WYOMING STATE GEOLOGICAL SURVEY
Gary B. Glass, State Geologist

TALC, INCLUDING STEATITE, IN WYOMING

by

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ABSTRACT

Talc, a hydrous magnesium silicate, is one of the softest minerals. It has a variety of uses including art material, ceramics, cosmetics, and paper coatings. It is formed in contact metamorphic zones by chemical reactions between magnesian carbonates and silica-rich hydrothermal fluids. Steatite is a term for compact, massive, finely crystalline talc. While there are many known occurrences of talc in Wyoming, most of these are relatively small and constitute either mineralogical curiosities or archaeological sites (Native Americans carved bowls and other implements out of massive talc). There are, however, a few talc occurrences in Wyoming that may be of commercial value. Talc is mined commercially in seven states, and it was mined in small amounts in Wyoming in recent years for sculpture material.

INTRODUCTION

Talc is a hydrous magnesium silicate mineral with the chemical formula $Mg_6(Si_8O_{20})(OH)_4$ (Deer and others, 1966). It is among the softest known minerals, having a hardness on the Moh's scale of 1. Although talc is designated as Moh's hardness 1, it can vary between 1 and 2 (Deer and others, 1966). Its industrial uses derive from this softness, as well as from its resistance to high temperatures. Steatite is a term describing a compact, massive form of talc. Soapstone is a term describing minerals usually, but not limited to talc, that have a smooth, soft, or greasy feel.

The U.S. Bureau of Mines usually reports production statistics for the mineral pyrophyllite together with talc. Pyrophyllite $[Al_4(Si_8O_{20})(OH)_4]$ (Deer and others, 1966) is another soft mineral (between 1 and 1.5 on Moh's hardness scale) used principally in ceramics and refractories (Virta, 1993). Pyrophyllite is not considered further in this report since it is found in Wyoming principally as a mineralogical curiosity associated with reaction rims at the boundaries of some magnetite-ilmenite zones in the Laramie Mountains anorthosite complex (**Figure 1**).

Talc is found throughout Wyoming although in the past little attention was given to its occurrence. This report describes some previously documented occurrences of talc as well as several occurrences heretofore unpublished in geologic literature. Due to its use by Native Americans for utensils, several sources of data for talc locations in Wyoming are archaeological publications or reports. Because of this historical interest, Native Americans must approve all mining plans involving talc prior to any mining operations. The author wishes to thank Dr. George C. Frison, a former Wyoming State Archaeologist, for

