THE ASBESTOS FACTBOOK

Wherein is given in compact form much information concerning asbestos — that amazing, versatile non-metallic mineral.

"ASBESTOS," Philadelphia, Pa.

Second Edition—Feb. 1st, 1944

QUALITIES OF ASBESTOS

Durability — Resists.....	Weather Corrosion Fire Heat Acid Vermin Fungi-growth
Insulates against.....	Vibration Electricity Sound
Binds.....	Fillers Magnesia Cement Rubber
Filters.....	Acids Alkalies
Attracts.....	Sludge Dust

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FOREWORD

In the compilation of this small book we have taken information from many sources, and have been helped by various executives in the Asbestos Industry. It is impossible to list them all, but to all of them our sincere appreciation is extended.

The Asbestos Factbook is for those who need, for one reason or another the main facts on asbestos without hunting thru many volumes. Those preparing luncheon talks may find it useful; teachers will welcome it; it can be used to answer the many inquiries received by "ASBESTOS" and by members of the Asbestos Industry for general information about the wonderful non-metallic mineral—Asbestos.

THE ORIGIN OF ASBESTOS

(Extracted from "The Origin of Asbestos"[1] published in "ASBESTOS," July, 1940)

Chemical and mineralogical studies clearly show that asbestos fibre is not of vegetable or animal origin, but entirely of mineral origin. Taking as an example the chrysotile asbestos mined in Canada, the observed facts lead to the following explanation of its formation.

In the greenstone region of Canada, covering hundreds of square miles, the present surface rock was at one time thousands of feet below its present elevation, and under very great pressure due to the weight of the overlying rock and soil. This rock is a variety of olivine called peridotite and is composed of iron, magnesia and silica. In certain extensive areas this rock was acted on by hot ground waters, under high pressure, and carrying dissolved salts and carbon dioxide. The pressure is easily understood when it is realized that the rock was very far below the earth's surface, and the high temperature is explained by the fact that the temperature of the earth increases about 1°F. for every fifty feet of depth. From depth alone, this would give a temperature increase of at least 20°F. for every

[1]By M. F. Smith, Research Chemist, The Philip Carey Mfg. Co.

1000 feet, not to mention the hot intrusive rocks also present. These ground waters gradually changed the original rock from the iron-containing peridotite to the magnesia-silica-water ($3MgO \cdot 2SiO_2 \cdot 2H_2O$) mineral, serpentine. During the alteration the volume of the rock increased, causing innumerable cracks, small and large. These cracks were filled with the hot ground waters, chiefly derived from the slow infiltration of rain or surface waters. This underground water circulated thru the cracks in the rock, descending slowly thru the smaller openings in the rocks and ascending thru the larger openings and cracks. This water at high temperature and containing carbon dioxide under pressure is a very good rock solvent. The water rising in the larger cracks loses pressure and slowly cools, losing some of its solvent power and throwing out a small amount of the dissolved rock. This material deposits on the sides of the crack in the rock thru which the water is flowing, and if suitable mineralizers are present, such as dissolved salts and carbon dioxide, tends to form regular crystal shapes, depositing the molecules in a regular rather than a haphazard manner. Rock salt gives cubes; diamond forms in octahedrons; graphite in six sided plates, gold in octahedrons or cubes. Asbestos forms in easily separable, closely packed filaments, which when teased apart give the workable form in which asbestos is marketed and used.

The theory for the formation of asbestos fibre as given in the foregoing is held by many experts, but may be and is contested in some of its minor details by others, based on slightly different conditions present where they made their observations. In most cases the difference of opinion relates to such details as to how the waters were heated, and what the mineralizers were rather than to the whole of the theory. What has been said above about Canadian asbestos fibre formation holds also for the Vermont chrysotile fibre, Arizona, Russian, Cyprus and South African chrysotile fibre, as well as for some of the other non-chrysotile types.

TERSE ASBESTOS FACTS

¶ "Asbestos" is not the name of a distinct mineral species, but is a commercial term applied to fibrous varieties of several minerals differing widely in composition, the fibres being diverse in strength, flexibility and consequent usefulness.

¶ The properties of asbestos that give it commercial value are fibrous structure and fire resistance.

¶ Grading of asbestos is on the basis of length rather than quality. Fibres of the same *quality* range in price according to length.

