

GEOLOGY AND MINING IN THE BLACK HILLS

Bob Otto

The Black Hills of South Dakota and Wyoming rise suddenly out of the prairie and have been described by a number of authors as an “Island in the Plains”. The Black hills are approximately 205 km long and 105 km wide. There is a core of Precambrian rocks that range in age from 2.5 to 1.84 billion years old. These core rocks range from granites to slates to iron-formation to quartzites and to meta-volcanics. The rocks that were deposited above the Precambrian core unconformably range in age from Cambrian to Holocene. The Black Hills uplift consists of a number of smaller domal uplifts which are all cored with Precambrian rocks. The main and largest area is called the Central (or Southern) Black Hills has Harney Peak (renamed as Black Elk Peak) (7244 feet above sea level) as the highest point and is made of granite. The northern part is called the Lead Dome and is where the Homestake mine is located. The highest point here is Terry Peak (7064 feet above sea level) which is made up of Tertiary-age intrusives. There is also a small but significant dome west of the Lead dome called the Tinton dome which is on the South Dakota-Wyoming line. The last area is the Bear Lodge Mountains where Devils Tower is located and the tallest point is Warren Peak (6652 feet above sea level) this uplift is in Wyoming. Complicating the geology of the area is a band of Tertiary-age intrusives that trend roughly east-west in the northern Black Hills and are exposed in the three northern domes but not in the Central Black Hills.

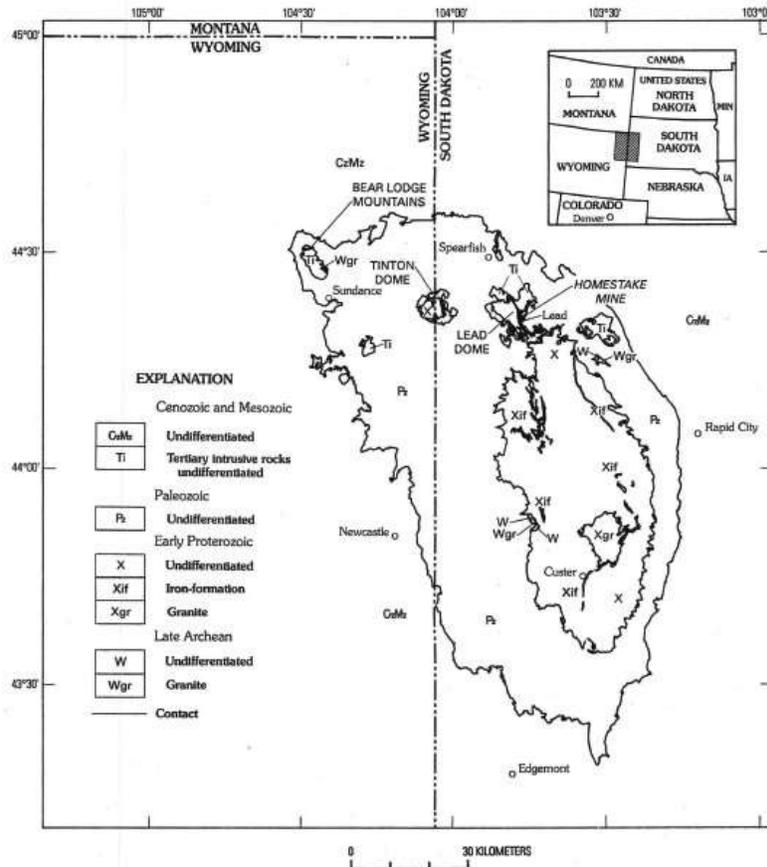


Figure 1. Generalized geology of the Black Hills uplift. (Modified from Caddey, S. W., et al, 1991, The Homestake gold mine, An early Proterozoic iron-formation-hosted gold deposit, Lawrence County, South Dakota: U.S.G.S Bulletin 1857)

Mining in the Black Hills has occurred in all areas of the Black Hills. Mining has been done for gold, tin, lead-zinc, silver, copper, tungsten, lithium, columbium-tantalum, feldspar, and mica. Gold has been the predominant item found and produced. The majority of the gold production has occurred in the Lead dome. Homestake mine has been the largest gold producer and has produced over 40million troy ounces. The Wharf mine is now owned by Coeur Mining and has produced over 2 million troy ounces and is the only currently operating gold mine.

The Homestake mine has produced its gold from iron-formation which is a rock that contains a minimum of 20% iron and can contain carbonates or silicates. The Homestake gold occurs only in the iron-formation and was emplaced there during the Precambrian time at approximately 1.84 billion years ago. Theories for the origin of the gold vary from gold that was deposited with the rock and was then concentrated in the ore-bodies we see today or the most current theory that the gold was emplaced during Precambrian metamorphism.

Below is a gold production table that lists gold-production as of 1971 (from Norton, J. J., USGS Circular 699).