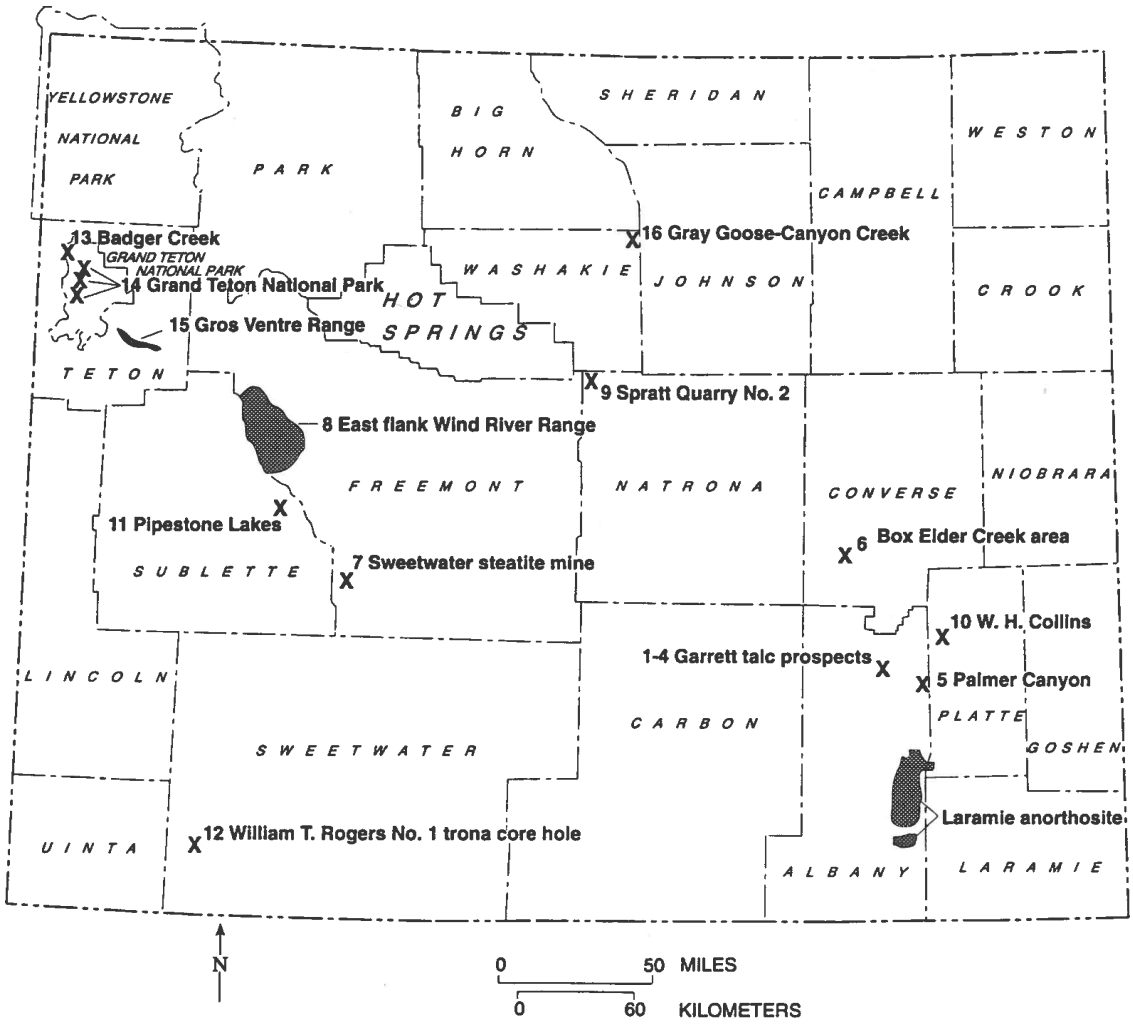

Figure 1. Index map showing the locations of talc occurrences and other related sites in Wyoming. An "X" or a stippled pattern indicates generalized locations; numbers refer to the occurrence described in the text.

instruction and insight in the recognition of archaeological sites, and for providing previously unavailable reports of the University of Wyoming's Department of Anthropology.

USE, PRODUCTION, CONSUMPTION, AND PRICE OF TALC IN THE UNITED STATES

The primary uses of talc are in ceramics (31 percent), paint (17 percent), paper coatings and fillers (16 percent), as a fire-resistant filler in roofing (11 percent), in plastics (6 percent), as a carrying agent in cosmetics and as talcum powder (5 percent), and in a number of minor uses, including the carrying agent in insecticides, a filler in rubber products, and as a refractory (14 percent) (Virta, 1992, 1993).

Nationally, the annual production and consumption of talc is fairly steady (**Table 1** and **Figure 2**). Talc was produced in seven states in 1993. The leading producers that year, in order of production value, were Montana, Texas, New York, and Vermont (Virta, 1993). Three other states produced talc in 1993, but were not identified to protect the confidentiality of single producers in those states. Three other talc-producing states in 1991 were California, Oregon, and Virginia (Virta, 1992), but the value of production from each of these states was not disclosed for the same reason as above. The price of mined, unprocessed talc fell from 28 dollars per short ton in 1989 to 11 dollars per short ton in 1992 (Virta, 1993). For the future, talc production is not expected to change much, with annual production remaining about one million short tons (Virta, 1992).

Table 1. Production and consumption of talc in the United States, 1979-1993 (in thousands of short tons).

Year	Production	Consumption
1979	1,453	1,020
1980	1,240	1,077
1981	1,343	937
1982	1,135	820
1983	1,066	989
1984	1,127	1,009
1985	1,269	1,079
1986	1,302	1,120
1987	1,349	1,084
1988	1,360	1,162
1989	1,381	1,116
1990	1,397	1,162
1991	1,143	1,021
1992	1,124	1,041
1993	1,102	1,020

