

METALLIC MINERAL DEPOSITS OF MONTANA

By F. M. Chace

Map Explanation.—The accompanying map is intended as a guide to the metal mining industry of Montana, and shows, by the use of symbols, the distribution of the productive and potentially productive mineral deposits, mines and metal mining districts. The well-known districts are named, and, where space permits, some of the important mines are identified. Metals produced are indicated by letter symbols arranged in order of importance of past production. Metals produced in relatively small quantities are shown in parentheses. For interpretation of the various symbols refer to the EXPLANATION.

This map was compiled chiefly from reports, maps, and records of the United States Geological Survey and from the published reports of the United States Bureau of Mines and the Montana State Bureau of Mines and Geology. Various publications in the technical and scientific areas also were consulted.

Because of the fragmentary nature of much of the data and the limited time available for the work, the map must be considered preliminary in nature and subject to correction, addition, and suggestion. A few mines, deposits, or districts were omitted because data on location or production were lacking, or because the information available indicated that they were not of sufficient importance to be included. Where a district or mine has more than one name or where a name has been changed, the more commonly known one has been used.

Metal Production.—Montana is one of the leading mining states of the Union, with a total metal production from the time of the discovery of gold in 1862 to the end of 1944, valued at over \$3,100,000,000. In total metal output since mining began in the United States, Montana ranks first in the production of manganese, second in both copper and silver output, fourth in zinc, sixth in gold and sixth in lead. Other metals such as arsenic, antimony and cadmium, are produced from Montana ores as smelter by-products or incidental to gold mining. A few metals, such as tungsten, molybdenum and chromium have been produced from scattered deposits or, as was necessary, from marginal or sub-marginal ores.

Mining activity in Montana centers in the Butte district in Silver Bow County. The total production from this famous camp is estimated at over \$2,500,000,000 in copper, silver, zinc, lead, gold, and manganese. Since 1864 when gold was discovered in this area, the total estimated production to the end of 1944 was 2,007,793 ounces of gold, 538,390,100 ounces of silver, 6,412,145 short tons of copper, 1,481,256 tons of zinc, and 226,334 tons of lead.

During the five-year period (1940-44), ore sold or treated in Montana averaged 5,668,000 short tons yearly. The average annual mine production in terms of recovered metals amounted to 128,467 tons of copper, 15,755 tons of lead, 45,349 tons of zinc, 155,115 ounces of gold, and 10,295,900 ounces of silver. The total value of this metal production was \$55,563,000 yearly. In addition, manganese production averaged 10,800 short tons of metal per year during this period.

A summary of Montana's metal production from 1940 to 1944 is given in the following table.

| MINE PRODUCTION Cu Pb Zn Au Ag Mn 1940-1944 | | | | | | | | | |
|---|-------------|-------------|-------------|-------------|-------------|------------------------------|------------|------------------|-------------------|
| IN TERMS OF RECOVERED METALS ¹ | | | | | | | | | |
| Metal | 1940 | 1941 | 1942 | 1943 | 1944 | Aver. amt. pr. yr. 1940-1944 | U. S. Rank | U. S. % of total | \$ if U. S. total |
| Copper | 252,782,000 | 256,072,000 | 282,388,000 | 269,050,000 | 236,380,000 | 259,324,400 | 3 | 13.0 | — |
| Silver | 46,072,000 | 42,518,000 | 48,100,000 | 32,448,000 | 26,510,000 | 37,948,600 | 5 | 4.1 | — |
| Zinc | 105,716,000 | 121,468,000 | 109,482,000 | 75,212,000 | 72,544,000 | 86,880,000 | 4 | 4.4 | — |
| Lead | 272,652 | 246,475 | 146,892 | 99,586 | 50,611 | 155,115 | 7 | 1.7 | — |
| Gold | 12,361,050 | 12,386,925 | 11,188,118 | 8,456,370 | 7,083,215 | 10,295,900 | 2 | 4.0 | — |
| Manganese | 21,645 | 54,565 | 130,006 | 138,115 | 109,889 | 100,864 | 1 | 65.0 | — |
| Cu-Zn Ag (total) | 5,099,241 | 5,642,249 | 5,678,200 | 5,873,616 | 6,084,462 | 5,668,400 | — | — | — |
| Value TOTAL (except manganese) | 55,825,078 | 59,181,627 | 68,128,053 | 53,642,658 | 49,039,855 | 55,563,814 | — | — | — |

¹Source of Data: Minerals Yearbook, U. S. Bureau of Mines 1940-1944, Chapter on Montana.

