THE GEOLOGICAL SURVEY OF WYOMING
Gary B. Glass, State Geologist

OPEN FILE REPORT 89-4

TRIPOLI (TRIPOLITE) IN WYOMING

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Laramie, Wyoming
1989

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Introduction

Tripoli, also called tripolite, is the industrial term for a rock composed almost entirely of soft and friable microcrystalline quartz. The hardness of the microcrystalline quartz (6.5 on the Mohs scale) and chemical inertness make it valuable for abrasives, fillers, and other uses. It probably forms by selective acidic leaching of siliceous limestone or calcareous chert (Bradbury and Ehrlinger, 1983) which removes the carbonate component and leaves the siliceous residue. This report describes tripoli deposits in the United States and four reported locations in Wyoming.

Physical and chemical properties

Tripoli (tripolite) is defined by the U.S. Bureau of Mines as:

> "An incoherent, highly siliceous sedimentary rock composed of the shells of diatoms, radiolaria, or finely disintegrated chert (Thrush, 1968)."

However, siliceous rock composed of diatoms or radiolaria is also known as diatomite, and these are not a subject of this report. (For information about Wyoming diatomite occurrences, see Harris and King ,1986.) Tripoli is composed of microcrystalline quartz in different stages of aggregation from minute particles to porous masses (Bradbury and Ehrlinger, 1983), or a soft, friable, porous rock composed of microcrystalline quartz (Rheams and Richter, 1988). Tripoli generally occurs in layers or masses in siliceous limestone or calcareous chert. The particle size of quartz in tripoli ranges from 0.1 to 10 microns (Bradbury and Ehrlinger, 1983). It is generally white but may be colored buff, tan, or pink by iron oxides. Its other physical characteristics are summarized in **Table 1.**

Table 1. Typical physical characteristics of tripoli (modified from Harben, 1983).

Specific gravity	2.65
Weight per solid gallon (pounds)	22.07
Bulking value	0.04531
pH value	7.0
Refractive index	1.54 to 1.55
Hardness (Mohs)	6.5
Melting point	3,100°F
Specific resistance (ohms)	25,700

Tripoli is composed of quartz with minor amounts of other material. A typical chemical analysis of tripoli is shown in **Table 2**. Commercial tripoli contains over 98% silica (SiO_2). However, tripoli produced in Pennsylvania is composed of only 60% silica. It can be washed to remove nonsilica constituents, so that the tripoli product is similar to that described in **Table 2** (Bradbury and Ehrlinger, 1983).

Table 2. Typical chemical analysis of tripoli (modified from Harben, 1983).

Constituent	Percent
SiO_2	99.5 ± 0.5
Fe_2O_3	0.025
TiO_2	.005
Al_2O_3	.009
CaO	.15
MgO	.008
Loss on ignition	.30

Origin of Tripoli

Tripoli is generally considered to form by leaching of siliceous limestones and calcareous cherts under surface or near-surface conditions (Bradbury and Ehrlinger, 1983). Hood and Levine (1973) stated that tripoli is finely divided silica which remains behind after calcium carbonate ($CaCO_3$) is leached from a bed. In an earlier study, Lamar (1953) described a bed of siliceous limestone containing 24% SiO_2 that was transformed to a bed of tripoli containing 98% SiO_2 over a distance of 350 feet. This demonstrated relative leaching of calcium carbonate in the bed, rather than post-depositional silica enrichment. In a recent study of tripoli in Alabama, Rheams and Richter (1988) concluded that tripoli formation was not a matter of simple carbonate solution leaving behind residual quartz. They noted that the presence of doubly terminated euhedral quartz seen in scanning electron micrographs indicates that free quartz crystal growth also occurred in the area of tripoli formation. There may be two

stages of diagenesis in the formation of some tripoli, an initial stage of carbonate dissolution, followed by (or occurring simultaneously with) silica mobilization and recrystallization.

Uses of tripoli

Tripoli is used in a variety of products depending upon its color and particle size. These include abrasives (buffing, scouring, and polishing compounds; toothpaste; industrial cleansers and soaps); mineral fillers in paint, plastic, and rubber; and electrical plastics, for which tripoli adds dielectric properties as well as flexural and compressive strength (Rheams and Richter, 1988; Bradbury and Ehrlinger, 1983). Minor uses include refractory glasses and ceramics, and fillers in adhesives, insecticides, wallboard and plastic wood. It has also been used as a fine aggregate in cement (Metcalf, 1946).