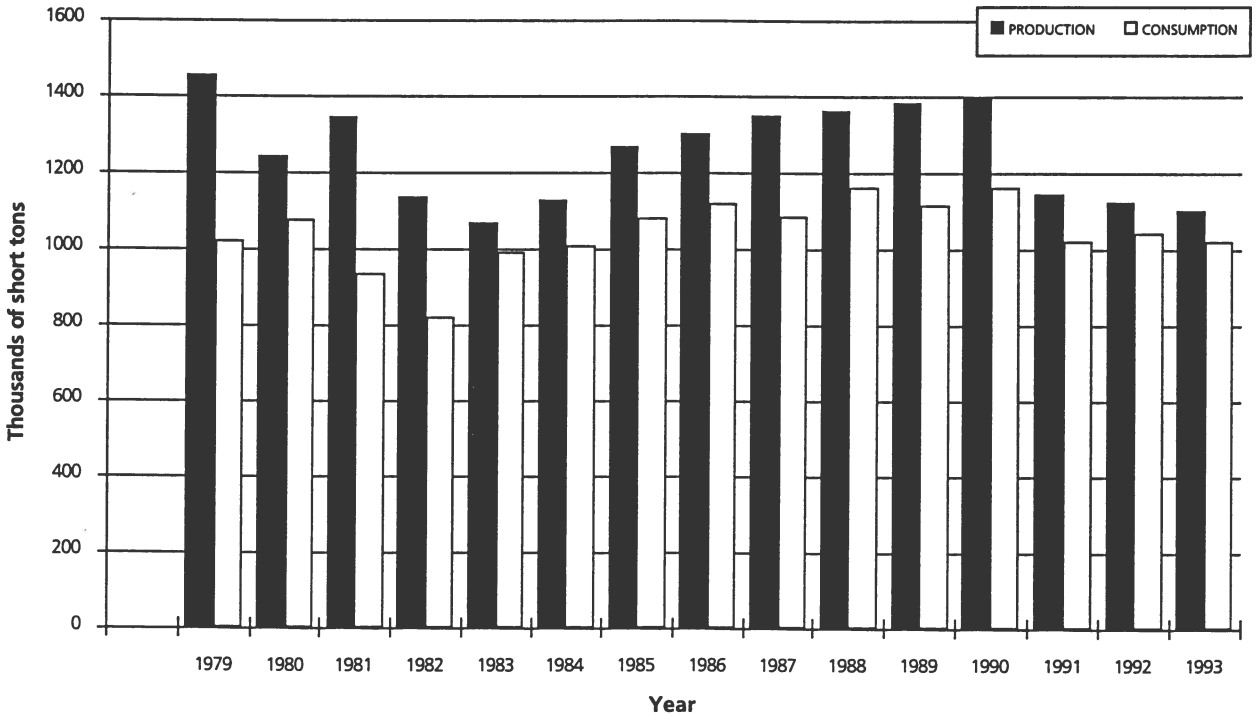

Figure 2. Production and consumption of talc in the United States, 1979-1993.

Talc is usually mined, milled (ground), and packaged for use without much processing. Sometimes commercial talc contains small amounts of impurities, such as serpentine, tremolite, altered pyroxenes, or dolomite. Objectionable impurities, which are sometimes removed by air flotation, include amphiboles and pyroxenes, quartz, iron oxides, and iron sulfides (Johnstone, 1954). Talc occurrences with too great a proportion of these minerals are not mined.

GEOLOGIC OCCURRENCES OF TALC

Commercial talc deposits are found primarily in contact metamorphic zones in which metadolomites or sometimes magnesian mafic or ultramafic rocks have been altered by hydrothermal fluids rich in silica. The chemical reaction that results in the formation of talc from metadolomite is: $6(MgCa)CO_3$ [dolomite]+ $8SiO_2$ [quartz]+ $2H_2O \leftrightarrow Mg_6(Si_8O_{20})(OH)_4$ [talc]+$6CaCO_3$ [calcite]+ $6CO_2$ (Roe and Olson, 1983).

Significant talc occurrences are found in California, Georgia, Maryland, Montana, Nevada, New Mexico, New York, North Carolina, Oregon, Texas, Vermont, and Virginia (Piniazkiewicz and others, 1994).

TALC OCCURRENCES IN WYOMING

In Wyoming, talc is known to occur in several areas (**Figure 1**). All these occurrences are in Precambrian metamorphic rocks, except for the Sweetwater County occurrence (Occurrence 12, **Figure 1**), which represents an unusual authigenic occurrence of the mineral talc in altered volcanic tuffs of Eocene age. This occurrence is not of economic interest.

The following is a description of known talc occurrences in Wyoming. The numbers preceding each occurrence refer to the numbers on the location map (**Figure 1**). This list is alphabetical by county.

