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**Colorado vermiculite deposits:
Mines, Prospects, and Occurrences**

by

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Summary

This report lists and locates 26 vermiculite deposits in Colorado, including 16 historic mines, 6 prospects, and 4 additional known occurrences. Table 1 lists the 26 deposits and provides details regarding their locations, as well as references specific to each vermiculite locality. The same information shown in table 1 is also provided in the accompanying digital file **COverm.xls**, which is a spreadsheet in Excel format (Microsoft Excel version 5.0/95 workbook) that can be imported into a variety of digital database programs and used to plot site locations with Geographic Information Systems (GIS) software. The vermiculite deposits were located on 7.5-minute USGS (U.S. Geological Survey) topographic maps based on available literature and on field notes made by Alfred Bush. The latitude and longitude values listed in table 1 and data file **COverm.xls** were calculated from hand-plotted points on the topographic maps. Data file **Refs.xls** (also in Excel format) provides full reference information for the references cited in table 1 and **COverm.xls**. Figure 1 is an index map showing the distribution of the known vermiculite deposits in Colorado.

Vermiculite is a group of platy, mica-like, hydrated silicate minerals with the general formula: $(\text{Mg,Fe,Al})_3(\text{Al, Si})_4\text{O}_{10}(\text{OH})_2 \cdot 4\text{H}_2\text{O}$. Vermiculite group minerals are typically the products of aqueous alteration of micas, primarily biotite and phlogopite, and they pseudomorph the platy morphology of the replaced mica. The vermiculites display a wide range of chemical compositions and vary in color from light yellow to brown to black, generally with a bronze hue. As described by Bates and Jackson (1987): “They are characterized by marked exfoliation when heated at 800° to 1100°C; granules expand 6 to 20 times at right angles to the cleavage [accordion like] as the contained water is converted into steam. The result is elongated wormlike particles that entrap air and produce a lightweight material that is used as an insulator and as an aggregate in concrete and plaster.” Other common applications of vermiculite are in horticulture, as an additive to mulch, potting soils, and growing mixes, and as a carrier and extender for fertilizers, pesticides, and herbicides (Potter, 2001).

The first reported discovery of a vermiculite deposit of commercial size in the United States was in 1913 in the Turret mining district of Chaffee County, Colorado (Henahen, 1914; Gwinn, 1944). Another deposit in the Turret district, which was also discovered in 1913 and called the “Tung Ash” deposit (table 1), was the first vermiculite deposit mined and marketed in the U.S. (Gwinn, 1944). The bulk of Colorado vermiculite production occurred during 1933 to 1950, mainly from the mines in Fremont, Custer, and Gunnison Counties (U.S. Bureau of Mines,

1935-1940, 1944-1950; data for 1942-1944 are provided in Vanderwilt, 1947, p. 251). The U.S. Bureau of Mines reports that minor vermiculite production also occurred in Colorado during 1962 and 1963 (U.S. Bureau of Mines, 1963, 1964). Although little production data is published for the Colorado vermiculite mines, their output was evidently modest. For example, Vanderwilt (1947, p. 251) reported that for 1942, 1943, and 1944, annual total vermiculite production from Colorado mines was 2,574 short tons, 356 short tons, and 1,189 short tons, respectively. As done with most vermiculite raw ores, the Colorado vermiculite was heat processed to expand (exfoliate) the mineral before their use in industrial applications. Their main applications were as loose-fill insulation, as filler in lightweight plaster, and as lightweight concrete aggregate. The qualities and uses of Colorado vermiculite are described in Goldstein (1946) and Bush (1951).

Bush's assertion (1951) that vermiculite was part of the hydrothermal suite was based on the literature available in 1947 and a brief 1947 field reconnaissance. Subsequent research and field examinations in 1965 (continuing through 1975) resulted in the now virtually universally accepted conclusion that vermiculite development resulted from the supergene alteration of micaceous minerals in the zone of groundwater (meteoric water) circulation (Bush and Sweeney, 1968, p. 222; Bush, 1972, p. 350; 1976, p. 151).