Since each tripoli deposit has its own unique properties and market, if a new deposit were to be located, new uses and increases in existing uses would occupy production from the new deposit.

Tripoli production

Tripoli, as geologically defined, includes any fine-grained siliceous material. However, in the United States, only such materials from Missouri, Arkansas, and Oklahoma have been marketed as tripoli. Illinois tripoli is marketed under the name "amorphous silica", even though it contains only crystalline silica. Pennsylvania tripoli is produced under the term "rottenstone".

Tripoli (all names) is produced only in the eastern and southern United States (**Figure 1**). In 1986, tripoli was produced by six companies from deposits in five states (**Table 3**). Tripoli prices varied with color and grain size from $71.00 to $196.00 per ton in 1986 (**Table 4**). Tripoli production is steadily increasing.

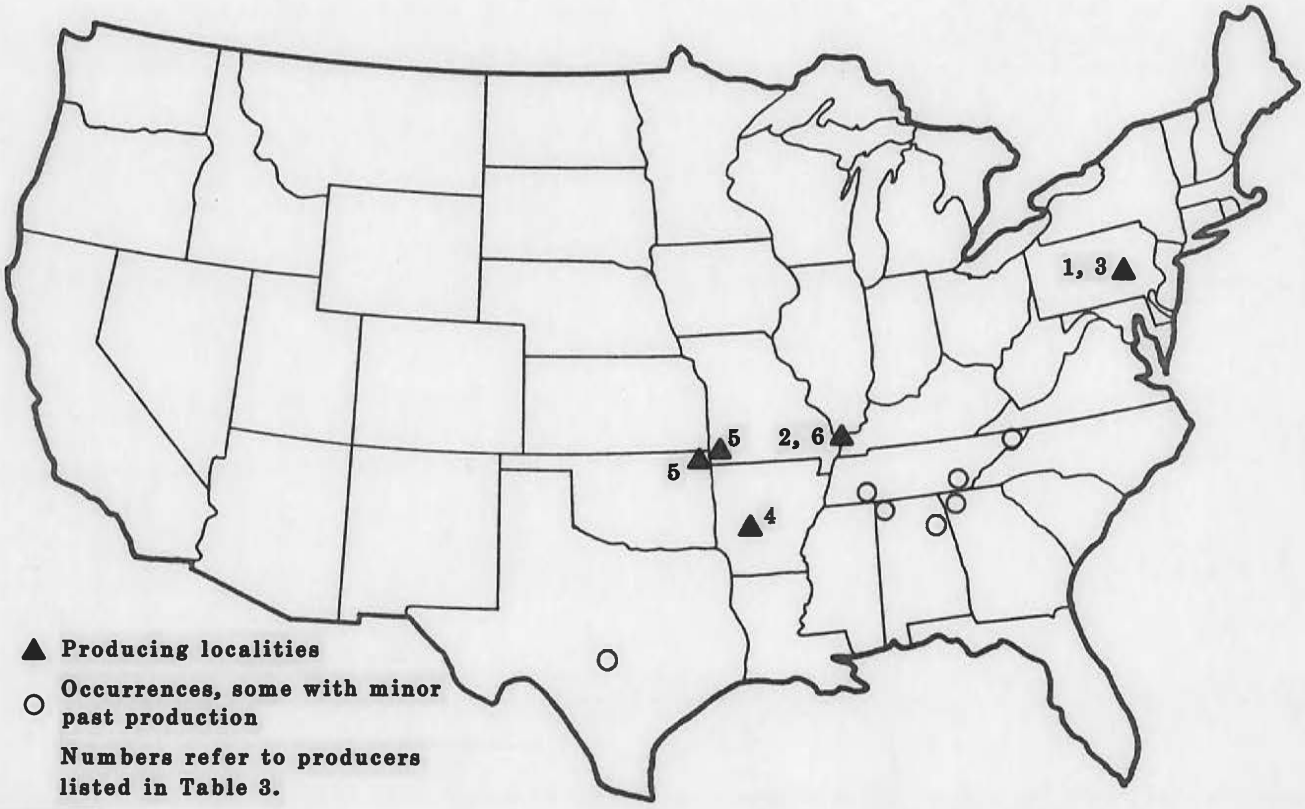

Figure 1. Domestic tripoli production and selected occurrences (after Austin, 1988; and Bradbury and Ehrlinger, 1983.

