ance (total yield to date estimated at $30,000,000). The deep gravels of Boisé basin seem to be exceptional, and to resemble the deep or high gravels of California. A very large portion of the mines (other than placer) of Idaho appear to be of the fissure class, and to be enclosed in a country rock of granite, resembling in many respects the veins of the vicinity of Austin in Nevada. In Arizona, which ranks along with Idaho in the production of the precious metals, and is next to Michigan and Montana as a producer of copper, the mode of occurrence of the metalliferous deposits is com­plicated and varied, and is still very imperfectly known. They appear to be largely of the nature of contact deposits, dependent on the presence of some ancient or modern eruptive mass. The famous Tombstone district, in Pima county, has been a productive one, but seems at present to be declining.

Table XII.—Gold and Silver Production of the Different States and Territories for 1885 (in Thousands of Dollars').

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Gold. | Silver. | Total. |  | Gold. | Silver. | Total. |
| Alaska | 300 | 2 | 302 | North Carolina | 152 | 3 | 155 |
| Arizona | 880 | 3,800 | 4,680 | Oregon | 800 | 10 | 810 |
| California | 12,700 | 2,500 | 15,200 | South Carolina | 43 | ... | 43 |
| Colorado | 4,200 | 15,800 | 20,000 | Utah | 180 | 6,750 | 6,930 |
| Dakota | 3,200 | 100 | 3,300 | Washington... | 120 | 70 | 190 |
| Georgia | 136 |  | 136 | Other States |  |  |  |
| Idaho | 1,800 | 3,500 | 5,300 | and Territories | 90 | 5 | 95 |
| Montana | 3,300 | 10,060 | 13,360 |  |  |  |  |
| Nevada. | 3,100 | 6,000 | 9,100 | Total | 31,801 | 51,600 | 83,401 |
| New Mexico... | 800 | 3,000 | 3,800 |  |  |  |  |

The production of gold in the United States for each of the seven years 1880-86 inclusive is estimated (in millions of dollars) as— 36, 34.7, 32.5, 30, 30.8, 31.8, 35. Similarly the coining value of the silver produced during the same years is returned as—39.2, 43, 46.8, 46.2, 48.8, 51.6, 51. The commercial value of silver has, however, of late been considerably less than the coining value— 42, 42.5, and 39.4 in 1884-85-86.

All the quicksilver produced in the United States comes from California, although small quantities of the ores of this metal have been obtained at various points in Colorado, and also in New Mexico. A little mercury has also been produced in Oregon. The Californian mines are all in the Coast ranges, in rocks of Cretaceous age. Small veins of quartz containing a little cinnabar have been found in the Sierra Nevada ; but this ore is not known to exist anywhere in that range in workable quantity. The mer­curial ores of the Coast ranges occur in very irregular deposits, in the form of strings and bunches, disseminated through a highly metamorphosed silicious rock. The first locality where this metal was successfully mined was New Almaden, about 100 miles south of San Francisco. Another locality—New Idria—about 100 miles still farther south, has also been productive, but in a less degree. Mercury ores have also been mined at several points north of San Francisco, in the neighbourhood of Clear Lake, where they occur, not only in metamorphic Cretaceous strata resembling those of New Almaden, but also in recent volcanic rocks, where gold has sometimes been found in intimate association with the cinna­bar. The New Almaden mine has been productive since 1850, but the yield has varied greatly from year to year, partly on account of the irregularity of the mode of occurrence, and partly on account of interference on the part of the United States based on a question of title to the property. The most productive year was 1876, when the number of flasks (of 76½ lb) obtained was 47,194. The number produced in 1880 was 23,465, and in 1886 18,000. The total pro­duce of the Californian mines was 59,926 flasks in 1880, 60,851 in 1881, 52,732 in 1882, 46,725 in 1883, 31,913 in 1884, 32,073 in 1885, and 29,981 in 1886. No new discoveries of localities of im­portance have been made during the past few years, and the mines now worked in California are all in a depressed condition.

Tin has been discovered in numerous localities, and various attempts have been made to open mines—in Maine, New Hamp­shire, Virginia, Alabama—but hitherto the amount of the metal produced has been quite insignificant. The region from which most has been expected is the Black Hills of Dakota, about 20 miles south-west of Rapid City. The occurrence of the tin ore and the associated minerals at the mine to which the name of Etta has been given is very similar to that of the ores in the Erzgebirge. The cassiterite is disseminated through a granitic or granitoid rock in irregular bunches, strings, and even masses, associated with the usual minerals. There has not hitherto been any production of commercial importance from this source.