Data Files Comprising this Report

Three data files comprise this report:

Readme.pdf	A copy of this text in Portable Document Format.
COverm.xls	A spreadsheet in Excel format (Microsoft Excel version 5.0/95 workbook)
Refs.xls	A spreadsheet in Excel format (Microsoft Excel version 5.0/95 workbook)

<i>Site name</i>	San Isabel deposit	Unnamed deposit	Shorty Robison-Marjorie Lode and Young deposits
<i>Extent of development</i>	Surface/underground mines	Surface occurrence	Surface/underground mines
<i>County</i>	Pueblo	Custer	Custer
<i>7.5-minute topographic map</i>	San Isabel	Mount Tyndall	Mount Tyndall
<i>Township</i>	24 S	22 S	22 S
<i>Range</i>	68 W	71 W	71 W
<i>Section</i>	8	8	5
<i>Sub-section</i>	SE $\frac{1}{4}$ SE $\frac{1}{4}$	SE $\frac{1}{4}$ SE $\frac{1}{4}$	Center of SW $\frac{1}{4}$
<i>Latitude</i>	37.971	38.1141	38.1595
<i>Longitude</i>	-105.015	-105.3386	-105.3520
<i>References</i>	Bush (1951, p. 344)	Alfred Bush, field notes, July 2001	Bush (1951, p. 333-335)

<i>Site name</i>	Sparling Ranch deposit	Unknown	Unknown
<i>Extent of development</i>	Surface/underground mines	Surface mine	Surface raw prospect
<i>County</i>	Custer	Custer	Fremont
<i>7.5-minute topographic map</i>	Mount Tyndall	Mount Tyndall	Curley Peak
<i>Township</i>	21 S	21 S	20 S
<i>Range</i>	71 W	71 W	71 W
<i>Section</i>	27	6	32
<i>Sub-section</i>	NE $\frac{1}{4}$ NW $\frac{1}{4}$	SW $\frac{1}{4}$ SE $\frac{1}{4}$	SE $\frac{1}{4}$ SE $\frac{1}{4}$
<i>Latitude</i>	38.1986	38.2461	38.2623
<i>Longitude</i>	-105.3124	-105.3627	-105.3386
<i>References</i>	Bush (1951, p. 335-336)	Christman and others (1959, p. 527-528)	Christman and others (1959, p. 527-528)

Table 1. Known vermiculite deposits in Colorado and corresponding references.

<i>Site name</i>	Unknown	Phares and Allen deposit	Voss Land deposit
<i>Extent of development</i>	Surface raw prospect	Surface/underground mines	Surface/underground mines
<i>County</i>	Fremont	Custer	Custer
<i>7.5-minute topographic map</i>	Curley Peak	Beckwith Mountain	Westcliffe
<i>Township</i>	20 S	21 S	21 S
<i>Range</i>	71 W	73 W	72 W
<i>Section</i>	33	26	16
<i>Sub-section</i>	SW ¹ / ₄ NE ¹ / ₄	NW ¹ / ₄ NW ¹ / ₄	SW ¹ / ₄ SW ¹ / ₄ SW ¹ / ₄
<i>Latitude</i>	38.2684	38.2032	38.2193
<i>Longitude</i>	-105.3240	-105.5185	-105.4453
<i>References</i>	Christman and others (1959, p. 527-528)	Bush (1951, p. 337-338)	Alderson (1925); Waldschmidt (1924); Bush (1951, p. 336-337)

<i>Site name</i>	Quist claim	Powderhorn No. 1 deposit	Powderhorn No. 2 deposit
<i>Extent of development</i>	Surface/underground mines	Surface mines	Surface mines
<i>County</i>	Custer	Gunnison	Gunnison
<i>7.5-minute topographic map</i>	Westcliffe	Rudolph Hill	Powderhorn
<i>Township</i>	21 S	46 N	46 N
<i>Range</i>	72 W	02 W	02 W
<i>Section</i>	17	14	12
<i>Sub-section</i>	SW ¹ / ₄ NE ¹ / ₄	NE ¹ / ₄ SE ¹ / ₄	NE ¹ / ₄ NW ¹ / ₄ NE ¹ / ₄
<i>Latitude</i>	38.2260	38.2396	38.2623
<i>Longitude</i>	-105.4517	-107.0566	-107.0417
<i>References</i>	Alderson (1925); Waldschmidt (1924); Bush (1951, p. 336)	Bush (1951, p. 339)	Bush (1951, p. 339-340)

Table 1. Continued.

