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Gary B. Glass, State Geologist

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MINERAL PIGMENTS IN WYOMING

by

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Abstract

Mineral pigments are coloring agents used in many materials. Two localities in Wyoming produced hematite for pigment in the past; one locality produced until 1991. Currently, white marble from near Wheatland is sold for pigment. This report describes these and other potential sources of mineral pigments in Wyoming.

Introduction

Mineral pigments are any insoluble rock products used as coloring agents. The U. S. Bureau of Mines defines pigments as "insoluble colored substances used as bases in compounding ceramic colors, inks, paints, etc." (Thrush, 1968). Iron oxide minerals are the most important and common pigment materials (Hancock, 1983), although several other rocks and minerals are also being used. This report outlines the uses of mineral pigments, and summarizes past and present production and occurrences of mineral pigments in Wyoming.

Iron oxide minerals commonly used in pigments include, in order of importance, hematite, goethite, lepidocrocite, magnetite, and pyrite (Hancock, 1983). Colored clays are sometimes used as mineral pigments, as are various colors of marble and mica (John Challinor, Swansea Minerals, personal communication, 1991). Rutile is used as a source of white titanium oxide pigment (Lynd, 1989). Specifications for natural pigment materials include color, tint tone, tint strength, particle size, moisture retention, solubility, dispersion, and oil absorption (**Table 1**). Iron oxide pigments must also contain from 96 percent to over 99 percent Fe_2O_3 (Hancock, 1983).

Iron oxide pigments are used primarily to color construction materials such as brick and concrete. Other uses include paint pigments; coloring agents for ceramics, glass, paper, plastic, rubber, and textiles; in foundry sands, industrial chemicals, and ferrites (ferromagnetic ceramics); and to color animal feed and fertilizer. Another minor use for iron oxide pigments is in cosmetic pigments. The United States both imports and exports iron oxide pigment, although 77 percent more pigment was imported than exported in 1988 (Mickelsen, 1990).

Table 1. Typical specifications for color pigments (after Hancock, 1983).

Property	Specifications
Mass color	3 ΔE FMC-2[1] units (maximum)
Tint tone	3 ΔE FMC-2[1] units (maximum)
Tint strength	±5% of standard (maximum)
Particle size	0.10% retention on 325 mesh
Moisture at 110°C	0.25% maximum
H_2O soluble salts	0.15% maximum
Dispersion	6.0 Hegman fineness (minimum)
Oil Absorption	±10% of standard (maximum)

[1]3 standard deviation units from the FMC-2 standard color chart.

In 1987, iron oxide pigments were mined and processed in Georgia, Missouri, Virginia, and Michigan (Mickelsen, 1990); a small amount was also mined in Wyoming. Prices for iron oxide pigments increased during the 1980s (Mickelsen, 1990), and new uses for mineral pigments are being developed.

Mineral pigment occurrences in Wyoming

In Wyoming, the only mined iron oxide used for pigment has been hematite. Pockets of hematite from deposits one mile north of Rawlins were mined for pigment. This color was known as "Rawlins Red". Hematite from iron mining in the Hartville uplift, particularly from the Sunrise and Good Fortune iron mines, was used as pigment in boxcar paint and cosmetics.

Finely ground white marble is currently produced by Georgia Marble Company at Wheatland, Wyoming. It is sold for use as mineral pigment.

Occurrences of mineral pigment in Wyoming are listed below. Each occurrence is shown on the index map (**Figure 1**). This list is necessarily incomplete because there are undoubtedly many rocks in Wyoming that could be a source for coloring agents. A rock can be used for a mineral pigment if the color is uniform and consistent

