copper in Arizona, but this appears to be due to unfavourable situation with reference to a market rather than to exhaustion. The Santa Rita mines, in New Mexico, near the Arizona line, were the first worked in that region, but are at present idle. The original workings were for metallic copper, occurring near the contact of a bed of limestone with an eruptive rock resembling felsite, the whole deposit being one of irregular character. Near the junction of the felsite and the limestone there is a series of parallel veins, in which the copper occurs in the form of carbonates and oxides. The Clifton district has been the scene of continuous mining opera­tions since 1872, and is at present the largest producer of copper in the south-west. Its cupriferous deposits have been divided into three classes,—those occurring in limestone, those associated with porphyry, and those in the granite. The ores of the first class are the red oxide in a gangue of compact haematite and the carbon­ates in a gangue of brown manganese ore. The ores of the second and third class are oxides and oxysulphides, changing into copper glance at a trifling depth, and into yellow sulphurets in the deepest workings. The deposits are irregular, in some respects resembling contact deposits, and in others the metalliferous occurrences in the North of England lead mines. They are called by many mining geologists “pockets”; but other authorities consider them true veins. The most productive mine of the district—the Longfellow —is described as being an almost vertical fissure in stratified lime­stone, at or near its junction with a dike of felsite.

Table XIII.—*Copper Production of United States (in Tons) from* 1882 *to* 1886.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 1882. | 1883. | 1884. | 1885. | 1886. |
| Lake Superior | 25,438 | 26,653 | 30,961 | 32,209 | 35,593 |
| Montana | 4,043 | 10,658 | 19,238 | 30,267 | 25,719 |
| Arizona | 8,029 | 11,010 | 11,935 | 10,137 | 6,989 |
| Other localities | 2,957 | 3,253 | 2,574 | 1,438 | 1,340 |
| Total domestic copper | 40,467 | 51,574 | 64,708 | 74,051 | 69,641 |
| From imported ores... | 446 | 726 | 1,276 | 2,271 | 2,000 |
| Total | 40,913 | 52,300 | 65,984 | 76,322 | 71,641 |

Zinc has become within the past few years an important article of production. The ores are found in very numerous localities, usually in connexion with those of lead, both in the Appalachian range and throughout the comparatively undisturbed Palæozoic regions of the Mississippi valley. The Illinois zinc furnaces are at Peru, La Salle, and Collinsville ; those of Missouri mostly at Caron- delet near St Louis, but there is one at Rich Hill and one at Joplin. Those of Kansas are at Pittsburg, with the exception of one at Weir City. There is also a small establishment at White River in Arkansas. There are also zinc works at Bergen Point, N. J., and at Bethlehem, Pa., and one small establishment in Tennessee.

Table XIV.—Total Zinc Production (in Tons) from 1881 to 1885.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 1881. | 1882. | 1883. | 1884. | 1885. |
| Illinois | 14,509 | 16,250 | 15,037 | 15,708 | 17,345 |
| Kansas | 4,464 | 6,576 | 8,500 | 7,017 | 7,591 |
| Missouri | 2,455 | 2,232 | 5,116 | 4,670 | 4,175 |
| Other States |  | 5,087 | 4,770 | 7,018 | 7,216 |
| Total ' |  | 30,145 | 33,423 | 34,413 | 36,327 |

The lead production was for many years, as already mentioned, limited to two districts near the Mississippi,—one, the so-called “Upper Mines,” covering an area of 3000 to 4000 square miles included within the States of Wisconsin, Iowa, and Illinois ; the other, the “Lower Mines,” in south-eastern Missouri. The yield of the Upper Mines reached its culminating point about 1845 ; and in 1852 it had fallen off to about 15,000 tons. That of the Missouri mines also fell off, so far as the south-eastern district was concerned, but the loss was more than compensated by discoveries of ore in south-western Missouri, and later in the adjacent State of Kansas. The production of all these districts (the lead of which contains but a trace of silver) for the years 1880-1884 is given by Mr E. A. Caswell as follows:—24,700 tons in 1880, 27,470 in 1881, 25,900 in 1882, 19,300 in 1883, and 17,567 in 1884. A considerable portion of the recently renewed activity in the Missouri mines is due to the in­creased utilization of the zinc ores associated with the galena. The numerous lead mines opened and worked in various States in the Appalachian region, from Maine to North Carolina, have nearly all proved unsuccessful. Yet, on the whole, the country has largely increased its product—a result due, chiefly, to the dis­covery and successful working of various lead ores containing silver in sufficient quantity to pay for separation, in several of the Cordilleran States and Territories. The total yield was 87,340 tons in 1880, 104,540 in 1881, 118,650 in 1882, 128,515 in 1883, 124,908

in 1884, 115,546 in 1885, distributed in 1883-84 as follows (Table XV.):—

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 1883. | 1884. |  | 1883. | 1884. |
| Utah | 25,900 | 25,000 | New Mexico | 2,100 | 5,350 |
| Nevada | 5,350 | 3,570 | Arizona | 1,350 | 2,400 |
| Colorado | 63,000 | 56,400 | California | 1,500 | 1,420 |
| Montana | ; 4,500 | 6,250 | Mississippi Valley.... | 19,300 | 17,567 |
| Idaho | 5,350 | 6,700 | Virginia | 190 | 220 |