<i>Site name</i>	Niles mine	Vermiculite mine	Letha Lee prospect
<i>Extent of development</i>	Underground mine	Surface mine	Surface raw prospect
<i>County</i>	Custer	Fremont	Fremont
<i>7.5-minute topographic map</i>	Hillside	Hillside	Hillside
<i>Township</i>	21 S	20 S	20 S
<i>Range</i>	73 W	73 W	73 W
<i>Section</i>	4	33	33
<i>Sub-section</i>	NW ¹ / ₄ SW ¹ / ₄ NW ¹ / ₄	SW ¹ / ₄ SE ¹ / ₄	SW ¹ / ₄
<i>Latitude</i>	38.2599	38.2669	38.2684
<i>Longitude</i>	-105.5531	-105.5449	-105.5500
<i>References</i>	Parker and Sharp (1970)	Parker and Sharp (1970)	Parker and Sharp (1970)

<i>Site name</i>	Unnamed deposit	Abe Lincoln Number 2 deposit	Spinney Mountain deposit
<i>Extent of development</i>	Surface occurrence	Surface occurrence	Surface occurrence
<i>County</i>	Chaffee	Chaffee	Park
<i>7.5-minute topographic map</i>	Nathrop	Buena Vista East	Spinney Mountain
<i>Township</i>	15 S	14 S	12 S
<i>Range</i>	77 W	77 W	74 W
<i>Section</i>	29	17	24
<i>Sub-section</i>	SW ¹ / ₄ SW ¹ / ₄	SW ¹ / ₄ NE ¹ / ₄	SE ¹ / ₄ NW ¹ / ₄
<i>Latitude</i>	38.7093	38.8329	38.994
<i>Longitude</i>	-106.0320	-106.0242	-105.618
<i>References</i>	Bush (1951, p. 333)	Bush (1951, p. 333)	Bush (1951, p. 342-343)

Table 1. Continued.

<i>Site name</i>	Hayman deposit	Quaintance mine	Riggs mine
<i>Extent of development</i>	Surface mine	Surface/underground mines	Surface/underground mines
<i>County</i>	Park	Jackson	Jackson
<i>7.5-minute topographic map</i>	Tarryall	Northgate	Northgate
<i>Township</i>	12 S	12 N	12 N
<i>Range</i>	72 W	80 W	80 W
<i>Section</i>	2	34	34
<i>Sub-section</i>	SE¼	Center of SW¼ SE¼	NE¼ NE¼ NE¼
<i>Latitude</i>	38.0395	40.9664	40.9782
<i>Longitude</i>	-105.4103	-106.3589	-106.3531
<i>References</i>	Bush (1951, p. 343-344)	Goldstein (1946); Argall (1949, p. 474); Bush (1951, p. 340-341)	Goldstein (1946); Argall (1949, p. 474)

<i>Site name</i>	Fourney mine	Resort claim	Unknown
<i>Extent of development</i>	Surface/underground mines	Surface raw prospect	Surface raw prospect
<i>County</i>	Jackson	Jackson	Jackson
<i>7.5-minute topographic map</i>	Northgate	Northgate	Northgate
<i>Township</i>	12 N	12 N	12 N
<i>Range</i>	80 W	80 W	80 W
<i>Section</i>	26	26	26
<i>Sub-section</i>	SW¼ SW¼	South half of south half	NE¼ SE¼ SE¼
<i>Latitude</i>	40.9789	40.9794	40.9817
<i>Longitude</i>	-106.3491	-106.3422	-106.3341
<i>References</i>	Goldstein (1946); Argall (1949, p. 474); Bush (1951, p. 341-342)	Bush (1951, p. 342); Neubert and Dersch (1994, p. A-11, fig. 41, sample #287)	Neubert and Dersch (1994, p. A-11, fig. 41, sample #285)

Table 1. Continued.

<i>Site name</i>	Unknown	Turret (Tung Ash) deposit
<i>Extent of development</i>	Surface raw prospect	Underground mine
<i>County</i>	Jackson	Chaffee
<i>7.5-minute topographic map</i>	Northgate	Cameron Mountain
<i>Township</i>	12 N	51 N
<i>Range</i>	80 W	09 E
<i>Section</i>	25	33?
<i>Sub-section</i>	NW¼ SW¼	NW¼ SW¼?
<i>Latitude</i>	40.9836	38.629
<i>Longitude</i>	-106.3320	-105.984
<i>References</i>	Neubert and Dersch (1994, p. A-11, fig. 41, sample #284)	Henahen (1914, p. 135-139); Bush (1951, p. 332-333)

Table 1. Continued.

