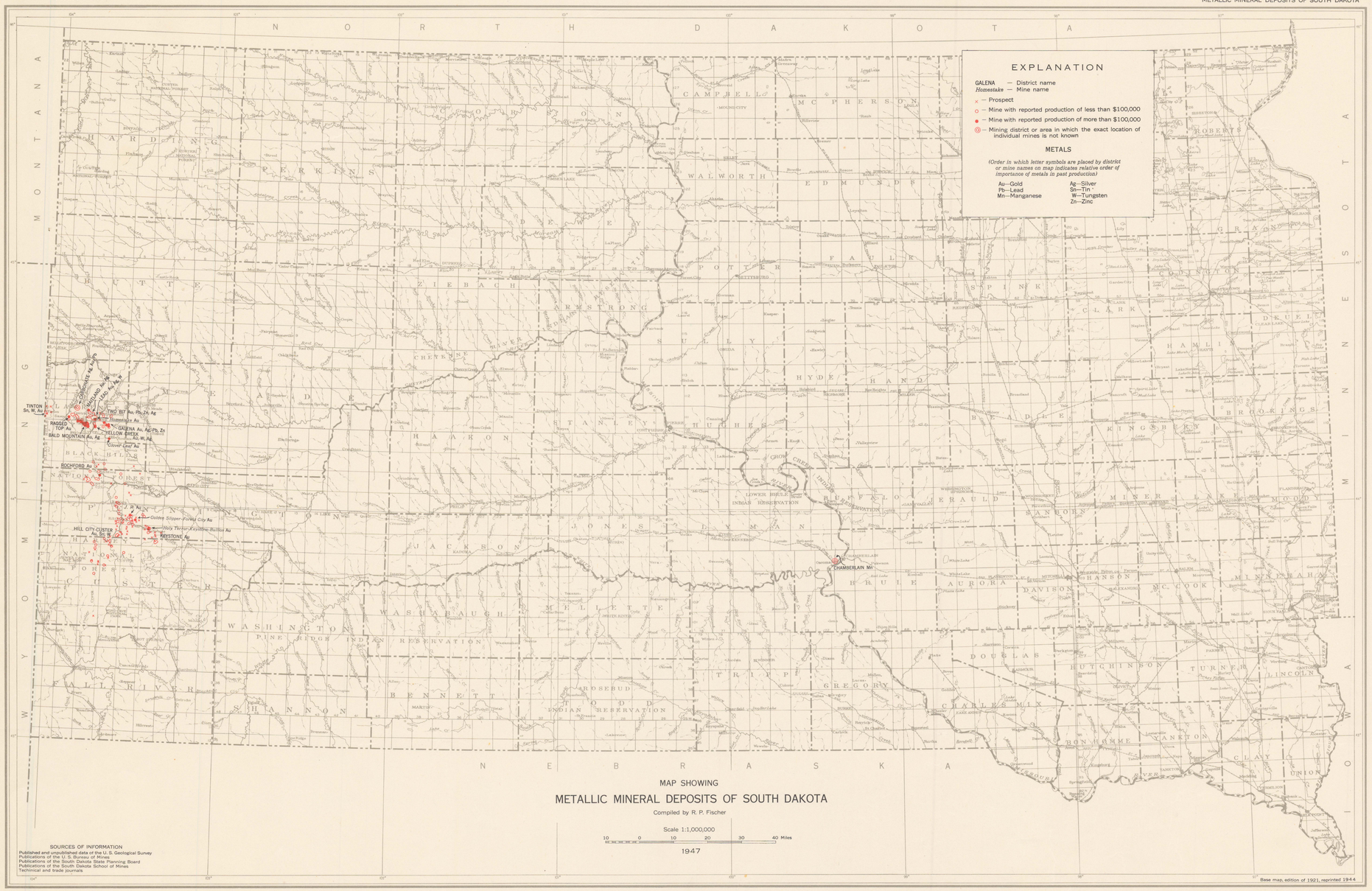
UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MISSOURI BASIN STUDIES, NO. 13
METALLIC MINERAL DEPOSITS OF SOUTH DAKOTA