The present sources of copper are almost exclusively the Lake Superior region, and the Territories of Montana and Arizona. The mines of Lake Superior are the only important mines in the world in which the metal is exclusively obtained in the native state. The mode of occurrence of the copper varies, however, considerably in different portions of the mining district, which extends from Point Keweenaw along the southern shore of the lake to a little beyond the Ontonagon river. The most productive mines at pre­sent are those in the vicinity of Portage Lake, about half-way between the eastern and western extremities of the cupriferous range. The rock in which the metal occurs is an old basalt, much metamorphosed from its original condition, and in the form now generally called melaphyre. This belt, commonly known in the region as the “trap range,” is a volcanic material, interbedded in numerous alternating layers with sandstone and conglomerate, equivalent geologically to the Potsdam sandstone of the New York Survey or the Primordial of Barrande. The metal occurs along nearly the whole extent of Keweenaw Point in veins crossing the formation, and having all the characters of true fissure veins, the gangue being a mixture of quartz and calcite with various zeolitic minerals. Copper in large masses has been found in various mines on Lake Superior, but in none of such great dimensions as at the Minnesota mine, near the Ontonagon river. The largest mass discovered here weighed about 500 tons. Its length was 46 feet, its breadth 18½, and its maximum thickness 8½. While a consider­able amount of copper has been obtained on Lake Superior in large masses, and lumps too small to be shipped separately, and therefore put in barrels and called “ barrel-work,” much the larger portion occurs in small grains, scales, and strings, disseminated through the rock. For crushing rock of this character a new form of stamp known as the Ball stamp was invented, one head of which is cap­able of crushing from 220 to 250 tons of rock in twenty-four hours. The most interesting mine on Lake Superior, and indeed the largest and most important—not being an open-work—in the world, is that of the Calumet and Hecla Company. The mode of occurrence of the copper, which is all in the metallic form, and like that of the other Lake Superior mines almost chemically pure, is peculiar. The cupriferous mass is a bed of eruptive material, interstratified with other masses of similar origin, but itself a conglomerate made up chiefly of more or less rounded pebbles of eruptive rock—rhyo­lite, trachyte, and basalt—cemented together by native copper. The Calumet and Hecla mines, which form one connected work, have been opened over a length of about 1¾ miles, and to a depth, on the inclination of the metalliferous bed, which is about 39°, of about 3300 feet. The number of men employed is about 2800, and the production for 1886 was 22,552 tons (the total amount since 1866 being 201,529 tons).

The copper mines of Montana are chiefly in the vicinity of Butte City. The really important operations seem to be pretty closely limited to an area only 2½ miles long by 1 mile wide, within which are three important silver mines, as well as the copper mines which make the district so famous. There are two great classes of mineral occurrences,—cupriferous veins, carrying more or less silver, and silver veins, with a manganese gangue, which carry little or no copper. These two groups have certain features in common. They all occur in granite, and are all accompanied by zones of decomposed country rock, which run parallel to and usually form the walls of all the large copper veins that have been opened to any great depths, and which are called porphyry dikes by the miners, but are really granite altered by the chemical changes which have accompanied the formation of the lode. They all pitch vertically or nearly so, and lack entirely the well-defined walls and the selvages which are characteristic of fissure veins. The cupriferous veins appear on the surface as wide bands of quartzose rock, much de­composed and stained with gossan. The surface ore always carries silver, is almost entirely in a free-milling condition, and generally in paying quantity. Nearly all the lodes at present worked for copper were at first worked for silver, and this condition continued until the water-line was reached, when the base ores—mainly the ordinary sulphuretted combinations of copper and of copper and iron, especially copper glance or vitreous copper and erubescite or variegated, peacock, and horseflesh ore—set in. The veins are of great size, being often thirty feet wide for several hundred feet in length. The average width of pay ore in the copper veins is stated to be not less than 7 feet ; the Anaconda—the widest of any yet opened—averages over 12 feet of profitable ore, and in many places widens to 30 or 40 feet for a great distance, showing no diminution in richness at the depth of 800 feet. In a part of these veins—as, for instance, the Anaconda and Liquidation—the ore is copper glance in a gangue of quartz and decomposed feldspathic rock ; while another type of veins, represented most perfectly by the Parrot vein, has nearly its entire metallic contents in the form of erubescite. This last-mentioned vein is also of great importance for its silver. The veins of the manganese-silver group lie all within a small area, but are of much interest and value. The gangue is quartz, heavily charged with its various oxidized com­binations of manganese, all more or less argentiferous, the amount of silver ranging from three or four to several hundred ounces of that metal per ton. In these manganese veins the transition from decomposed oxidized combinations to the hard silicate and carbonate of that metal at the water-line is as sudden and striking as that from oxidized to sulphuretted ores in the previously-mentioned class of veins. An exceptional occurrence in this district is that of the Gagnon mine, of which the gangue is chiefly quartz, and the ore argentiferous zinc blende.

There has of late years been a falling off in the production of