DEPARTMENT OF THE INTERIOR.
CENSUS OFFICE.
ROBERT P. PORTER, Superintendent.

REPORT

ON

MINERAL INDUSTRIES

IN

THE UNITED STATES

AT THE

ELEVENTH CENSUS: 1890.

DAVID T. DAY,
SPECIAL AGENT.

WASHINGTON, D. C.:
GOVERNMENT PRINTING OFFICE.
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DEPARTMENT OF THE INTERIOR,
CENSUS OFFICE,
WASHINGTON, D. C., October 4, 1891.

SIR:

I have the honor to transmit herewith all the statistical tables and text which will comprise the final volume of the statistics of the mineral industries in the United States as returned by the Eleventh Census. This report has been prepared under the direction of Dr. David T. Day, special agent in charge, by a corps of experts selected solely because of their familiarity with the subject allotted them for inquiry. The result has proved most satisfactory. All the reports were completed on time, at a cost of several thousand dollars less than the original estimated cost of this branch of the work. The report, as a whole, is undoubtedly the most thorough and complete exhibit of our vast mineral resources ever published, and reflects great credit on its compilers. The ability, energy, and care exercised by Dr. Day and his expert collaborators in the preparation of this volume have not only made it one of the most valuable of the Eleventh Census reports, but it is the first of the final volumes ready for the printer.

I have the honor to be, sir, respectfully, yours,

ROBERT P. PORTER,
Superintendent of Census.

Hon. JOHN W. NOBLE,
Secretary of the Interior.

LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
CENSUS OFFICE,
WASHINGTON, D. C., October 3, 1891.

SIR:

On July 18, 1889, I was designated by you as special agent to organize and carry out the investigation into the mining industries for the Eleventh Census. I have the honor to transmit herewith the final report on that subject, entitled "Mineral Industries in the United States".

In transmitting this report I beg that you will accept my hearty thanks for the consideration which you have given to the many demands upon your time and attention, and I wish particularly to express my gratification for the freedom which you have given me in the selection of the experts through whose efforts this report was made possible.

Very respectfully, your obedient servant,

DAVID T. DAY,
Special Agent in charge of Mines and Mining.

Hon. ROBERT P. PORTER,
Superintendent of Census, Washington, D. C.

INTRODUCTION.

SCOPE.—This volume is the result of an investigation simply of the position of the mineral industries among the various forms of industrial activity in the United States. It shows the extent of the industry, measured by the quantity and value of the minerals produced, by the amount of capital at stake in the various mining enterprises, and, more particularly, by the extent to which it affords a means of livelihood to the people of the United States. In considering even these few subjects by the census method, in a country of such vast proportions as the United States, the necessary economy of time and money required sharp limitations with each subject.

The inquiry therefore did not extend to the personnel of mining communities. In short, the effort is made to show:

(1) The minerals actually produced.

(2) The industrial features of capital and wages involved in this production.

(3) The number of persons who obtained a living from this product and their usual rates of payment.

Only the persons who gained a livelihood in direct connection with the mines were considered. It was of course impossible to get accurate returns of the large number of prospectors or of the labor cost which they would add if considered in the expenses of mining.

The forms of questions for obtaining this information will be found in the appendix.

The resources still underground but not drawn upon have been omitted, as not pertinent to a census primarily of the population. The peculiarities of race, age, financial welfare, disease, or accident are questions too complicated to be applied to the entire country within reasonable time; further, the conditions of mining are, in important cases, too experimental to furnish any data valuable in efforts for the improvement of these conditions. In cases, however, where the mining possibilities of a certain industry have been thoroughly studied and the information could be obtained by other means than the necessarily expensive census method they have been used. A case in point is the production of quicksilver, an industry which, brought from insignificant beginnings to an important position in the world's supply, has passed that stage and has now declined again. The opportunity has here been embraced to show what may be expected for miners employed for a long time at American wages and under the conditions of taking a store of natural wealth from the ground until it gradually becomes impoverished. The chapter on this subject shows more exactly than could be done by a generalization from many mines the vast amount of persistent, enterprising prospecting in barren ground to find the ore supplies, the necessary development work and its machinery, the methods of ore extraction, the ventilation and drainage, and the optional and enforced social and hygienic conditions among the miners.