MAP SHOWING

METALLIC MINERAL DEPOSITS OF SOUTH DAKOTA

Compiled by R. P. Fischer

Scale 1:1,000,000

10 0 10 20 30 40 Miles

1947

SOURCES OF INFORMATION
Published and unpublished data of the U. S. Geological Survey
Publications of the U. S. Bureau of Mines
Publications of the South Dakota State Planning Board
Publications of the South Dakota School of Mines
Technical and trade journals

Base map, edition of 1921, reprinted 1944

METALLIC MINERAL DEPOSITS OF SOUTH DAKOTA

By R. P. Fischer

INTRODUCTION

Productive deposits of metalliferous ores in South Dakota are almost entirely restricted to the Black Hills. In terms of recovered metals the total production of South Dakota from 1874 through 1943 was $513,000,000, of which about 98½ percent was gold, slightly more than 1 percent was silver, and the rest tungsten, tin, lead, copper, zinc, iron, and manganese. From 1900 to 1933 the yearly total production remained fairly steady at about $6,000,000 a year, but with the increase in the price of gold in 1933 the yield increased to about $20,000,000 a year, until 1942 when curtailment of gold mining during the war caused the production to drop sharply. Continued production at a high rate can be expected when conditions return to normal. With careful geologic guidance in prospecting and development, old mines might be made productive and new mines might be found. Among other factors, lower power costs would aid in pumping out old mines and might aid new mining and milling operations in places.

THE MAP

The accompanying map is primarily an index map showing the general distribution of the metalliferous deposits of South Dakota. It was compiled from reports and maps prepared by the United States Geological Survey, the Bureau of Mines, various South Dakota State organizations, and several scientific journals. Production data were compiled partly from these sources but mainly from the Mineral Resources and Minerals Yearbook series of the Geological Survey and Bureau of Mines. The compilation of a map to show the general relation between ore deposits and the major geologic features is believed desirable, and it may be possible to prepare such a map in the future. In the meantime it is hoped that the issue of this map in its present form will serve a useful purpose.

As far as the limitations of the map scale permit, each productive mine and each prospect that could be accurately located from available information is shown individually. Many others are mentioned in literature, but their exact locations are not given and hence they are not shown or are shown collectively by a single symbol for a mining district. Within the limits of error resulting from lack of complete production data in publication, the change of mine names, etc., all mines having a production thought to be worth $100,000 or more are shown with a solid circle, and those thought to have a smaller production are shown with an open circle. Prospects with no recorded production are shown with crosses, but some of them probably have yielded a small production or at least might have made test shipments.

Organized mining districts that stand out on the map as a definite unit are named, but other districts that adjoin and are not clearly defined in limits are combined in areas chosen for convenience of description and common geologic characteristics. Letter symbols by the district or area names indicate the metals produced, and they are arranged in the order of importance of past production.

Gravels containing placer gold are rather widely scattered in the Black Hills, but as few areas have yielded much placer production except near important lode deposits, none are delimited on the map.

HISTORY, PRODUCTION, AND OUTLOOK

Organized prospecting and mining in South Dakota began in 1874, when placer gold deposits near the present site of Custer were discovered. The placer deposits near Deadwood were discovered in late 1875 and resulted in a gold rush to the Northern Black Hills in 1876. The original Homestake claim was located in 1876, and that mine, which is the most productive gold mine in the United States, has been operated almost continuously from that time. Many of the other lode deposits in the Black Hills were discovered in 1876 or shortly afterward. Although many of the deposits in which free gold occurs were intensively mined before 1900, the refractory siliceous ores in the Cambrian dolomites generally were not operated successfully on a large scale until shortly after 1890, when the chlorination process was introduced. They were even more productive after 1900, when cyanidation became widely used. Most of the silver obtained has been a byproduct of gold mining, but some silver-lead deposits have been mined, mostly before 1890. Tin production began in 1884, but for many years now the production has been desultory and without a significant yield. Tungsten production was recorded from the Black Hills for nearly every year from 1898 until 1929, though during this time no single mine made a yield for more than a few years at a stretch.