Table 3. Domestic tripoli producers, January, 1987 (modified from Austin, 1988). Locations shown on Figure 1.

	Producing firms[1]	Location
1.	B. J. Ulrich & Sons	Northumberland County, Pennsylvania
2.	Illinois Minerals Co.	Alexander County, Illinois
3.	Keystone Filler & Mfg. Co.	Northumberland County, Pennsylvania
4.	Malvern Minerals Co.	Garland County, Arkansas
5.	Processed Minerals, Inc.	Ottowa County, Oklahoma Newton County, Missouri
6.	Tammsco, Inc.	Alexander County, Illinois

[1]Includes producers of amorphous silica and Pennsylvania rottenstone.

Table 4. Tripoli prices, September, 1987 (Engineering and Mining Journal, 1987; and Austin, 1988).

Tripoli, packed in paper bags, in carload lots:	cents/pound
White, f.o.b. Elco, IL: passed 200 mesh	3.55¢
Rose and cream, f.o.b. Seneca, MO, and Rogers, AR:	
Once ground	2.90
Double ground	2.90
Air float	3.15
Amorphous silica, packed in 50-pound, paper bags, f.o.b. Elco, IL	dollars\ton
Passes 200 mesh, 90% to 95%	$71.00
Passes 200 mesh, 96% to 99%	72.00
Passes 325 mesh, 98% to 99.4%	78.00
Passes 325 mesh, 99.5%	95.00
Passes 400 mesh, 99.9%	128.00
Below 15 microns, 99%	137.00
Below 10 microns, 99%	164.00
Below 8 microns, 99%	196.00

Table 5. Processed tripoli[1] sold or used by producers in the United States (modified from Austin, 1988).

	1982	1983	1984	1985	1986
Total (short tons)	91,111	103,211	106,753	108,822	110,492
Total value (thousands of dollars)	$7,034	$9,280	$10,727	$10,122	$12,178

[1]Includes amorphous silica and Pennsylvania rottenstone.

Tripoli in Wyoming

Four occurrences of tripoli have been reported in Wyoming (**Figure 2**). Of these, only the Platte County occurrence may be significant. Its importance lies both in its reported large size and its location in the United States, north and west of other production (**Figure 1**). The distance to West Coast markets would be much shorter and transportation costs much lower. Also, since individual deposits have individual characteristics, a Wyoming tripolite deposit may provide a specialized product to the entire United States.

Reported occurrences

Campbell County/Cottonwood Creek

In 1888, the U.S. Geological Survey reported tripolite "35 miles west of Sundance on the Wind River" (U.S. Geological Survey, 1888). This site was located in Crook County in 1888, before the formation of Campbell County. Osterwald and others (1966) incorrectly placed this locality within present Crook County. Thirty-five miles west of Sundance is near Cottonwood Creek near Adon (approximate location shown on **Figure 2**). Although the deposit was described as extensive (U.S. Geological Survey, 1888), there has been no further report of tripoli from this area.

Recent investigations by U.S. Geological Survey personnel indicate the presence of silcrete in the Fort Union Formation (Paleocene) in this area (Jude Gassaway, personal