History.—Although gold was reported in Montana as early as 1852, it was not until 1862 when gold placer deposits were discovered along a tributary of the Beaverhead River in western Montana, that the first successful mining began in the state. This discovery, near the town now known as the Bannack district, was followed during the next decade by a series of finds which led to the establishment of a permanent mining industry in Montana. In 1863, placer gold deposits were discovered in Alder Gulch, near Virginia City, which have proved to be among the richest placer deposits ever to be found in the state. Over \$30,000,000 in gold was recovered from these deposits by 1868. Numerous other placer deposits, such as Oro Fino, Last Chance, and Grizzly Gulch, were discovered during 1864 in the area around the present city of Helena. In the gulches and streams which drain the west slope of the Belt Mountains and which are tributary to the Missouri River, other notable gold deposits were found between York and Last Chance gulches, as well as along terraces and sand bars in the Missouri River itself. Among these, Confederate Gulch is outstanding. Although less extensive than Alder and Last Chance gulches, it exceeded them in richness; estimates of gold production from this gulch and its tributaries vary from \$10,000,000 to \$30,000,000.

The Butte District, now one of the world's most famous mining camps, was discovered in 1864 when placer gold was first washed from the gravels at the foot of Butte Hill, where the city of Butte now stands. During the first three years, \$1,500,000 in gold is estimated to have been won from the area around Silver Bow Creek. Although the black-stained quartz outcrops on Butte Hill, which contained rich oxidized bodies of silver, were soon recognized and located, the preoccupation with gold distracted interest in them until the gold diggings were exhausted. The first successful silver treatment was developed in 1875, and Butte as a silver district reached its climax in 1887.

Copper was recognized in the Parrott lode in 1865, and during the early seventies copper ore was hauled 400 miles overland by wagon to Corinne, Utah, where it was shipped to smelters in Colorado, along the Atlantic seaboard, and as far away as Swansea, Wales. Unfortunately, in spite of exceedingly high grade ore (35% Cu), transportation charges were too high for profit, and copper mining had to await the coming of the railroad (1881) and the discovery of smelters to realize its full development. In 1883 a copper smelter, destined to become one of the greatest in the world, was established at Anaconda.

In the period from 1880 to 1910 many mining companies were organized in Butte and many copper bonanzas were discovered and mined as deeper mining progressed. In 1895 the original Anaconda Copper Mining Company was formed, and eventually it became the leading company of the district. Through consolidation with other companies in 1910 and purchase of the Clark interests in 1928 the Anaconda Company became preeminent in Montana mining.

Most of the other mining districts in Montana were discovered during the two decades from 1860 to 1880. Copper, lead, zinc, and silver deposits predominated, although manganese, chromite, and deposits of other metals have subsequently been found. More than 150 mining districts have been recognized in the state, the precise number being a matter of definition dependent upon location of boundaries, magnitude of production, relative importance, and other determining factors. The Montana Bureau of Mines and Geology reported in 1933 that there were 488 placer deposits and 727 lode mines being operated. The number of these, of course, varies considerably from year to year.

The Ore Deposits.—Metallic ore deposits occur principally in the western half of Montana within the Rocky Mountain province where the geologic structure is complicated, where intrusive and extrusive igneous rocks are widespread, and where great regional faults and folds are developed. The greater number of deposits are clustered in and around the Boulder Batholith and its related satellite intrusive bodies in the southwestern part of the state. Most of the productive districts are centered around Butte within an area bordered by Marysville, Helena, Radersburg, Virginia City, Dillon, Phillipsburg, and Garnet. A few deposits of note occur in the detached front ranges of the Rockies in the Little Belt, Moccasin, Judith, and Belt Mountains. Another group of deposits occurs north of Yellowstone Park, and numerous small deposits have been found along the boundary between Montana and Idaho in Lincoln, Sanders and Mineral Counties.

The great copper deposits at Butte are replacement veins and fissure fillings in a complex vein system which cuts late Cretaceous or early Tertiary quartz monzonite of the Boulder Batholith. In addition to copper, a large output of zinc, lead, gold, silver, and manganese has been made; also arsenious oxide is recovered as a by-product of copper smelting. Although various small copper deposits are known outside of the Butte district, production has been small and Butte alone accounts for Montana's position as a major copper producing state.

Placer-gold deposits are widespread in Montana and have been extensively exploited. Although some gold is recovered each year by hand methods, modern dredging operations account for the greater part of the present production from this source.

Quartz veins carrying gold, silver, or both, are common throughout western Montana. The Marysville district, the Granite-Bimetallic mine near Phillipsburg, the Jardine mine in Park County and many other districts and mines have been highly productive. Gold is also produced as a by-product of copper or lead-zinc smelting operations and the greater part of the silver recovered in recent years has also been from this source. Most of this silver production comes from Silver Bow County, but the Flathead mine, near Kalispell, and mines in the Nelhart district are substantial producers.