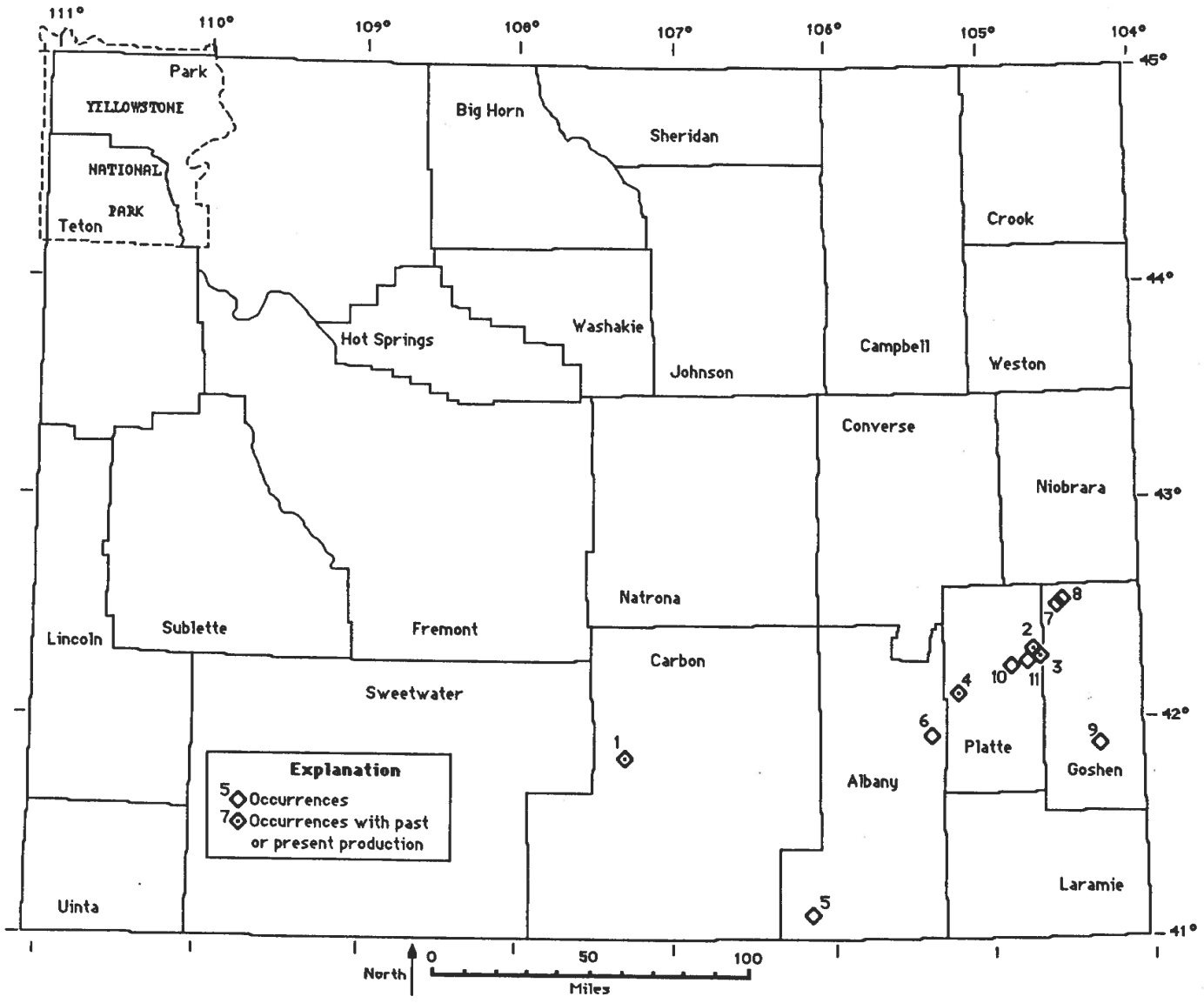

Figure 1. Index map showing occurrences of mineral pigments in Wyoming. Numbers refer to localities discussed in text.

in the rock, and if the rock can be ground up or otherwise dispersed into fine particles that retain the color. Only those iron oxide deposits known to contain hematite suitable for pigment are described below. The reader is also referred to Harrer (1966) and Osterwald and others (1966) for descriptions of known iron oxide mineral occurrences in Wyoming. There are no known occurrences of rutile in Wyoming of sufficient size to warrant development for mineral pigment (Harris, 1990).

Deposits with past or present production

Carbon County

Rawlins Red deposits (No. 1, **Figure 1**). Located in SE section 5, SW section 6, and NE section 8, T21N, R87W, Rawlins 7 1/2' topographic quadrangle map.

Replacement deposits of hematite are found in the Flathead Sandstone and the Madison Limestone in this area. The hematite occurs as oolitic, pisolitic, and stalactitic forms as well as low-density, soft, powdery and ocherous hematite mixed with some limonite (Harrer, 1966). It is estimated that most of the individual occurrences each contain less than 300 tons of hematite. Subsurface reserves may be present northeast of the surface prospect pits (Harrer, 1966).

These deposits were mined at the surface and by shallow underground methods in the late 1800s, primarily for boxcar paint. Less than 100,000 tons of ore were produced (Lovering, 1929). A small amount of material was removed as late as 1945 for pigment and as an additive to drilling mud (Harrer, 1966). The area is now partially reclaimed, and as of June, 1992, some of the pits were filled with trash. Since houses are now located within yards of the reclaimed mining area, further development of these deposits may be impractical or impossible.

Platte County

Sunrise and Chicago pond fines and tailings deposit (No. 2, **Figure 1**). Located in NE section 7, T27N, R65W, Guernsey 7 1/2' topographic quadrangle map.

Iron ore from the Sunrise and Chicago surface and underground iron mines was processed into iron at the Sunrise mill, operated by the CF&I Steel Company

(CF&I). Although iron production ceased in 1982, the pond fines from the milling continued to be used for boxcar paint and cosmetic pigment until the late 1980s. The pond fines were mined by the Red Dog Mining Company, in agreement with CF&I, and shipped to Solomon Grind-Chem Services of Springfield, Illinois. Shipments of this material were small and averaged around 100 tons per year.

In 1991, about 100 tons of pond fines were still stockpiled on a concrete pad in Columbia Gulch, located between the Sunrise and Chicago mines. A resource of pond fines also remains in the settling pond in Columbia Gulch. The Sunrise mine area (which includes the Chicago mine) was recently abandoned by CF&I, and the mining of pond fines and production of pigment has ceased. Due to the bankruptcy of CF&I, the ownership of the pond fines and the remaining facilities at Sunrise is not certain; however, Red Dog Mining plans to resume production when the ownership of the Sunrise mine is determined.