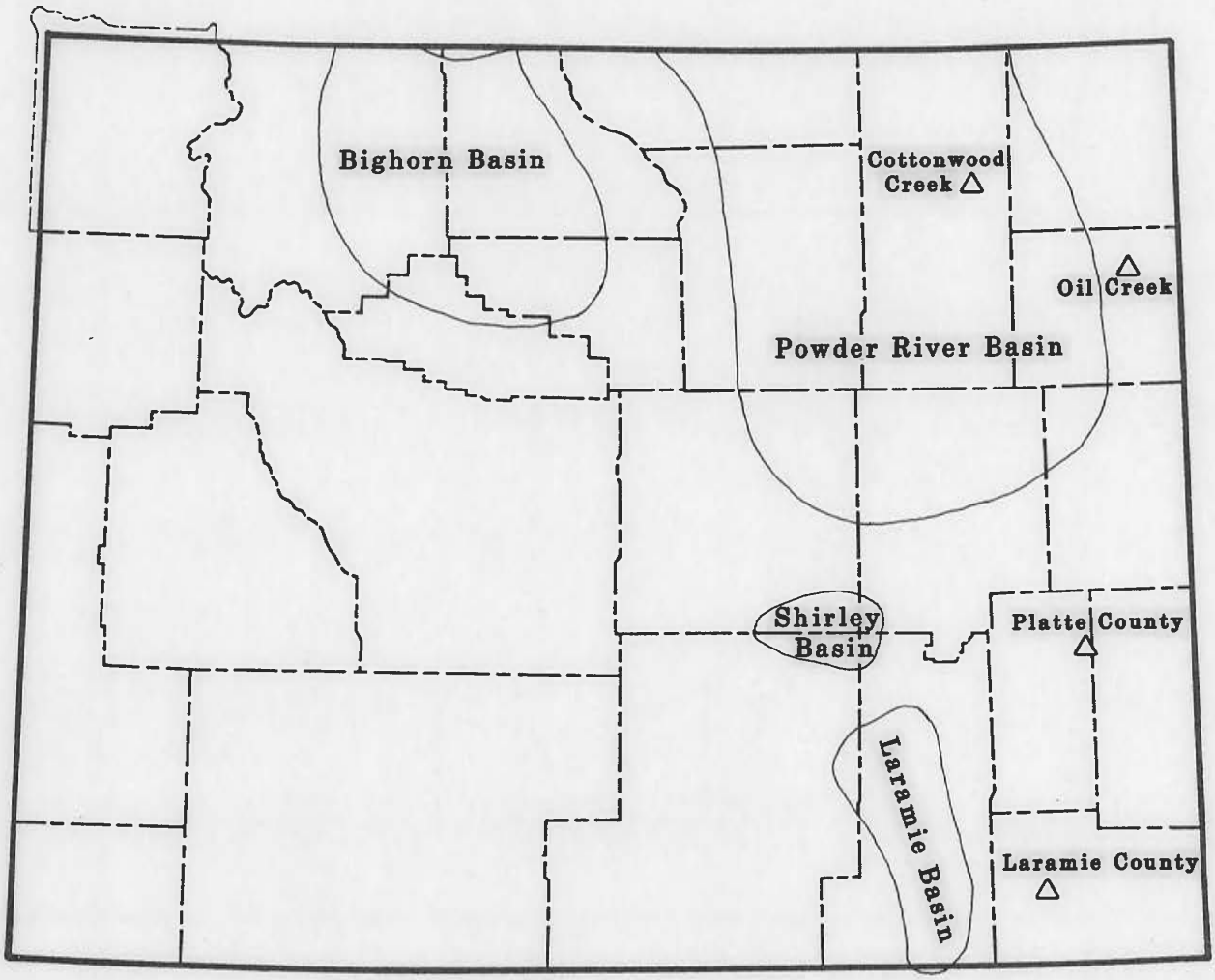

Figure 2. Reported occurrences of tripoli in Wyoming.

communication, May, 1989). It may be that the "tripoli" reported by the U.S. Geological Survey in 1888 is this silcrete.

Gravel deposits in Laramie County (and elsewhere)

Osterwald and others (1966) reported small nodules of agate coated with tripoli on the gravel flats west of Cheyenne. This type of occurrence is relatively common in Wyoming. The author has noted occurrences of tripoli coating agate and chert clasts or gravel deposits in the Wind River, Laramie, Shirley, Powder River, and Bighorn Basins (**Figure 2**). This type of tripoli occurrence is never economic. It is produced by surface weathering of the chert or agate clasts.

Platte County

Bartlett (1928) reported tripoli occurrences 8 or 10 miles north of Sunrise in Carboniferous rocks. This material was used for foundry facings and blocks were sawed using an ordinary wood saw. There has been no subsequent report of this "tripoli" and Investigations by the Wyoming Geological Survey did not locate an occurrence. These investigations resulted in locating a substance resembling tripoli, some of which has been used locally as an abrasive. Found in Sections 7, 8, and 17, T.28N., R.65W., this material is volcanic ash, probably of Tertiary age (Glenn Izett, U.S. Geological Survey, personal communication, May, 1989). The volcanic ash in that locality is too hard to be cut with a wood saw.

Weston County/Oil Creek Area

Extensive deposits of tripolite were reported by the U.S. Geological Survey (1888) in Crook County "on Skull Creek, near Stockade." This location is on Oil Creek, west of Newcastle, near what was known as Jenny's Stockade (Holt, 1885). The locality is now in Weston County. There has been no report of tripoli in this area since 1888.

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