The subjects taken for the investigation included all minerals which would have a definite market value wherever they occur, provided the deposit contained the mineral in sufficiently pure form. This ruled out such minerals as ice, water (except mineral waters), sand for street paving, and other materials the condition of which is not changed, but which are simply made valuable by the work of placing in a special position, as earth for embankments.

In the treatment of the various subjects the limit of the mining features was considered as reached when the product became a regular article of commerce. The copper investigation considered the production as far as ingot copper without regard to the subsequent manufacture into sheet copper, castings, etc. Similarly, the inquiry into the precious metals was carried to the stage of the production of metallic gold and silver. In the case of iron ores it is customary to consider the ores themselves as articles of commerce, and the production of metallic iron is considered a separate industry. A necessary inconsistency is introduced in summing up the total value of the mineral products where the total value of the pig iron product is taken, because, from usage, a total value at any other stage would be less intelligible.

ORGANIZATION.—In distinction to allotting a definite section of the domain to an individual for the purpose of dividing the work and expecting this individual to collect the information for all minerals within his section the division was made by separate minerals. This was done because men could not be found equally well informed concerning all minerals. It was possible to find a man specially informed in regard to one industry, even for the

entire country, because of the similar work done by the statistical organization in the United States geological survey. The following gentlemen were accordingly placed in charge of their respective subjects:

Mr. John Birkinbine, Philadelphia, Pennsylvania—Iron ore.
Mr. R. P. Rothwell, New York, New York—Gold and silver.
Mr. C. Kirchhoff, New York, New York—Copper and lead and zinc.
Hon. J. B. Randol, San Francisco, California—Quicksilver.
Dr. Charles A. Ashburner, (*a*) Pittsburg, Pennsylvania, and Mr. John H. Jones, Philadelphia, Pennsylvania—Coal.
Dr. William C. Day, Swarthmore College, Pennsylvania—Stone.
Mr. Joseph D. Weeks, Pittsburg, Pennsylvania—Manganese, petroleum, and natural gas.
Mr. E. W. Parker, Austin, Texas—Minor minerals (those unassigned to other agents).
Mr. George F. Kunz, New York, New York—Precious stones and diamond cutting.
Dr. A. C. Peale, Washington, District of Columbia—Mineral waters.

After the preceding organization was perfected the subject of aluminum was assigned to Dr. R. L. Packard and mica to Mr. Lyman J. Childs.

The schedules of questions to be answered concerning the mineral product, its value, the payments for labor and other expenditures, the capital, and the number of employés were modified as far as necessary for the different industries. These schedules of inquiry were transmitted to the special agents in charge of individual industries, who collected the information from the producers and transmitted the completed reports to the special agent in charge.

METHOD OF COLLECTING INFORMATION.—The problem of securing returns from about 30,000 productive establishments and of determining accurately that fully twice as many more were unproductive, and involving in all the entire area of the United States, is difficult from many considerations, but especially from the fact that the confidential character of the replies is seldom understood, and because the actual records are frequently very incomplete for even the simple inquiry attempted. The method must be more or less modified to suit the subject treated and the localities concerned. The method adopted, and which can be recommended, was to spend a considerable amount of time and money in compiling from all records a directory of the mines before any requests for statistical information were distributed. This work did not present the insuperable difficulties apprehended by many experts. After separating duplicate mines as far as possible, the schedules were distributed to the producers, so that an opportunity was offered them, as in the case of the population schedule, of answering at their convenience and without the annoyance of an interview. More schedules were returned by this correspondence method than was expected. Meantime a corps of visiting special agents was organized, and when their work had been reduced to a minimum by correspondence they were furnished with lists of the delinquents and those whose returns were unsatisfactory. They then visited the producing districts, added the names of such new producers as were found, and finally compared the tabulated returns with the statements by other authorities to determine the reason for any existing discrepancies.