To the non-metallic mineral substances mined or quarried in the United States, apart from coal and petroleum, which have beer already considered, only very brief reference can here be made. The value of the lime and building-stone used in the country in 1885 was, for each of these articles, at least as great as that of the petroleum. Coal alone constitutes nearly seven-tenths of the value of the non-metallic minerals mined, and coal, petroleum, building­stone, and lime together make up almost nineteen-twentieths of the same total. Other important articles are—salt (value $4,825,345 in 1885), cement ($3,492,500), phosphate-rock ($2,846,064), and limestone for flux in iron manufacture ($1,694,656).

The utilization of the brine springs of New York and Virginis was begun towards the end of the last century, and has become ex­tensively developed. To this development has been added that of similar saline resources in Ohio and Michigan. Previous to this, however, some salt had been made by the evaporation of sea-water at points along the coast, and especially in the neighbourhood of Massachusetts Bay ; and the census of 1880 showed still six estab­lishments of this kind in existence, producing nearly 10,000 bushels of salt per annum. In California the evaporation of sea-water has attained some importance (884,443 bushels in 1880), the climatic conditions being much more favourable than along the northern Atlantic. A very small amount of salt was also made on the Florida coast. There are various lakes and partially or wholly dried-up beds of former lakes in the Cordilleran region, which are capable of furnishing a large quantity of salt, and some of these have been worked to a limited extent for use in metallurgy. By far the larger portion of the salt manufactured in the United States comes from the evaporation of brine, obtained by boring. The produce of the four brine-producing States (in bushels of 56 lb) is given as follows in the census report for 1880 :—Michigan, 12,425,885 ; New York, 8,748,203; West Virginia, 3,105,333; Ohio, 2,650,301; total, 26,929,722; total production of all the States, 29,800,298. The New York salt region is in the centre of the State, near Syracuse. The brine is obtained in a detrital deposit, varying in size from the coarsest gravel to the finest sand, which fills depressions in the Onondaga or Salina shales, to the depth in places of 300 or 400 feet. These shales are of Upper Silurian age. No rock-salt has been struck by boring ; but farther west, at various points in New York, Canada, and Michigan, the presence of large bodies of salt has been proved by the aid of the diamond drill. As yet, however, this source of supply has only been utilized to a limited extent. The salt of Michigan comes from several distinct geological horizons. The uppermost one is in the Coal-measures, the next lower in the Lower Carboniferous, and the lowest in the Onondaga or Salina salt group, the salt-bearing formation of New York. It is only in the last-named formation that rock-salt has been found in Michigan, namely, at Bay City, on Saginaw Bay, where, at a depth of 2085 feet, a bed of salt 115 feet in thickness was bored through. In the Saginaw valley salt can be produced more cheaply than any­where else in the country ; the business of salt-making is asso­ciated with that of sawing lumber, and the refuse of the saw-mills feeds the fires under the salt-pans.

The following table (XVI.) shows the value of the metallic pro­ducts of the United States for the years 1882, 1883, 1884, and 1885, as reported by the chief of the Division of Mining Statistics of the United States Geological Survey :—

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 1882. | 1883. | 1884. | 1885. |
| Pig-iron | $106,336,429 | §91,910,200 | §73,761,624 | §64,712,400 |
| Silver | 46,800,000 | 46,200,000 | 48,800,000 | 51,600,000 |
| Gold | 32,500,000 | 30,000,000 | 30,800,000 | 31,801,000 |
| Copper | 16,038,091 | 18,064,807 | 18,106,162 | 18,292,999 |
| Lead | 12,624,550 | 12,322,719 | 10,537,042 | 10,469,431 |
| Zinc | 3,646,620 | 3,311,106 | 3,422,707 | 3,539,856 |
| Mercury | 1,487,042 | 1,253,632 | 936,327 | 979,189 |
| Nickel | 309,777 | 52,920 | 48,412 | 191,753 |
| Antimony | 12,000 |  |  |  |
| Platinum | 600 | 600 | 450 | 187 |
| Aluminium |  | 875 | 1,350 | 2,550 |
|  | $219,755,109 | §203,116,859 | §186,414,074 | §181,589,365 |

The value of the iron is the spot value ; that of the gold and silver the coining value ; that of the copper, lead, and zinc the value at New York; and that of the mercury the value at San Francisco.

The total values of the mineral products of the United States for the same years are returned on the same authority as amount­ing respectively to $235,461,580, $249,049,889, $226,800,674, and $246,931,991. (J. D. W.)