A few of the described occurrences warrant further investigation. The Garrett deposits (Occurrences 1 - 4, **Figure 1**), the unlocated occurrence reported on the east flank of the Wind River Range (Occurrence 8, **Figure 1**), and the Pipestone Lakes occurrence (Occurrence 11, **Figure 1**) have the potential for commercial development. The Pipestone Lakes occurrence, though large, is within a Wilderness Area although the talc resource was not known at the time the wilderness was designated.

Albany County

Garrett talc prospects

These comprise a group of large, separate, irregular, lenticular areas of talc mineralization contained in actinolite schists and hornblende schists. Considerable talc may exist in this area, but the area has not been prospected for talc since the 1940s. Nevertheless, the probable volume of talc in this area suggests it may have commercial value. Hagner (1945) also notes that there is: "more talc in area - not opened up."

Occurrence 1. Located in the SE section 32, T25N, R73W. Fine-grained medium gray shistose talc is found in two zones in this locality. One zone is 40 feet long and eight to ten feet wide. Another is 250 feet long and two to three feet wide. The zones, which are probably altered metadolomites, strike N80°W and dip 75°W. Locally, the irregular area of talc mineralization is iron-stained from surface weathering (Hagner, 1945).

Occurrence 2. Located in the W2 NE and E2 NW section 32, T25N, R73W. Iron-stained, weathered talc is found from the surface to a depth of two feet. Below that level, the talc is gray and unweathered in appearance. In the surface zone, the talc strikes N25-45°W and dips vertically. The zone of talc is somewhat contorted, is exposed for a length of 180 feet between covered portions, and averages five to six feet in width (Hagner, 1945). This irregular area of talc mineralization has not been tested at depth.

Occurrence 3. Located in the NE section 32, T25N, R73W. An irregular area of talc mineralization exposed at the surface in this locality is 20 feet wide and can be traced along strike for 100 feet. There is a small zone of hornblende-actinolite schist less than two inches wide within the irregular area of talc mineralization. The talc occurrence strikes N45°E and dips 65°SE (Hagner, 1945). Several small pits were developed in this area of talc mineralization before 1950.

Occurrence 4. Located in section 32, T25N, R73W. A small irregular area of talc mineralization, five feet wide, crops out in this area, southeast of Occurrence 3. This mineralized zone strikes N25°E and dips 65°SE.

Palmer Canyon (Occurrence 5)

Located in section 1, T24N, R71W. Hagner (1942a) notes that there is good quality talc in this area, but he does not give the size of the occurrence. Talc is exposed only in prospect pits developed to a depth of eight feet on a ridge composed mostly of anthophyllite

schist, cut by a few stringers of granite. The author visited this locality in the fall of 1989 and noted that the pits were mostly caved in and filled with windblown debris. Small specimens of talc at the surface were light gray and relatively pure.

Converse County

Box Elder Creek area (Occurrence 6)

Located in sections 17, 18, 19, and 20, T32N, R75W. Numerous pod-like, irregular areas of talc mineralization, consisting of light greenish gray talc, greenish talc-serpentine, and dark green to light yellowish green serpentine occur in this area. Some of these irregular areas of talc mineralization have been mined in the past for decorative stone and there is an active serpentine quarry in the SW section 17. This area may be the site of prehistoric steatite quarries mentioned by Frison (1982) at the northernmost end of the Laramie Mountains.

Fremont County

Sweetwater steatite mine (Occurrence 7)

Located in the S2 SE section 20 (unsurveyed) and N2 NE section 29 (surveyed), T30N, R102W. Large boulders and possible outcrops of steatite measuring 30 feet by 30 feet by 30 feet and 10-foot-wide dikes of chloritic talc occur in this area. The chloritic talc trends N30°W and is nearly vertical. The country rock is primarily amphibolite gneiss with foliation trending N88°E and dipping nearly vertical. Isolated outcrops of granite are also found. Most of the area is forested and is covered by glacial deposits and recent colluvium.

The steatite is dark olive green to brown to medium gray. The chloritic talc is light green to olive green. The talc and chloritic talc were determined by X-ray diffraction at the Wyoming State Geological Survey. Small amounts of serpentinite were also identified to be present. The mineral claims in this area were held as late as 1993 by Sweetwater Steatite Company, which quarried large boulders for sculptors. Sweetwater Steatite acquired small mining permits from the U.S. Forest Service and the Land Quality Division of the Wyoming Department of Environmental Quality.