In two regions, viz, the Rocky mountains and the Pacific coast, the difficulty of access to the mines made the work of visiting special agents particularly difficult; hence early in the investigation Mr. Frederic F. Chisolm was appointed to supervise the work of the visiting agents in the Rocky mountain region and to act as the personal representative of the special agent in charge, except in the gold and silver investigation, and Mr. Charles G. Yale was similarly appointed for the Pacific coast.

The subagents engaged in collecting the statistics of the various subjects were as follows:

Iron ore—Messrs. F. L. Bitler and J. M. McMahon.

Gold and silver—Mr. William Kent, chief assistant; eastern states, Messrs. S. W. Cramer and R. H. Wilkinson; Alaska, Mr. J. H. Burfeind; Arizona, Messrs. S. C. Bagg, J. F. Blandy, and William O. O'Neill; California, Messrs. Stephen Barton, G. M. Beatty, A. S. Bent, M. H. Burnham, F. M. Campbell, J. H. Connell, J. H. Crossman, Henry De Groot, R. L. Dunn, J. M. Fisher, F. G. Hail, G. W. Kemble, W. S. Lowden, G. W. Merritt, C. H. Mitchell, J. E. Parker, W. B. Parker, E. F. Southern, W. T. Turner, Samuel Tyler, and Charles G. Yale; Colorado, Messrs. R. M. Cash, F. F. Chisolm, C. J. Eldredge, F. G. Foreshaw, Henry Fulton, J. B. Gilchrist, F. J. Hood, J. S. Lawrence, John Livezey, William McCabe, J. G. Paine, N. B. Quick, I. G. True, C. Van Timmons, H. R. Wagner, W. L. J. Warren, Albert Williams, jr., H. W. Woodward, Carl Wulsten, and C. E. Zelle; Idaho, Messrs. J. S. Childs, M. H. Joseph, and R. L. Packard; Michigan, Mr. F. B. Phelps; Montana, Messrs. Spruille Braden, W. S. Kelly, W. F. Wheeler, R. T. Woliston, and Andrew Young; Nevada, Messrs. James Delavan, M. H. Joseph, George Nicholl, and H. R. Wagner; New Mexico, Mr. J. R. Johnson; Oregon, Mr. W. H. Hampton; South Dakota, Mr. James Long, jr.; Texas, Mr. F. W. Taylor; Utah, Mr. W. G. Van Horne; Washington, Mr. W. H. Hampton; Wyoming, Mr. R. W. Burkhardt.

Copper and lead and zinc—Missouri, Mr. J. A. Zook; Wisconsin, Mr. James Freeman.

Quicksilver—Messrs. F. S. Rice and Fred. Von Leicht.

Tin—Mr. Samuel Scott.