In terms of recovered metals, the total metal production of South Dakota from 1874 through 1943 was about $513,000,000. Of this amount, the total gold production was $504,924,184; silver $6,807,080; copper $36,196; lead $53,060; and zinc $31,326.[1] The production of tungsten totals about $1,280,000[2] and of tin about $95,000.[3] In addition, a little iron, manganese, and arsenic has been produced from the state.

The following figure shows the total yearly value of gold and silver produced in South Dakota from 1876 to 1943.

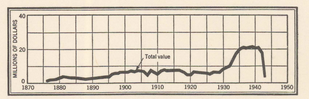


Figure 1.—Total value of mine production of gold and silver in South Dakota, 1876-1943. (Henderson, C. W., and Cushman, R. V., Gold, Silver, Copper, Lead, and Zinc in South Dakota: Minerals Yearbook, U. S. Bureau of Mines, p. 453, 1943.)

The outlook for continued gold mining at a high rate is good, after the labor supply returns to normal and after the companies that were operating before the war have a chance to resume work. The production record of the larger operations just before the war in itself seems indicative of a healthy ore reserve situation, and the reserves of developed ore in the Homestake mine alone are known to be moderately large. The geologic character of the ore and the distribution of the known deposits suggests strongly that additional reserves can be developed in some of the operating mines and that new ore can be developed in some of the inactive mines and in deposits yet to be discovered. Careful geologic mapping and prospecting should aid greatly in this development. Cheaper power would undoubtedly encourage development through lowered costs for pumping out old mines and for operating new mining and milling ventures, particularly at some of the larger, low-grade deposits. As to the future of gold mining in the Black Hills, in 1939 Altsman concluded:[4] "The immediate future of gold mining in the Black Hills appears to depend on successful reopening of old mines. Better understanding of the geology of the Hills, improved mining and milling methods, and good management should make several properties attractive for small- and moderate-size operations. . . . In addition to the older prospects in which ore shoots may have been overlooked, large areas still offer possibilities for prospecting."

The rate of silver production is largely dependent upon the amount of gold ore mined, though small deposits of silver-lead-zinc ore have been worked at a few places and may yield a small production in the future. There is little hope for a significant production of tungsten or tin in the future unless important new deposits are found, which appears unlikely. The few deposits of copper and iron that have been prospected seem to offer little hope of yielding much ore. Deposits near Chamberlain contain much manganese, but the ore is too low in grade to be of commercial importance under present economic conditions.

GENERAL GEOLOGY AND ORE DEPOSITS

The area of South Dakota is mainly plains country of low relief except in the western part of the state where the Black Hills form a topographic eminence of moderate relief. Pre-Cambrian igneous and metamorphic rocks are exposed in the core of the Black Hills. These exposures are partly covered with remnant patches of Paleozoic sediments and are flanked with outward-dipping Paleozoic and Mesozoic strata. Igneous rocks of Tertiary age intrude the older formations in the northern part of the Black Hills. Elsewhere in the state bedrock at the surface consists of flatlying Mesozoic and Cenozoic sediments, except in the southeastern corner where pre-Cambrian rocks are exposed. The eastern half of the state is largely covered with a thin veneer of glacial deposits.

