

BOOK REVIEW

CHASING THE GLITTER: BLACK HILLS MILLING, 1874–1959, by Richard L. Clow. South Dakota State Historical Society Press, Pierre, South Dakota, 2002, 202 p.

The Black Hills mining district of South Dakota, including its premier Homestake Mine, is one of the richest gold producing districts in the world. During the 1930s, South Dakota was second only to California in gold production in the United States. Clow's book details the natural, technological, and market influences that made this district so important. A major theme of the book is the complex interplay among prevailing metal prices, investment capital, interested entrepreneurs, technological advances, a stable work force, and availability of well-trained mining professionals. The book describes the numerous and eventually successful attempts to remove the gold and silver from sulfide ores, which required new and ingenious milling methods. The author reviews the discovery and processing of gold ores in the Black Hills and provides both a history of the mining district and a concise introduction to the dealings among the miners, the U.S. Government, and the native peoples of the area. A wealth of historical photographs and drawings illustrates the processes and machinery used to extract the metals from the ore. Many historic photographs are also included of the engineers, miners, mills, and mines in the Black Hills mining district.

The book is divided into 12 chapters that present a logical sequence ranging from a description of the geology of the Black Hills from a miner's perspective (Chapter 2), through development of power for the mills (Chapter 4), the various extraction techniques used in recovery of the metals (Chapters 5 through 11), and a brief section on conclusions (Chapter 12). Chapter 2 provides a succinct overview of the geologic setting of the mines and the influence that the geometry of the ore bodies (veins, shear zones, and replacement deposits) had on the ability to mine and process the ore. Early placer mining recovered "free" or native gold and silver from the streams, and this led to discovery of the lode or bedrock deposits. The gold and silver in the ore deposits in bedrock are bound up in complex sulfide minerals or as very fine grains of native gold and silver that require extensive crushing to liberate. Much of the volume is a detailed description of the various methods used to extract the gold and silver from the enclosing rock. These include amalgamation with mercury, the use of bromine and chlorine, smelting, treatment with cyanide and treatment of the refractory or "blue" ores. The author demonstrates a thorough understanding of both the processes and their historical importance. The volume includes a useful index, an extensive set of footnotes and references, and a bibliographical essay that is arranged by subject such as General Works, Geol-

ogy of the Black Hills, and Smelting. While concentrating on the processing of gold ores, Clow briefly describes the occurrence of other commodities such as tin, lithium, beryllium and columbium-tantalum that are primarily derived from pegmatites in the Black Hills.

This volume will be of interest to a wide audience including geologists, prospectors, engineers, historians and anyone interested in the natural and human history of the Black Hills. Two of the most interesting historical facets relate the development of the milling processes and the negotiation (or lack thereof) with the native peoples, who inhabited the area before the discovery of gold. Perhaps the most unique aspect of the book is its documentation of the development of ideas and their implementation in solving difficult logistical and metallurgical problems. Some innovations were obvious such as building mills on steep slopes where gravity could be used to transfer the ore from one processing stage to the next, but others were far more complex. The cross-fertilization of inventions and ideas between the Black Hills and other mining districts is especially interesting.

Many entrepreneurs, inventors and engineers contributed to the development of the mining industry in the Black Hills. The book brings them to life with many fine old photographs and anecdotes. For example, Clow describes the role played by John V. N. Dorr who developed new methods of classifying and filtering finely crushed fragments of ore from the cyanide solutions in which they were suspended. Such filtering processes found widespread application, not only in mining, but in other industries as well. Improved efficiencies in mill design and operation and construction of larger mills made lower grade ores profitable to mine and resulted in improved use of the resources. Later improvements in chemical processing meant that ores that could not previously have been treated could now be mined profitably.

The successes and failures in ore processing in the Black Hills and elsewhere emphasize the need to tailor the extraction processes to the unique mineralogy, chemistry and physical behavior of the ores in each district and mine. Clow documents this by comparing the extraction techniques used in the Black Hills, a crucible of innovation after the Civil War, with those employed in the Mother Lode district of California and the mining districts of Colorado. The period between 1874, when gold was discovered in the Black Hills, and 1890 was one of experimentation and improvements. New technologies resulted in the reopening of mines that had been previously abandoned as unprofitable. By 1904 cyanidation had become an effective method of ore extraction in the Black Hills. In contrast, chlorination, though pioneered in the Black Hills, was not very effective in processing

ores there; however, it became an important recovery process in Colorado. Similarly, smelting was effective in California, but this method was ineffective in the Black Hills.

The innovations in the Black Hills were also important in recognizing and addressing some of the negative effects of mineral processing on the environment and on the workers. In Chapter 4, Clow describes the general lack of surface water sources and coal that might have provided power for the mills. This lack of other viable sources of power led to the decimation of the forests in the area by miners seeking both fuel for the mills and timbers for the extensive underground workings and surface facilities. The situation became so dire that in 1897 president Grover Cleveland created the Black Hills Forest Preserve in an attempt to protect public lands from overuse by entrepreneurs. The mining community strongly opposed this presidential action. Later, the discovery of coal and its use in generating electrical power eliminated the need for a large steam facility at each mine and led to the establishment of electric utility companies. Coal also meant that the limited water resources could be used for ore processing rather than steam production. Water rights became critical to success and were hotly contested.

The book is clearly written and generally free of typographical errors. The large format allows details of the historical draw-

ings and photographs to be seen clearly. Flaws in the book are largely restricted to a few instances of stilted language. For example, on page 20 "coarse granite pegmatites" are described as "(volcanic rock cooled at temperatures low enough for unusually large crystals to form)". While detailed descriptions of the physical processing of the Black Hills ores are provided, this reviewer would have benefited from a more detailed discussion of the chemistry and mineralogy of the ores and the changes that take place during processing, such as chemical reactions, and complexing.

Publication of this book is extremely timely, coinciding as it does with the closing of the famous Homestake Mine after approximately 124 years of gold production. The Homestake is the most famous gold mine in the Black Hills and was the training ground for many mining engineers and geologists who have had a profound influence on the mining industry. This book will appeal to anyone interested in the history of mining and the history of the Black Hills.

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