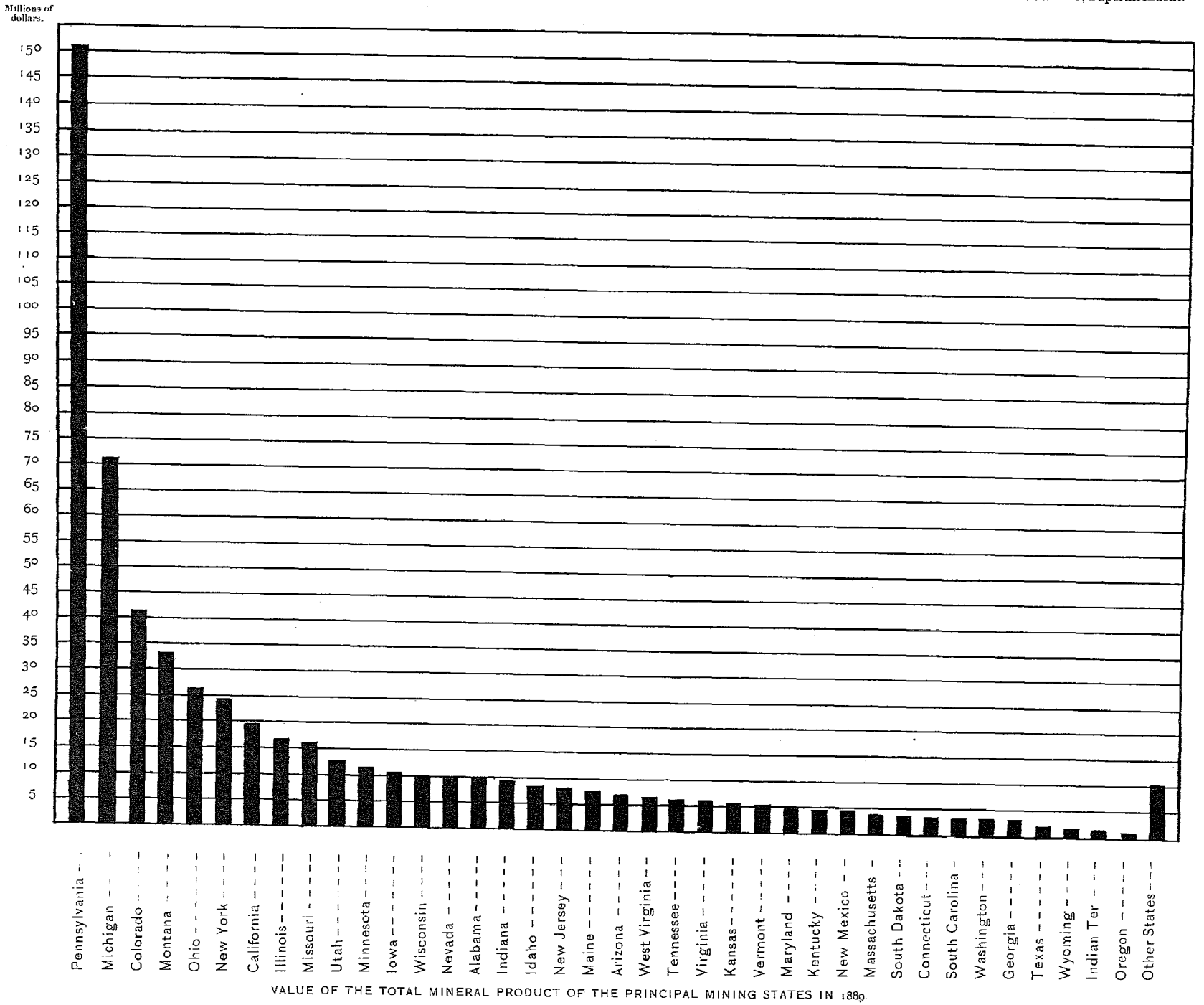
Manganese, petroleum, and natural gas—Mr. A. L. Feldmann.