¶ The three varieties of asbestos most used commercially are Chrysotile, Amosite and Crocidolite (blue) the bulk of world production and use, both long and short fibres, is Chrysotile.

¶ The earliest use of asbestos known to the world was over 2000 years ago by the Romans for the wrapping of their dead.

¶ Canadian Asbestos (chrysotile variety) was first "discovered" near St. Joseph, Que., in 1860; the deposits at Thetford and Coleraine were found in 1877; but, according to the story of Benjamin Franklin's purse[1], asbestos was actually known in Canada, probably by the Indians, as early as 1724.

¶ Blue asbestos was discovered near the Orange River, South Africa, in 1816; the name "crocidolite," meaning "flakey" or "woolly" stone, was applied to it in 1831; exploitation of the material began in 1893.

¶ Amosite (in Central Transvaal) was first known in 1907; the name was given to it in 1918, being taken from the initials of the company most interested in its production—Asbestos Mines of South Africa. Commercial production started in 1916.

¶ Rhodesia first reported production of asbestos (chrysotile variety) in 1908—55 tons.

[1]See March, 1939, "ASBESTOS," page 2, for this story.

¶ Asbestos in itself does not have low heat conductivity. Its extensive use for heat insulation is because of its fireproof qualities; the porous structure or aircell content of asbestos insulation materials accounts for their insulation value.

¶ Italy is called the cradle of the Asbestos Industry because the mining of asbestos and the manufacture of its products began on an industrial scale in that country.

¶ Asbestos was found in the Ural District (Russia) between 1710 and 1720.

¶ Asbestos was discovered in Vermont in 1824, but production was first recorded in 1908.

¶ A patent on engine packing using asbestos was granted as early as 1857 to Richard Lloyd, of England.

¶ Insulation containing asbestos was first used in 1866; it was made of asbestos fibre and silicate of soda and was in sectional form.

¶ Great Britain's asbestos manufacturing industry began in 1871 in a factory founded by the Patent Asbestos Manufacture Limited, of Glasgow, Scotland.

¶ The first known attempt to make asbestos paper was in 1765; it was first made in the United States about 1878.

¶ Cape Asbestos Company were the original spinners of crocidolite or blue asbestos—as early as 1895.

¶ Ludwig Hatschek, an Austrian, invented asbestos-cement shingles in 1900; they were introduced into the United States in 1905 by the Keasbey & Mattison Company.

¶ Asbestos-cement pipe was first used for carrying corrosive salt water for street cleaning and fire-fighting in an Italian seacoast town.

¶ Patents on asbestos-cement pipe were granted in Italy in 1913; the manufacture of such pipe began by Eternit Pietra Artificiale in Genoa, Italy, in 1915; it was introduced into the United States by Johns-Manville in 1929 and the first shipment made by J-M in 1930.

¶ Arizona asbestos is important for electrical insulation because of its low iron content.

¶ Crocidolite and Amosite asbestos are highly acid resistant, making them valuable for use in chemical plants.

¶ Amosite asbestos was first spun in England in 1924 by the Cape Asbestos Company. The pioneer in the spinning of Amosite was S. Weingarten, of South Africa, who spun Amosite yarns as early as 1909.

¶ Asbestos was first used in brake lining in 1906.

¶ A capital investment of $22,000,000 is represented in the asbestos mining and milling industry in Canada.

¶ The United States is the largest consumer of asbestos in the world.

ASBESTOS IS FOUND:

The four largest asbestos producing countries are Canada, Russia, Southern Rhodesia (Africa) and the Union of South Africa. Next in importance are the United States, Cyprus, Italy and Finland.

In spite of the fact that asbestos is found in practically all countries, its occurrence in *satisfactory quality and economic quantity* is not common. Altho deposits are continually being reported, there are very few which upon examination are found to warrant the expense necessary for development. The following tabulation forms an index to the varieties of asbestos produced in the various countries or localities.

AFRICA:
Southern Rhodesia (chrysotile of excellent quality).
Swaziland (chrysotile of excellent quality).
Union of South Africa—Transvaal produces amosite, blue and chrysotile. Cape Province produces the well-known Cape Blue exclusively and extensively. Other occurrences of asbestos (chrysotile) have been reported from Natal.

