly lustre.

Mountain Leather and Mountain Cork. Mountain leather occurs in thin flexible sheets made of interlaced fibres; Mountain cork is the same, but in thicker pieces.

These varieties do not readily separate into fibres, and are not suited for most of the purposes for which asbestos is used. Mountain cork possesses the lightness and elasticity of cork, and is usually light brown in color.

Mountain Wood is compact, fibrous, gray to brown in color, and looks somewhat like dry wood. Some specimens so closely resemble wood that they cannot be distinguished from the latter upon a cursory examination.

Crocidolite or "blue asbestos" is a highly fibrous, elastic mineral, the fibres being easily separated. ~~as separated~~
with chrysotile

PREPARATION OF ASBESTOS FOR THE MARKET.

The material after coming from the mine is dried by exposure to the air; by exposure on steam pipes; or by passing through a rotary drier. It is then passed through rock breakers which crush to about $1\frac{1}{2}$ inch diameter and thence goes to the rolls for final crushing. This machinery has for its main object the liberation of the asbestos fibre from the rock, but in order to make the mineral more amenable to treatment it is necessary that the coarse fibre be split and divided into a fine fibre of feather-like appearance and weight. This operation is carried on in the fibroizer. The material is then screened on shaking screens and the asbestos fibre is blown by fans into collectors or settling chambers. A rough statement of the treatment of the asbestos rocks follows: The asbestos rock is dumped into ore bins, then crushed in a jaw breaker, raised by means of an elevator to a chute which empties into a rotary drier. An elevator raises the material to a belt conveyor and delivers it to a second drier. The end of the latter is perforated and effects a division of the rock into "rough" and "medium". The rough is again crushed while the medium falls upon a belt conveyor which discharges to a crusher a bucket conveyor then delivers the rock into a fibroizer. After thorough diminution the material falls onto a screen where a fan takes up the liberated fibre and deposits it in a collector. From the collector the fibre passes through a grading screen which divides it into long fibre and short fibre. The short fibre, sand and gunk go through the same process until a clean separation is made.

OCURRENCE OF ASBESTOS.

Asbestos occurs only, so far as known, in crystalline rocks of paleozoic or earlier age, and the rocks in which it is found are almost invariably of igneous origin, peridotite, altered to serpentine, being by far the most important.

The asbestos region of Canada is now so well exposed in mines and other openings that it affords an excellent opportunity for investigation. J.A.Dresser, who has recently made a detailed study of the Canadian field, points out that the conditions most important to observe in prospecting for chrysotile asbestos are purity of serpentine, its fractures, and the presence of granite.

The purity of the serpentine is regarded as the most important and depends on the degree of differentiation of the magma. Abundance of fractures is a scarcely less important condition. The more abundant they are the more likely it is that the circulating magmatic waters will form asbestos.

The rocks of the Casper district are, so far as observed, much the same as those of the Canadian asbestos region, being wholly igneous. They lie unconformably beneath the Cambrian sandstone, and comprise hornblende schist, diorite, granite, and serpentine. As it is the source of the asbestos

LOCATION OF CLAIMS.

^{the}
The laws of United States and of the state of Wyoming provide that any citizen of the United States may locate one or more placer claims of not more than 20 acres each. Each claim must be located separately, that is, by separate location certificates. Within 60 days after location, copy of the location certificate must be filed with the County Recorder of the county in which the claims are located. Eight persons may locate claims 160 acres each. In regard to the number of claims that may be located, they are limited only by their greed.

constituting
No title is conveyed by the mere location of a claim. Discovery of oil in commercial quantities must be made. Mere springs and seepages have been held by the courts as not ~~constituting~~ a legal discovery. However, a pit may be sunk near an oil spring and if oil is discovered in commercial quantities, say one-half barrel or more per day, such discovery complies with all legal requirements. When such discovery is made the claimant has title dating from the date of location as against everyone except the Federal Government. Title in fee simple may be secured by doing the necessary amount of work--\$500.00 and obtaining patent. The title obtained by reason of discovery is good against all as long as the annual assessment work--\$100.00 per year is kept up. The advantage to the locator of locating a number of claims is that when he makes discovery, should it be one month or 10 years later, his title reverts and dates from the date of original location as against all persons and corporations.

