Gunnison County

Powderhorn District (aka **White Earth District**)

The Powderhorn District is a unique area in southern Gunnison County. The mining district has variously been considered to be synonymous with the White Earth, **Cebolla**, **Vulcan**, and **Domingo Districts** (Vanderwilt, 1947). Henderson (1926) did not list the Powderhorn, but considered the White Earth District the same as the Cebolla District. Mindat.org also lists the White Earth and the Powderhorn as the same district. Dunn (2003) considers the Powderhorn to be part of the larger Cebolla District.

Streufert (1999), in his survey of Gunnison County mining districts, considered the Powderhorn District to cover "a large area in the southern portion of Gunnison County," much larger than we have considered it here. The central geologic and topographic feature of the Powderhorn District is Iron Hill. Iron Hill consists of a carbonatite stock with numerous carbonatite dikes, pyroxenite and syenite intrusions in the surrounding area. For this reason, we are considering the Powderhorn District to encompass the area in which these uncommon rocks occur. The best geographic definition of the Powderhorn District is found in Olson and Hedlund (1981), who outline the area that includes the thorium-bearing veins in the Powderhorn, Rudolph Hill, and Gateview Quadrangles, compiled from the geologic maps of those quadrangles (Hedlund and Olson, 1975; Olson, 1974; and Olson and Hedlund, 1973 respectively). Thus, the Powderhorn District overlaps other districts, but is defined exclusively on the thorium-bearing rocks.

Hunter (1925) first noted in southern Gunnison County "an area of highly sodic and nephelinitoid rock, ranging from soda to cancrinite syenite, ijolite and nepheline gabbro to pyroxenite with many curious apatite, analcite and melilite rocks." He also described the carbonate rocks, calling it as many early workers, *limestone* and postulating a sedimentary origin. He considered the entire complex as Precambrian.

Larsen (1942) revisited the complex and described in detail the unusual rocks. He suggested the possibility that the *marble* was of igneous origin. He also was not certain of the age, pointing out that the rocks of the complex clearly intruded known Precambrian rocks and were overlain by know Jurassic-age strata.

Following up on a survey by Burbank and Pierson (1953), Olson and Wallace (1956) referred to "pre-Jurassic metamorphic and igneous rocks" of the district. They took special note of the thorium-bearing rocks, which had been the object of prospecting for a number of years - mostly contained, they said, in thorite and thorogummite. They also mentioned the rare earth-bearing apatite and provided a detailed description and discussion of the Little Johnnie Claims.

In a brief description, Hedlund and Olson (1961) were the first to refer to the rocks as *carbonatite*. They distinguished four rock types with higher radioactivity signatures: carbonatite dikes, magnetite-ilmenite-perovskite bodies, thorite veins and trachyte porphyry dikes. The thorium in the richest areas - the carbonatite dikes - was contained in monazite. Rare earths were described as occurring in baestnesite and synchisite.

Staatz et al. (1979) considered the thorium-rich dikes as a potential thorium resource as well as the major Iron Hill stock, although the latter is also rich in niobium and rare earth elements (REE). In a follow-up report, Staatz et al. (1980) and Armbrustmacher (1980) calculated the resource for ThO_2, RE oxides, Nb_2O_5 and U_3O_8 from the stock itself.

Olson and Hedlund (1981) summarized the geographic distribution of rocks enriched in thorium and thus provided a good outline of the Powderhorn District as this report defines it, compiled from the quadrangle mapping noted above.

In the twenty-first century, considerable interest in "strategic minerals," led to more investigations of the Powderhorn District and the Iron Hill complex for information on REE, thorium, niobium, and titanium. Van Gosen (2009) provided a history of exploration at Iron Mountain, and reported an estimate of reserves from Teck Corporation suggesting their White Earth property along (within the Powderhorn District) contains 41.8 million metric tons of mineable reserves grading 13.2% TiO_2. The titanium is present in perovskite, lucoxene, ilmenite, and titanite. This was noted by Thompson (1987) as the largest known titanium resource in the United States. Van Gosen et al. (2009) and Long et al. (2010) also summarized the resource estimates for those commodities in the Powderhorn District. An additional reference is Del Rio (1960).

Mines listed in the district (mindat.org) include:

- Aaberlite Mines
- Alexite Manganese Mine
- Alexite Vermiculite Mine (Novel)
- Beaver Creek (2)
- Beaver Creek basin
- Boyd Roberts property
- Cebolla Creek Titaneferous Iron Deposit
- Hone-Nielson property
- Huntsman Gulch
- Iron Hill (Iron Hill carbonatite complex)
- Iron Hill Area (Big Iron Hill; Du Pont Adit)
- Powderhorn No. 1 Mine
- Powderhorn No. 2 Mine
- Powderhorn Prospect (Cebolla Creek)
- Titan Mine (Patented Claims: Iowa; Horseshoe; Centre; Aaberite Mines)
- Vermiculite Mining Company Mine

Minerals in the district (mindat.org) include:

Aegirine
Åkermanite
Albite
Analcime
Anatase
Andradite var: Melanite
'Apatite'
Augite
Baryte
'Bastnäsite'
Bastnäsite-(Ce)
'Biotite'
Britholite-(Ce)
Britholite-(Y)
Brookite
'Brugnatellite'
Calcite
Cancrinite
'Cebollite' (FRL)
Cerite-(Ce)
Chalcopyrite
'Chlorite Group'
'Columbite'
Diopside
Dolomite
Epidote
Fluorapatite
Fluorite
Galena
'Garnet'

Gehlenite
Goethite
Grayite
'Gunnisonite'
Hastingsite
Hematite
var: Martite
var: Specularite
'Hornblende'
Hydroxylapatite
var: Carbonate-rich
Hydroxylapatite
Ilmenite
'Juanite' (FRL)
Kyanite
'Leucoxene'
'Limonite'
Magnesio-arfvedsonite
Magnesio-hornblende
Magnesite
Magnetite
var: Titaniferous Magnetite
'Melilite'
Microcline
'Monazite'
Monazite-(Ce)
Monticellite
Muscovite
Natrolite
Nepheline
Norsethite
'Olivine'
Opal
Orthoclase
'Parisite'
Parisite-(Ce)
Perovskite
Phlogopite
Piemontite
Pyrite
'Pyrochlore'
Pyrochlore Group
Pyrophanite
'Pyroxene Group'
Quartz var: Jasper
Rhabdophane-(Ce)
Richterite
Riebeckite
Rutile
Schorlomite
Siderite
Siegenite
Sphalerite
Spinel
Staurolite
Strontianite
'Synchysite'
Synchysite-(Ce)
Tainiolite
Thorite
Titanite
Tremolite
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'Wad'
Winchite
Wollastonite
Xenotime-(Y)
Zircon
Zoisite

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