AUSTRIA:
Short fibered amphibole known as "micro-asbestos" used, in combination with concrete or asphalt, for road surfacing.

AUSTRALIA:
Chrysotile of various qualities and lengths is found

in Western Australia, South Australia, Queensland and New South Wales. Blue asbestos is found in South Australia; the deposits of blue in Western Australia are being developed at the present time.

CANADA:
Chrysotile variety, found principally in the provinces of Quebec and Ontario. Asbestos Mines in Quebec are the best known in the world. Canadian quality and grading are considered as standard the world over.

CHINA:
Deposits of chrysotile worked to some extent in a number of provinces, the most important being in Chihli (Hopeh) Province and Manchuria.

CYPRUS:
Good quality of chrysotile; most of the production is of "shingle stock" grade or lower.

FINLAND:
Produces fair quantities of short anthophyllite.

INDIA:
Produces both amphibole and chrysotile to some extent. The chrysotile is of excellent quality and low iron content.

ITALY:
Chrysotile of fair grade and tremolite of excellent quality are produced. Mining and manufacture of asbestos on an industrial scale first began in Italy.

RUSSIA:
Very extensive deposits of good grade chrysotile are found in the Ural Mountains and have been extensively developed by the U. S. S. R., altho quite large production was recorded previously.

SOUTH AMERICA:
Deposits of chrysotile in Venezuela are the most important from a commercial standpoint. Other deposits, some chrysotile and some amphibole, are reported in Argentina, Brazil, Chile and Bolivia. Very long blue asbestos, not strong enough for spinning,

is found in Bolivia. So far no commercial use has been found for it.

UNITED STATES:

Arizona Mines produce an excellent long fibre chrysotile, valuable for electrical work because of its freedom from iron.

California has deposits of short chrysotile, not being worked to any extent at present. Tremolite asbestos is also being produced in commercial quantities for Gooch Crucible use.

Georgia has been the most consistent producer of amphibole (anthophyllite) asbestos of any of the states. Large deposits are found in Sall Mountain (near Gainesville) and at Hollywood.

Maryland has a deposit of anthophyllite and tremolite, from which filter fibres are made.

Vermont produces good grades of chrysotile ranging from shingle stocks to shorts.

Wyoming, Montana and New York have deposits of good chrysotile asbestos also, but these have not been worked.

Deposits of amphibole (principally anthophyllite) which are being worked to some small extent are found in North Carolina, Idaho, Wyoming, Montana, Oregon and Alaska.

Deposits have also been reported in Maine, New York, Pennsylvania, Virginia, Texas, Michigan, Connecticut, South Carolina, South Dakota, Wisconsin.

OTHER COUNTRIES:

Occurrences of asbestos of various types, principally chrysotile or anthophyllite, have been reported from time to time from Albania, Algeria, Bulgaria, Chosen (Korea), Czechoslovakia, Corsica, Cuba, France, Germany, Ireland, Japan, Mexico, Madagascar, Newfoundland, New Zealand, Philippine Islands, Portugal, Spain, Switzerland, Spitzbergen, Syria, Turkey and Turkish Armenia.

THE USES OF ASBESTOS AND ASBESTOS PRODUCTS

In presenting this list of uses of asbestos and asbestos products, we have included only the basic and more important uses—those which consume the largest volume of asbestos (or the product made therefrom) or those which require small quantities of material but perform a very valuable function.

We have not tried to include in this list the end use of every item, that is the place where the asbestos or asbestos product is used, or the purpose for which it is used, except where that place or purpose is most important, or unique. For instance, asbestos blankets are used for fire fighting in hotels, department stores, laundries, dry cleaning establishments, at airplane hangars, by fire departments; the one designation "Asbestos blankets for fire fighting" covers a multitude of what might be regarded as the "Uses of Asbestos Cloth" if the list were carried out to the *nth* degree.

There are also innumerable uses of asbestos and asbestos products which may be extremely interesting but are unimportant from the viewpoints mentioned. Most of these have been published at some time or other in "ASBESTOS" and a complete list, so far as is known, is kept on file.

As an illustration, a certain actor's pockets were made of asbestos cloth[1], but we do not consider "asbestos pockets" sufficiently important to include in this printed list.