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It has not been decided by the courts as to whether a well on one claim will constitute discovery for the four adjoining claims. However, as assessment work may be done on 1 claim for that claim and the 4 adjoining claims, it seems probable that discovery made by drilling a well, will hold for the 5 claims.

There is nothing in the law which prohibits a citizen of the United States from locating an entire state or a number of states, should such states be open to location. These locations may all be made on the same day. They must conform to the public land surveys. Notice of location must be posted on the ground. Such notice must contain description of the claim, the name given by the locator to the claim, the date of location, and the name of the locator. Such locations although conveying no title until discovery is made are, by unwritten law, respected in the west.

The State of Wyoming

Office of State Geologist

Cheyenne

ASBESTOS.

Asbestos, chiefly of the valuable chrysotile variety, is found in the Casper, Big Horn, Laramie, Wind River, Seminole and Medicine Bow ranges of mountains. As a deposit is also reported in the Black Hills area of Crook County, the mineral occurs in all of the mountain ranges of the central and eastern portions of the State. ^{This} ~~That~~ distribution is of far wider extent than in other producing states in which commercial deposits are generally confined to one comparative ^{ly} small locality.

Probably, the highest grade ~~of~~ asbestos so far uncovered in Wyoming is the Wind River deposit recently examined. ^{by a representative of this office} At the extreme southeastern ^{tip} tip of the mountain range a serpentine dike, approximately 3,000 feet in length and 400 feet in width, intrudes in an easterly-westerly direction in Sec. 26, T. 30 N., R. 100 W., 6th P. M. at ~~a~~ points situated 4 miles due north of Atlantic City. A tunnel 440 feet in length and other smaller prospect workings have disclosed considerable areas of the dike to be interspersed with small bands or veinlets of cross fiber chrysotile, the most valuable of all asbestiform minerals. At places fully 15% of the serpentine is composed of silky, greenish yellow fiber varying from 1/8 to more than 1/2 inch in length. By inspection, the color, silkiness, flexibility and tensile strength of the local fiber appeared to be of the highest order known to the trade.

Fiber of 1/2 inch and longer is used for spinning purposes, ^{Present} ~~and at~~ ^{this} ~~that~~ ^{range} ~~valuable material~~ ~~command~~ from \$200.00 to ^{650.00} ~~525.00~~ per ton in New York. The local fiber has already been spun into yarns,

ropes and woven into fabrics. ~~and~~ Many samples of the finished products were inspected ~~in June 17~~ in the offices of A. H. Maxwell, attorney for Chicago ^{who} interests ~~that~~ recently patented a group of ^{S/A} claims at a favorable location on the mineralized dike.

CASPER MOUNTAIN.

The largest deposits of asbestos in Wyoming are those ^{on} Casper Mountain generally known as the Casper Mountain and Smith Creek areas. The former is situated 8 miles due south of Casper and the latter lies 20 miles southeast of the city.

The Casper Mountain area covers approximately $4\frac{1}{2}$ square miles in extent. Both areas are composed of serpentine, diorite and granite rocks. The local variety is chrysotile, and as in the Atlantic City district it appears exclusively in the serpentine.

No reports on the mentioned areas have been prepared by this office in recent years. In Bulletin No. 470, printed in 1911, the United States Geological Survey published quite a complete description of the local depositions. Therein, the conclusion was reached that the Casper region seems destined to become a factor in the asbestos industry of the United States. Since that time a considerable tonnage has been mined by Fred Patee and associates but in lieu of attempting any costly manufacturing processes it appears that all of the asbestos so far recovered has been made into fireproofing ^{and roofing} material ~~and other crude products~~ for which a local market has ~~been~~ developed [^] on a comparative large scale.

USES.

Asbestos is an ~~extremely~~ important fireproofing material and it is largely from the best chrysotile variety that heat and fire resisting textile products are made. On the other hand as a common insulating material for pipes

and furnaces its use baffles both heat and cold.