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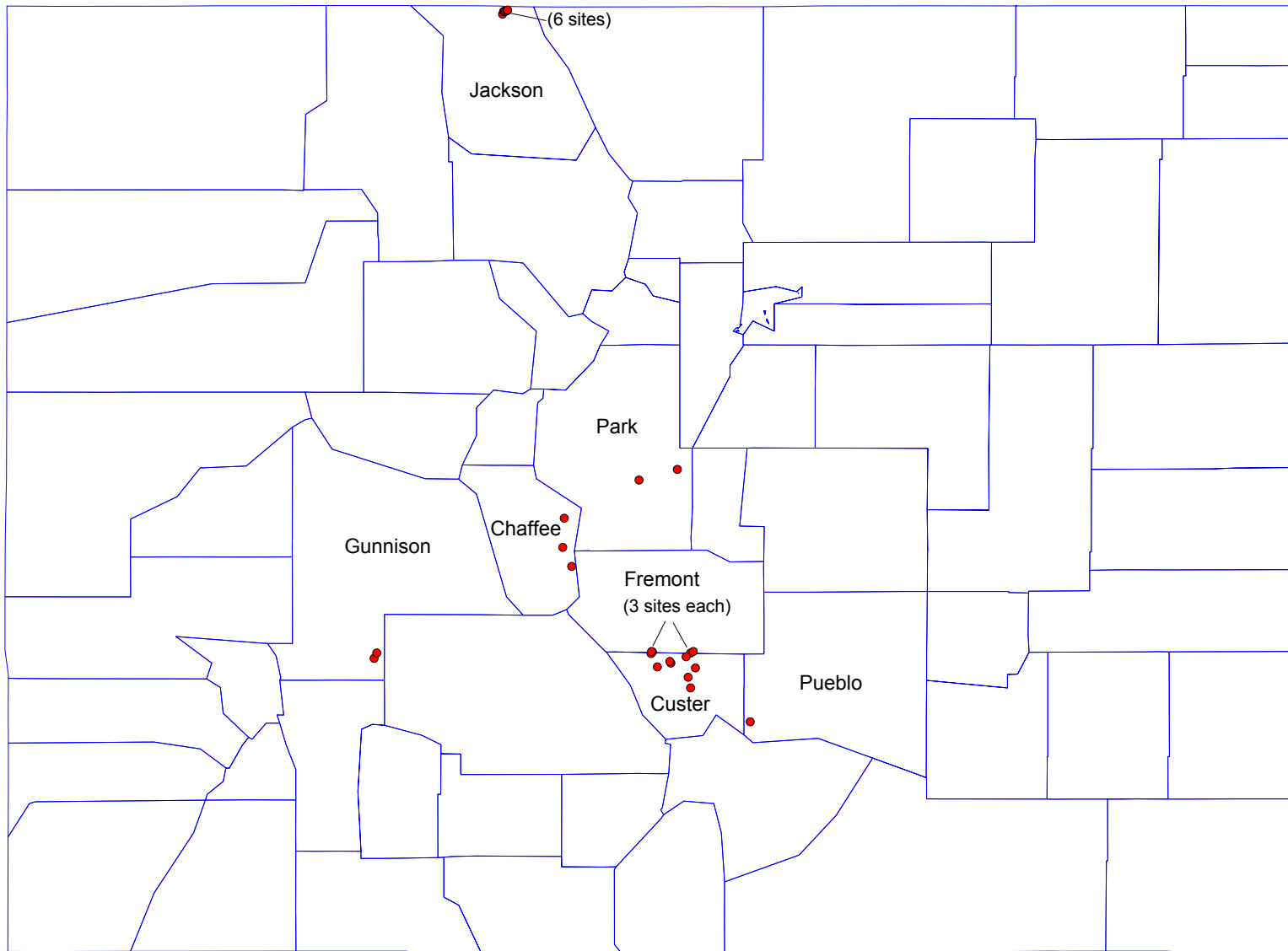


Figure 1. Index map showing the distribution of the 26 known vermiculite deposits in Colorado.