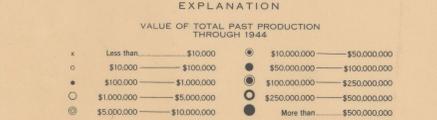
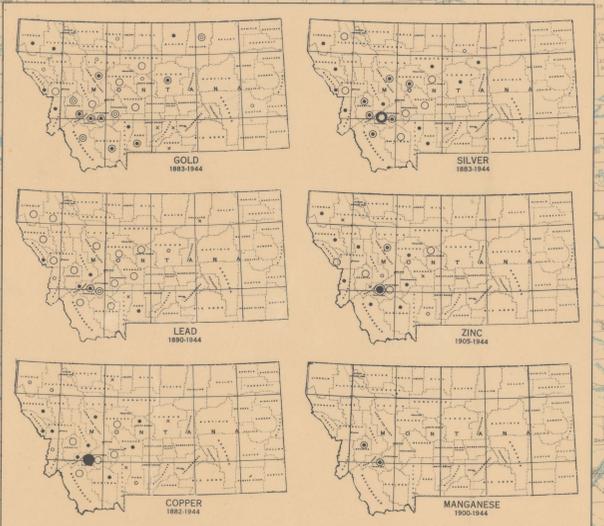
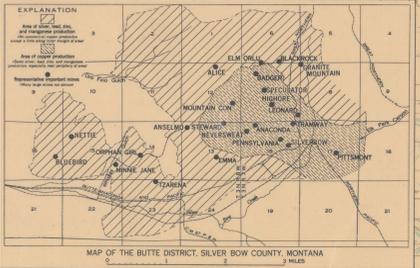
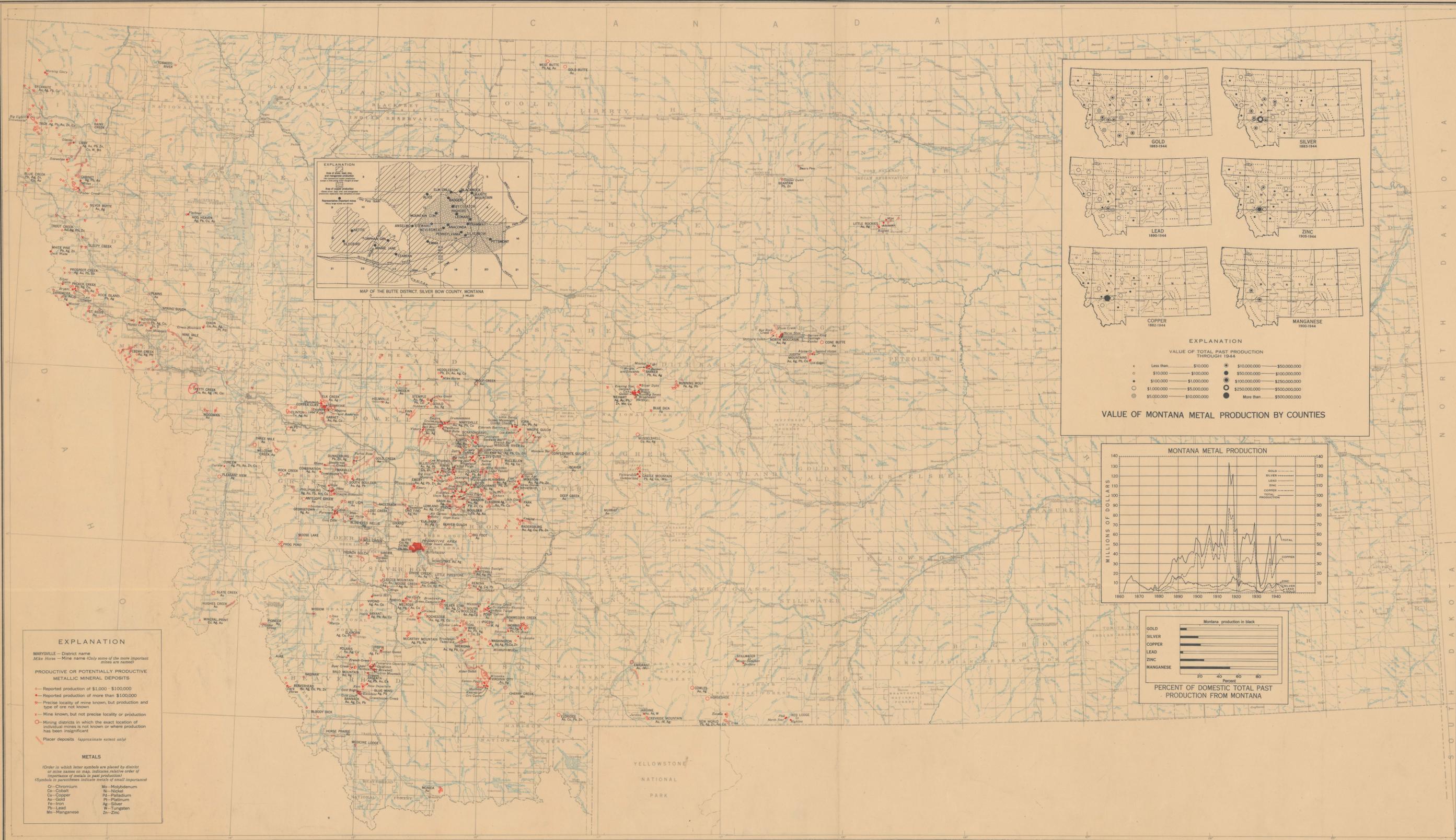
Many quartz veins which carry gold and silver also are rich in sulphide including pyrite, galena, sphalerite and chalcopryite, forming complex ores. Examples of deposits of this type, such as those at Helena and Boulder, are plentiful. Replacement deposits of silver-bearing galena occur in the Elkhorn district, southeast of Helena, in the Little Belt Mountains and at Castle in Meagher County, but production from this type has not been large.