Spun and woven into incombustible cloth it commonly serves for theatre curtains, gaskets, automobile brake linings as well as for the fire-proof suits, aprons, gloves, leggings and helmets used by firemen and modern welders. Increasing ^{ly} large quantities of the shorter length fibers are annually consumed by the building trade and automobile industries. New uses in the rapidly expanding fields of mechanical refrigeration, electric insulation, oxyacetylene welding and other strictly modern industries all offer added markets for the product. Such constantly increasing demands promise early development for the Wyoming deposits, ~~but so far commercial exploitation has been wholly confined to only these local markets that the pioneers in the industry have been able to develop and create by their own efforts alone. As a consequence the chimneys for more than 2,000 homes erected in the Casper district during the several years last past were constructed of asbestos fire proof material mined from local deposits.~~

EXTENT OF EXPLOITATION OF CANADIAN DEPOSITS BY THE AMERICAN ASBESTOS INDUSTRY

While the United States is by far the largest manufacturer and consumer of asbestos products in the world, nevertheless, the quantity mined within its boundaries is wholly insignificant. According to latest figures of the Government, in ¹⁹²⁷ 1925, the producers of United States sold ²⁹⁸⁶ 1258 tons of asbestos while the quantity imported during that year amounted to no less than ²³⁶⁹³ 25520 tons. As developments now stand America is ~~wholly~~ dependent upon foreign minerals for ~~nearly~~ 99% of its asbestos requirements.

For many years past the American asbestos industry has largely been in the control of a single, strongly entrenched corporation. Their raw product

is obtained from ~~the~~ widely known asbestos properties that are situated in Canada less than 75 miles ^{north of} ~~from~~ the Vermont line. As the ^{product} ~~is~~ from these proven and developed mines are imported into this country free of charge, it suffices to state that comparative^{ly} little capital has been expended on the known prospects of Wyoming and other states.

Until some form of protection can be procured, America will probably remain entirely dependent upon the conveniently situated and easily obtained Canadian deposits for the major share of the world's asbestos ^{production} ~~products~~ it actually consumes. Manifestly, the domestic ~~mining~~ mining of the important and basic mineral should be encouraged in every possible manner. In event a favorable tariff could be obtained the development of the widely distributed Wyoming deposits containing the most valuable ~~of~~ asbestiform minerals should be considerably accelerated.

A PIONEER SHINGLE MANUFACTURER
NOW DEVELOPING WYOMING ASBESTOS DEPOSITS

DURING the past year capital was floated for the establishment of an asbestos shingle mill in Casper. The leading party of interest in the enterprise is Mr. Fred Patee, who has been a pioneer of asbestos exploration and development in the Casper region for many years past.

For raw materials the new organization will depend upon the extensive deposits of asbestos situated on Casper mountain, a few miles south of the city. ^{Until} the recent activities of Mr. Patee practically no steps were taken to exploit these unusual deposits in a commercial manner.

One factor that retarded development for so long a period is the shortness of fiber of the Casper deposits. Most all of the local deposits consist of fiber from one-eighth to one-half inch long, or lengths far too short to serve as the extremely valuable spinning fibers of commerce. However, in the past few years the monopoly that long has had complete control of the asbestos industry of America discovered that a most excellent type of shingle could be manufactured from their comparative worthless short fiber material. The superiority of the new shingle is ~~already established and since the~~

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DEVELOPMENT STIMULATED

past year the asbestos monopoly conducted a nation-wide advertising campaign that doubtlessly led to vastly increased sales of their modern and costly roofing products.

The new shingles will be made under Patee's own patents exclusively. In the process it is understood that no attempt is made to separate the contained asbestos from the gangue rock. All of the material, as mined, is ground and pulverized into a matrix which is later casted and moulded into shingle squares ~~by the aid of mechanical operations.~~ The contained fiber acts as a mechanical binder and thereby sufficient additional strength and resiliency is imparted to the thin casting to permit its use as modern ~~with costly hand separations.~~ Patee's shingling material. In doing away

^{with costly hand separations, Patee} maintains that he can produce asbestos shingler at a cost approximating 10 per cent of the retail prices now established by his powerful competitors. At the present time Patee also claims ownership of countless thousands of tons of rock suitable for the manufacture of ~~asbestos shingles.~~ As fully 99 per cent of the asbestos products consumed in the United States are of foreign origin, and in view of the many superiorities that have lately been recognized in asbestos shingles as modern roofing material, Mr. Patee and financial conferees now appear to be opening up an exceptionally promising field of industrial activity. As the form of mineral deposits now being exploited is exceedingly rare in the United States, it is believed that the pioneer efforts of Patee and associates