(Several uses have been added in this 2nd Edition.)

—:—

USES OF RAW ASBESTOS

Yarn
Thread
Wick packing
Rope packing
Felt
Paper (plain and corrugated)
Rollboard
Millboard
Insulating wire
85% Magnesia pipe covering, blocks and locomotive lagging
High temperature insulation (moulded) (various types)
Compressed sheet packing
Compound for encasing of motor windings
Moulded composition for electrical and other purposes

[1]See page 18, January, 1930, "ASBESTOS."

Moulded brake lining and brake blocks
Automobile bodies and railway sleepers (moulded composition)
Filler in Plastics
Flooring
Pottery and sculpture
Asbestos Cement Products, viz:
- Shingles, siding, tile
- Wall tile and flat sheets
- Corrugated roofing and sheathing
- Decorative panels
- Insulated board
- Floor tile backing
- Pipes
- Miscellaneous articles, such as ventilators, flower pots, louvres, etc.

Asbestos cement for insulation of boilers
Roofing cement
Furnace cement
Plaster and stucco
Paints, varnishes and fillers
Sprayed asbestos (acoustical)
Filling for asbestos mattress insulation
Insulation of batteries (loose fibre)
Insulation of walls and floors (loose fibre)
Insulation in underground conduits (loose fibre)
In foundations to resist shock
Packing for explosives or other materials
Wadding in cartridges and timing devices
Filter fibres and filter pads
Platinized asbestos fibre for filtering
Coating for welding rods
In cheese making (on which to place spores)
Pavement in sewer pipe

USES OF ASBESTOS YARN

Cloth
Tape, electrical and other
Brake lining
Clutch facings
Packing—valve stem, braided and other
Gaskets and gasket cloth
Tubing
Wick for oil burning apparatus
Rope
Twine or sewing thread
Stocking for lead cable
Electric fixture wire covering

Electric cable covering
Tying gas mantles
For spark plugs
Edges for hair felting

USES OF ASBESTOS CLOTH

Packing—sheet, high pressure, folded or wound
Brake lining, folded and stitched
Clutch facings
Gaskets
Asbestos insulation mattresses
Substitute for canvas on insulation where temperatures are high
Clothing, viz:
- Suits
- Helmets
- Gloves and mittens
- Aprons
- Leggings
- Berets

Tapestry
Hangings for firestops
Blankets for fire fighting
Blankets in electrolyzer cells
Bags and diaphragms (in oxygen producing)
Mailbags
Awnings
Rugs
Theatre curtains
Theatre scenery
Floor lining in theatres
Portable motion picture booths
Motion picture screen
In acoustical treatment
In acetylene welding
Gun grips
Asbestos faced wipers in commutators
Facing for dryer felt
Filtering (fruit juices, acids, etc.)
Filter in dust collectors
Oil filter sack (in automobiles)
Protectors for gas bags in balloons
Oven insulation
Lining in motors
Lining of laboratories, cooling chambers and other rooms
Lining of automobile footboards

Padding for laundry presses and mangles
Padding prison cells
Wrapping oil tanks and oil lines in engines
Umbrellas and shields (protecting firemen)
In various medical test apparatus
Sand bags (for pressing hats)
Conveyor belting
In hay curing to preserve aroma and color
In cheese making to control temperature
Insulation against noise and vibration (especially in airplanes)
Fittings for airplanes

USES OF ASBESTOS FELT

In acoustical work
Protection of underground pipes
On paper machines
Noise insulation
Padding in pianos

USES OF ASBESTOS TAPE

Wick for oil burning apparatus
Belts for conveying hot glass or other articles
Pull strings for ovens
Insulating locomotive steam pipes at bends, etc.
Insulating armatures
Winding coils
Winding buss bars
Insulating underground cables
Laboratory uses, such as insulation for flasks, test tubes, retorts; tie straps in diffusing materials
In glass manufacture for wrapping tines of forks to take bottles from ovens; reinforcing paddles for stirring molten glass

USES OF WICK PACKING

As packing
For wiping of wire, armor plate or galvanized materials

USES OF ASBESTOS PAPER

Air cell and other pipe coverings
Boiler jackets
Asbestos felt roofing
Asbestos built-up roofing
Asbestos protected metal roofing
Gaskets, plain and metallic
Wick in oil burning apparatus
Tubes in electrical industry
Wrapping of electrical wire
Wrapping of hot air pipes
Linings of
  Stoves
  Heaters