In early 1992, a Mr. Les Wahl applied for a permit to remove some tailings from the Sunrise area for processing into mineral pigment. This material is similar to the pond fines, but requires processing to achieve the same color and grade as the fines.

Good Fortune iron mine deposit (No. 3, **Figure 1**). Located in SE section 7, T27N, R65W, Guernsey 7 1/2' topographic quadrangle map.

Iron ore was mined at the Good Fortune mine in the mid-1950s. Some of the ore, which was shipped to Pascagoula, Mississippi, was reportedly used for pigment. The paint made with this pigment was reportedly used to protect hulls and external structures of ships built at the Ingalls Shipbuilding Plant (Richard Rush, Guernsey, Wyoming, personal communication, 1988).

Georgia Marble Company's quarry (No. 4, **Figure 1**). Located in section 3, T24N, R70W, Hightower SW 7 1/2' topographic quadrangle map.

White marble, known as Wyoming White, is quarried by the Georgia Marble Company. At a processing plant in Wheatland, Wyoming, the marble is crushed, sized, and sold as aggregate. The finest sizes are used as coloring agents (pigment) in concrete, plastic, and other products (Jerry MacArthur, Georgia Marble Company, personal communication, 1991).

Occurrences

Albany County

Lincoln Gulch (No. 5, **Figure 1**). Located in SE section 33, T13N, R78W, and NE section 4, T14N, R78W, Albany 7 1/2' topographic quadrangle map.

A dark purple mafic rock, probably a pyroxenite cumulate, is exposed in this area. The rock is evenly colored, medium grained, and resistant. The finer-sized material produced as a by-product of decorative aggregate production could be marketable as a coloring agent (pigment) in construction materials or other products.

Kennedy Ranch black granite (amphibolite) quarry (No. 6, **Figure 1**). Located in SW SE section 9 and NW NE section 16, T23N, R72W, Bull Camp Peak 7 1/2' topographic quadrangle map.

Sunrise Stone is currently operating a dimensional stone quarry at this location. The quarried stone is a fine grained black amphibolite. The rock is almost pure black with a purplish iridescence, and is marketed as "Wyoming Raven." Fines in the waste from the quarrying operation may be used as a gray to dark gray coloring agent.

Goshen County

Muskrat Canyon (No. 7, **Figure 1**). Located in N2 section 24 and SE section 13, T30N, R65W, Rawhide Buttes West 7 1/2' topographic quadrangle map.

Fine grained hematite and massive hematite occurs in pods and lens-shaped bodies in both hematitic schist and fine-grained quartzite host rocks in this area. Fine grained hematite also occurs in tailings near the site of the abandoned smelter at the Michigan mine in NW section 24. The amount of hematite that may qualify as mineral pigment is not known.

Little Wildcat Canyon (No. 8, **Figure 1**). Located in SW section 8, NW section 17, and NE section 18, T30N, R64W, Rawhide Buttes West 7 1/2' topographic quadrangle map.

Dark gray and dark red marbles occur at the mouth of Little Wildcat Canyon and extend southwest to Muskrat Canyon at Muskrat Spring (Harris, 1991). Although the marble loses some color strength when finely ground, the resulting powder may be usable as a coloring agent.

Yoder clay (No. 9, **Figure 1**). Located in S2 section 29, and NE section 32, T23N, R62W, Yoder 7 1/2' topographic quadrangle map.

Dark red, brick red, green to blue green, and buff clay in the lower Chadron Formation (Rapp and others, 1957) is exposed about 1.5 miles northwest of Yoder, Wyoming, in an irrigation canal and in spoil piles from the construction of the canal. Very small amounts of the red clay have been used (both as construction material and as pigment) to surface athletic fields.

Platte County

Fairbank area (No. 10, **Figure 1**). Located in S2 NW section 26, T27N, R66W, Guernsey 7 1/2' topographic quadrangle map.

Orange to salmon pink marble is found on isolated hills in this area, and outcrops are found about 3/4 mile to the west along the North Platte River, (Harris, 1991). Although the marble loses some color strength when finely ground, the resulting powder appears to be usable as an orange coloring agent.

Sparks Canyon (No. 11, **Figure 1**). Located in NE section 13, T27N, R66W, and N2 section 18; T27N, R65W, and extending into sections 8 and 17, T27N, R65W, Guernsey 7 1/2' topographic quadrangle map.

Light and dark gray and dark red marbles occur at the head of Sparks Canyon and on the brush-covered hill in the north half of section 18 (known locally as MS-108) (Harris, 1991). Although the marble loses some color strength when finely ground, the resulting powder appears to be usable as a coloring agent.

Summary and conclusions

Mineral pigments have been relatively minor commodities produced by Wyoming's mineral industry. Future development, such as at the Sunrise mine or elsewhere, may result in the development of small mines. Production will probably be limited to a few thousand tons or less per year at each locality.

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