ORE DEPOSITS IN THE BLACK HILLS

Deposits in pre-Cambrian rocks.—The ore deposits in pre-Cambrian rocks have yielded much gold and some silver, tungsten, and tin. The ore at the Homestake mine, which from 1876 to 1943 brought a net return of $439,239,773 and paid $149,805,802 in dividends, is principally in a favorable bed of cummingtonite-chlorite schist. Schist reported to be similar to that at the Homestake mine is gold-bearing in the Rochford area, but the values are lower and the production has been small. The ore at the Clover Leaf mine is mostly with quartz that forms a saddle-shaped mass along an anticlinal axis in the metamorphic rocks; the total yield in gold is about $900,000. Gold-mineralized shear zones have been mined in the Keystone, Hill City-Custer, and Rochford areas, and gold-bearing quartz veins have been mined in the Hill City-Custer area. The total reported gold production from these three areas does not exceed $3,000,000. The tin and tungsten deposits in the Tinton, Keystone, and Hill City areas are in pegmatites and quartz veins. In the last two areas these deposits are closely related in distribution and environment to the gold-bearing quartz veins, though the three metals are rarely present in recoverable amounts in a single deposit.

Deposits in Cambrian and Carboniferous rocks.—Deposits of gold ore, containing some silver and in places tungsten, occur in the Cambrian beds in the vicinity of Lead, Trojan, and Maitland (Garden), and in the Yellow Creek and Two Bit districts. The estimated total value of gold and silver produced through 1943 was about $55,000,000, of which nearly 80 percent came from near Trojan (Bald Mountain or Ruby-Portland district); the total tungsten production slightly exceeds $1,250,000, most of which came from just north of Lead and the rest from the Yellow Creek district. Mainly the deposits are refractory siliceous ores formed by replacement in favorable dolomitic beds, and controlled by vertical fracture zones. The deposits appear to be closely related to Tertiary intrusive rocks. Free-milling gold was mined before 1881 from the basal conglomerate of of the Cambrian near the Homestake ore bodies. Some lead-zinc ore containing gold and silver was mined in the Two Bit district during World War II.

Deposits in Carboniferous limestone have been worked in the Ragged Top and Carbonate districts, yielding gold, silver, and lead ore from fracture zones and from the limestone-igneous contacts. The total reported production from these two districts does not exceed $2,500,000.

Deposits in Tertiary intrusives.—Deposits of gold containing some silver occur in the Tertiary intrusives in the Tinton district, near Maitland, at the Cutting mine near Lead, and in the Galena district, where some of the deposits also contain lead and silver. Most of the deposits are veins along fracture zones in the intrusives, but in places the fractures extend into the pre-Cambrian metamorphic rocks and also into the Cambrian dolomites, where they form replacement bodies. Except for the Galena district, which has a reported production of $1,500,000 to $2,000,000, these deposits have not been very productive.

Other deposits.—Iron deposits have been prospected at a few places 15 to 20 miles west and northwest of Rapid City and at Iron Mountain south of Keystone, but no ore has been shipped except possibly a little from Iron Mountain. Near Rochford, bog iron deposits, which have formed in the present-day stream beds, have yielded a small amount of "paint rock." Low-grade copper deposits have been prospected in places, but except for small shipments of oxidized material for test runs and smelter flux, none has been productive.

CHAMBERLAIN MANGANESE DEPOSIT

The Pierre shale of Upper Cretaceous age near Chamberlain contains a large amount of manganese in scattered nodules. Estimates total many millions of tons of contained metallic manganese, but the grade of the rock in place is low. Although the nodules can be separated fairly readily from the shale, they have to be treated chemically to recover the manganese for ordinary uses, so that the cost of the metal recovered would probably considerably exceed its commercial value. The deposit, however, is a potential source of manganese under conditions of extreme National emergency, when costs are a secondary element. Production has been limited to small shipments for test purposes.

[1] Henderson, C. W., and Cushman, R. V., Minerals Yearbook: U. S. Bur. of Mines, p. 453, 1943.

[2] Tungsten mining in South Dakota: So. Dak. State Planning Board, Brookings, So. Dak., p. 2, 1936.

[3] Tin mining in South Dakota: So. Dak. State Planning Board, Brookings, So. Dak., p. 2, 1936.

[4] Altsman, P. T., Reconnaissance of gold-mining districts in the Black Hills, South Dakota: U. S. Bur. of Mines, Bull. 427, pp. 141, 142, 1940.