Most of Montana's substantial zinc production is obtained from Butte, though some comes from the deposits mentioned in the preceding paragraph. Lead production has been much less than zinc. The Mike Horse mine in Lewis and Clark County is the largest present source of lead in the state, but some comes from the Nelhart district and from scattered deposits in Lincoln and Sanders counties.

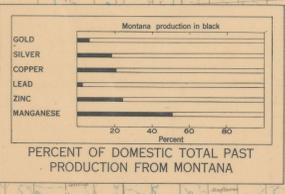
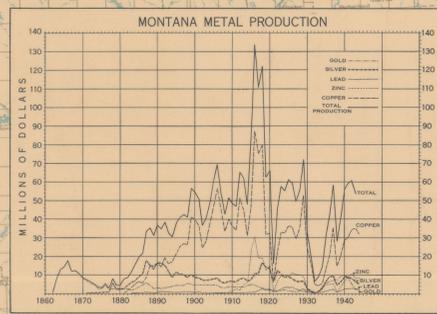
Manganese deposits occur primarily in the Butte district and at Phillipsburg. At Butte manganeseiferous silver ore, oxidized ore, and rhodochrosite-bearing carbonate ores have been mined, but the bulk of the production comes from the rhodochrosite ores. At Phillipsburg, battery and metallurgical grade manganese occurs in irregular and tabular replacement bodies in limestone bordering steeply dipping silver-zinc veins. The manganese ore is chiefly pyrolusite.

Large deposits of medium to low-grade chromite occur in Stillwater, Sweet Grass, and Carbon counties. Less extensive deposits have been found in Madison County. In Stillwater County chromite occurs as distinct layers associated with basic igneous rocks of the Stillwater complex, whereas near Red Lodge in Carbon County the chromite forms massive ore in pod-like bodies and disseminated masses in altered serpentine. These chromite deposits were first exploited during World War I and may be exploited extensively in the future.

Deposits of other metals, iron, molybdenum, antimony, nickel, and tungsten have been found in the state, but not in large enough quantities or of high enough grade to warrant large scale development. However, there is always the chance in an area as extensively mineralized as western Montana that larger and better quality deposits of these and other metals will be found.



VALUE OF MONTANA METAL PRODUCTION BY COUNTIES



EXPLANATION

Marysville — District name
 Arrows — Mine name (only some of the more important mines are named)

PRODUCTIVE OR POTENTIALLY PRODUCTIVE METALLIC MINERAL DEPOSITS

- Reported production of \$1,000 - \$100,000
- Reported production of more than \$100,000
- Precise locality of mine known, but production and type of ore not known
- Mine known, but not precise locality or production
- Mining districts in which the exact location of individual mines is not known or where production has been insignificant
- Placer deposits (approximate extent only)

METALS

(Order in which letter symbols are placed by district or mine names on map, indicates relative order of importance of metals past production)
 (Symbols in parentheses indicate metals of small importance)

C — Chromium Mo — Molybdenum
 Co — Cobalt Ni — Nickel
 Cu — Copper Pd — Palladium
 Fe — Iron Ag — Silver
 Pb — Lead Sn — Tin
 Mn — Manganese Zn — Zinc

SOURCES OF INFORMATION

Publications and reports of the U. S. Geological Survey
 Publications of the U. S. Bureau of Mines
 Publications of the Montana State Bureau of Mines and Geology
 Technical and trade journals

MAP SHOWING
METALLIC MINERAL DEPOSITS OF MONTANA

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