Linings of
  Filing cabinets
  Cartridges
  Soldiers' helmets
  Carpets
  Auto mufflers
  Radiator covers
  Drum controllers
  Cookers
  Electric appliances
  Armored car roofs
  Auto floorboards
In enameling ovens to catch drip
Insulation of ovens and dry kilns
Diaphragm in electrolytic cell
Tank covers
Reinforcing aluminum foil for insulation
Filtering
In window glass machinery to guide hot sheets; to shield hot glass from flying fragments
In welding and other processes for protection from heat
In annealing (crumbled paper)
In chemistry and physics in many various ways
Reinforced with cotton thread for automobile tops
Covering of rockwool blankets which must be sewed
Wrapping of wires and cables
Insulating exhausts on automobiles
Baking sheets
Table pads and mats
Construction of air ducts or lining of paper ducts

USES OF ASBESTOS MILLBOARD

Linings of
  Stoves and heaters
  Safes
  Garages
  Motion picture booths
  Electric switch boxes
  Dry cleaning machines
  Garbage incinerators
  Hoods of automobiles
  Bottoms of brooder stoves
  Ovens and dry kilns
As fireproof wallboard
Ceiling over boilers, smoke stacks, etc., for fire protection
Gaskets, plain and metallic

(Uses of Asbestos Millboard — Continued)

Paddles in glass mills
Washers in electrical apparatus
Tent shields and stove pipe rings
In metal clad doors (between outside metal and wood core)
Table pads and mats
Stove mats

USES OF ASBESTOS-CEMENT FLAT SHEETS AND WALLBOARD

Interior sheathing (of factories, refrigerator rooms, etc.)
Partitions, movable and fixed
Exterior sheathing (half-timber effect)
Brick-type siding
Portable buildings
Roofs and sides of small buildings
Semi-portable motion picture booths
Fireproof layer on insulated board
Fire protection around engines
Lining of fireless cookers
Backing for dies (in moulding glass)
Brake shoes for elevators
Hoods over machines or vats (from which vapor rises)
Mounting of test instruments and gauges
Laboratory table tops
Switch boards
Cabinets and panel box work
Insulators between phases and on arc deflectors
Electric motor casings
Spark arresters
Miscellaneous uses in electrical apparatus
Lining for bleaching and other tanks and vats
Backgrounds and cut-outs for window displays
Blackout or bombproof board

USES OF ASBESTOS CEMENT PIPES

For carrying of water, sewage, gas and special liquids
As gas vent pipes
Conduits for electric light wires, etc.
Purlins, rafters, trusses, etc., for wartime buildings

USES OF ASBESTOS COMPOSITION MATERIAL

Insulation compounds
Heater cord insulation
Electric wire insulation
Lamp sockets, rheostat backings, switch parts, arc deflectors, resistance mountings and other electrical uses

[1]Of many types.

(Uses of Asbestos Composition Material — Continued)

Underground insulation
Flooring
Phonograph records, buttons and other small objects made of plastic
Sealing of percussion caps in large cells

USES OF VARIOUS ASBESTOS PRODUCTS IN MOVIES

To localize fires in location
To protect nearby buildings when fires are set
For wall sections in sets to prevent reverberations
Firebox in fireplaces
Insulation of camera booths against sound
Blinders or ears for lights or sun arcs
Dressing winter scenes as snow
Dust on cobwebs, old wine kegs, etc.
Noise insulation
Insulation for maintaining even temperature

TYPICAL ANALYSES

	Chrysotile[1]	Blue	Amosite
Silica (SiO_2)	39.05	51.1	50.24
Alumina (Al_2O_3)	3.67	...	....
Ferric oxide (Fe_2O_3)	2.41	...	7.80
Ferrous oxide (FeO)		35.8	32.00
Magnesia (MgO)	40.07	2.3	3.96
Lime (CaO)	....	...	....
Sodium oxide (Na_2O)	....	6.9	2.12
Combined water (H_2O)	14.48	3.9	3.00
	99.68	100.0	99.12

[1]Canadian (Thetford)