East flank of the Wind River Range (Occurrence 8)

According to Frison (1982), steatite extends from "just below to well above timberline on the slopes east of the Continental Divide."

Natrona County

Spratt Quarry No. 2 (Occurrence 9)

Located in the SW section 12, T40N, R89W. A pit measuring about ten feet in diameter and four feet deep at this location exposes dark gray and dark red impure steatite. The steatite trends N50°E and dips 80°NW. There are several other small depressions in the area that were evidently prospect pits in other steatite lenses. The host rocks are quartzofeldspathic gneisses, quartzites, and amphibolite gneisses that trend in the same direction as the talc lenses and pods. The author noted numerous worked pieces of steatite in the vicinity. The site was a major source of steatite for prehistoric Native Americans (George Frison, written communication, 1983).

Platte County

W.H. Collins (Occurrence 10)

Located in the C S/2 section 15, T27N, R70W. An area of relatively large areal extent (over 160 acres) contains numerous small irregular areas of talc mineralization in a groundmass of granite, quartz veins, and hornblende schist. Pure talc is found in veins and stringers up to five feet wide. These irregular areas of talc mineralization extend for strike lengths of several tens of feet (Hagner, 1942b). There is a large amount of talc in this area, but it is mixed with much gangue.

Sublette County

Pipestone Lakes (Occurrence 11)

Approximately located in the W2 section 13 and the E2 section 14, T34N, R106W, at Pipestone Lakes, on the Halls Mountain 7 1/2-minute Quadrangle. Large amounts of high-quality gray steatite are present at this locality, but no reserves have been determined and no exploration has been recorded. The area is remote, at an elevation of 10,100 feet above sea level, and at the present time, is accessible only by foot or horseback. This occurrence is within the Bridger Wilderness Area. The area is a prehistoric Native American steatite quarry site, and numerous prospect pits are present at this locality (Frison, 1982; University of Wyoming, Department of Anthropology, 1974).

Sweetwater County

William T. Rogers No. 1 trona core hole (Occurrence 12)

Located 200 feet E of the center of the west line section 19, T15N, R111W. Talc, chlorite, lazurite, and sapionite (?) occur as authigenic minerals in a 21.5-foot-thick lacustrine salt bed in the Wilkins Peak Member of the Eocene Green River Formation. The talc is in salt bed 14, as measured from the bottom of the evaporite sequence. This was the first reported occurrence of the mineral talc in such an environment (Bradley, 1964).

Teton County

Badger Creek (Occurrence 13)

Located in section 5, T46N, R117W. Beckwith (1939) reports: "A reported occurrence of asbestos... on the west side of the Teton Range proved to be a small deposit of massive soapstone and fibrous talc in olivine diabase, which is cut by granites and quartz stringers."

Grand Teton National Park (Occurrence 14)

"At several places in Snowshoe, Waterfall, and Colter Canyons the layered gneisses contain discontinuous masses a few tens to hundreds of feet in diameter of heavy dark-green or black serpentine. This rock is frequently called 'soapstone' because the rock feels smooth and soapy to the touch" (Love and Reed, 1971). Some of these occurrences also contain talc.

Gros Ventre Range (Occurrence 15)

Love and Reed (1971) report that Native Americans carved bowls from soapstone from the Gros Ventre Range. Frison (1982) designates the south side of the Gros Ventre Range as a source of steatite for Native Americans. No specific locations for these occurrences are given in either report.

Washakie County

Gray Goose-Canyon Creek Cow Camp-Canyon Creek (Occurrence 16)

Located in the SE and SW section 25 and the N2 section 36, T48N, R86W. Dark gray steatite and fibrous talc are exposed in several small propects pits and in a partially filled-

in shaft on the ridge above the Canyon Creek cow camp in the southwestern part of the Bighorn Mountains. The talc is present in a sequence of greenstones, hornblende schists, and olivine metadiabases that strike N15°E. In the summer of 1934, the Wyoming Asbestos Mining Company sank a shaft. Rocks exposed in the shaft were talc schist and fibrous talc (Beckwith, 1939). This shaft was sunk to approximately 25 feet, but is now almost filled in. Other smaller pits in the area are in steatite, and were developed by prehistoric Native Americans. The area is recommended for historical preservation due to the presence of the prehistoric quarries and artifacts in the area (Frison, 1982; Zieman, 1978).

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