TABLE 1.—Gold production of the Black Hills, 1875-1971

Mine or locality	Location	Principal source of ore ¹	Gold produced (in troy ounces) ²
Principal mines:			
Homestake	At Lead, Lawrence County	pCif	31,446,997
Golden Reward group of mines .	2 mi. (3 km) SW. of Lead	Cdd	³ 950,000
Bald Mountain group of mines .	3 mi. (5 km) W. of Lead	Cdd	⁴ 836,000
Mogul	3 mi. SW. of Lead	Cdd	⁵ 350,000
Placers of Deadwood region	Near Deadwood	QTp	⁶ 200,000
Maitland (Penobscot)	3 mi. NNW. of Lead	Cdd	147,000
Wasp No. 2	2 mi. S. of Lead	Cdd	⁷ 120,000
Keystone and Holy Terror	At Keystone, Pennington County	pCq	86,000
Gilt Edge	5 mi. (8 km) ESE. of Lead	Ti	56,000
Spearfish Gold	7 mi. (11 km) W. of Lead	Mp	⁸ 45,464
Clover Leaf (or Uncle Sam)	At Roubaix, 7 mi. SE. of Lead .	pCq	43,885
Lundberg, Dorr, and Wilson	2 mi. WSW. of Lead	Cdd	43,617
Hoodoo—Union Hill	5 mi. ESE. of Lead	Ti	⁹ 30,000
Reliance	5 mi. W. of Lead	Cdd	27,003
Rockerville placers	Just E. of Rockerville, Pennington County	QTp and Cdc	¹⁰ 20,000
Ragged Top	6 mi. W. of Lead	Mp	15,800
Deadwood Standard	7 mi. W. of Lead	Mp	11,953
J.R.	3 mi. N. 60° E. of Hill City, Pennington County	pCq	11,500
Hidden Fortune	Just N. of Lead	Cdd	10,997
Other deposits:¹¹			
Lawrence County (especially Alder Creek, Cleopatra, Bismarck, Golden Crest, Monarch, and Kicking Horse). ¹²	Cdd	50,000
Pennington County (especially Empire, Bullion, Standby, and Sunnyside). ¹²	pCif and pCq	30,000
Custer County	pCq	4,000
Total production from identified sources			34,536,246
Production from unidentified sources			158,306
Total recorded production			34,694,552

The pegmatite bodies are located primarily around the Harney Peak granite in the Southern Black Hills. But there are important pegmatites in the Tinton Dome. Mica was the first product from the pegmatites to be mined starting in 1879. Tin was mined after 1883. Lithium was being mined (spodumene and amblygonite minerals) around 1900. The minerals of columbite\tantalum were mined starting in 1918. Feldspar, beryl, scrap mica, and specimen production (rose quartz and rare phosphate minerals) continue to the present day.

The other mines in the hills produce their gold from a variety of different environments. They range from gold in quartz veins within the Precambrian rocks to Tertiary-age replacement deposits in the over-lying rocks. The Precambrian rocks have also produced copper and silver. The replacement deposits related to the Tertiary-age intrusives within the Cambrian and younger rocks have produced gold, lead-zinc, tungsten and silver.

During the Mining History Association's 2018 conference we will be in the heart of Black Hills mining and its history. We hope you can join us in experiencing and learning more about our proud mining heritage.

Suggested Reading

Bayley, R. W., 1970, Structure and mineralization of Precambrian rocks in the Galena-Roubaix district, Black Hills, South Dakota: U.S. Geological Survey Bulletin 1312-E, pp. E1-E15

Bayley, R. W., 1972, A preliminary report on the geology and gold deposits of the Rochford district, Black Hills, South Dakota: U.S. Geological Survey Bulletin 1332-A, pp. A1-A24

Caddey, S. W., Bachman, R. W., Campbell, T. J., Reid, Rolland, R. R., and Otto, R. P., 1991, The Homestake gold mine, an early Proterozoic iron-formation hosted gold deposit, Lawrence County, South Dakota: U.S. Geological Survey Bulletin 1857-J, pp. J1-J67

Fielder, M., 1970, The treasure of Homestake gold: Aberdeen, S. Dak., North Plains Press, 478 p.

Fielder, M., 1972, A guide to Black Hills ghost mines: Aberdeen, S. Dak., North Plains Press, 240 p.

Fielder, M., 1978, Lost gold: Aberdeen, S. Dak., North Plains Press, 188 p.

Fielder, M., 1978, Silver is the fortune: Aberdeen, S. Dak., North Plains Press, 239 p

Linde, M., 1976, Rushmore's golden valleys: Custer, South Dakota, Martha Linde, 140 p.

Mitchell, S. T., 2009, Nuggets to neutrinos: The Homestake story: Xlibris Corporation, 738 p.

Page, L. R. and others, 1953, Pegmatite investigations 1942-1945 Black Hills, South Dakota: U.S. Geological Survey Professional Paper 247, 228 p.

Parker, W., 1966, Gold in the Black Hills: Lincoln, Nebraska, University of Nebraska Press, 259 p.

Parker, W., 1981, Deadwood-The golden years: Lincoln, Nebraska, University of Nebraska Press, 302 p.

Roberts, W. L. and Rapp Jr., G., 1965, Mineralogy of the Black Hills: Rapid City, South Dakota, South Dakota School of Mines and Technology Bulletin 18, 268 p.

Smith, D. A., 2001, Staking a claim in history - The evolution of Homestake Mining Company: Walnut Creek, California, Homestake Mining Company, 215 p

Waterland, J., 1987, The spawn & the mother lode: Rapid City, South Dakota, Grellind PhotoGraphics & Typesetters, 268 p.

Waterland, J. K., 1988, Gold & silver or sweat & tears: Rapid City, South Dakota, Grellind PhotoGraphics & Typesetters, 244 p.

Waterland, J. K., 1991, The mines around & beyond: Rapid City, South Dakota, Grellind PhotoGraphics & Typesetters, 424 p.