Coal—In the Philadelphia office, Messrs. J. W. Alder, Baird Halberstadt, J. N. Pott, and John Totty; Alabama, Mr. H. S. Livingood; Arkansas, Mr. C. R. Claghorn; Colorado, Messrs. J. S. Buchanan, J. A. Crawford, W. A. Raborg, and J. C. Weston; Illinois, Messrs. Elisha Beadle, Quintin Clark, James Freer, Walton Rutledge, and Reuben Street; Indiana, Mr. Thomas McQuade; Iowa, Messrs. Thomas Binks, James Gildroy, and M. G. Thomas; Kansas, Messrs. James Gray and J. T. Stewart; Kentucky, Mr. J. C. Norwood; Maryland, Mr. Theophilus George; Michigan, Mr. William Dickinson; Missouri, Mr. B. E. Bloom; Montana, Mr. O. C. Mortson; New Mexico, Messrs. I. M. Bond, Robert Carter, and H. S. Lutz; North Dakota, Mr. R. M. Tuttle; Ohio, Messrs. Alexander Johnson, J. W. Kail, and J. L. Morris; Pennsylvania, Messrs. W. H. Barnhart, J. W. Books, H. J. Boyde, J. O. Edelblute, A. W. Feely, W. W. Fiscus, M. W. Jenkins, T. J. Lee, J. E. Menges, A. B. Miller, W. L. Owens, S. D. Patterson, I. F. Piersol, George Scheffner, E. C. Weaver, and J. H. Westcoat; Tennessee, Mr. H. E. Colton; Utah, Mr. K. C. Kerr; Virginia and West Virginia, Mr. H. A. Wilbourne; Wyoming, Mr. T. J. Bouton.

a Dr. Ashburner died early in the investigation. He gave most valuable aid in determining the scope of the work and in formulating the schedules of inquiry, and this at a time when his work in other directions was very exhausting, fatally so. The investigation was then completed under the sole direction of Mr. Jones.—D. T. DAY.

Eleventh Census of the United States.

Robert P. Porter, Superintendent.



VALUE OF THE TOTAL MINERAL PRODUCT OF THE PRINCIPAL MINING STATES IN 1889.

Stone—Messrs. M. H. Bancroft, E. M. L. Bates, Arthur Beardsly, G. F. Bird, J. T. Cushing, Hasbrouck Davis, T. J. Dolphin, Morris Ebert, C. H. Elliott, R. D. Emslie, J. G. Falck, I. P. Fell, C. H. Hardon, G. A. Hoadley, J. H. Humphries, Harry C. Jones, G. H. Knight, G. C. Koyl, L. M. Kuhns, Eugene Leamy, J. L. Midwood, W. R. Orndorff, G. W. Reese, G. J. Roote, Benjamin Smith, M. M. Smith, W. B. Smith, W. D. Stearns, G. E. Weaver, and E. W. Yarnall.

Mineral waters—Messrs. James Reay and C. H. Richmond.

RESULTS.—The work which has been done annually by different authorities left little doubt that the statistics of production could be obtained with a satisfactory degree of accuracy, although the work of ascertaining the total product by the census method (returns from every producer) is not the usual one, and, indeed, owing to its considerable cost, has not been attempted for all mineral industries since the Tenth Census. The results have proved generally good, and while only in isolated cases has the census method led to very surprising results respecting the total product, still the results may be accepted as confirming the statistics previously collected, rather than depending upon the previous work for establishing the accuracy of the census. A base work of considerable value is therefore established, which will be useful for years. In the direction of distributing the product to the states in which it was produced a great gain has been made. It is unnecessary to call attention to the fact that minerals taken from the ground in one state often first become known to statisticians after treatment in a remote refinery.

The statistics of the employment of labor in mining is practically a new inquiry. No great difficulty was found in obtaining fairly good results, except in very minor operations, in which no records were kept. In all, 636,419 persons found employment directly in the mining industry, and depended upon this industry as their regular means of support. They received in wages $265,290,643, or more than 52 per cent of the entire value of what they produced. In addition, the other expenditures aggregated $115,874,135. It should be noted that the amounts specified for each industry as expended in payments for wage accounts are the actual sums paid, as shown by the pay rolls. An entirely independent statement was obtained, designed to show the usual rates of wages prevalent in the different sections of the country. The result of computing the total wages paid from the usual rates of wages and the total number employed will obviously not agree necessarily with amounts recorded in the books as actually paid.

The statistics as to capital involved in the mining industry are naturally the least accurate, for the estimate of what the property would bring in the market, if offered for sale, must depend on many chance conditions; but the results thoroughly fulfill their purpose in giving an approximate idea of the extent to which the industry is changing from a speculative to a more conservative pursuit, involving an outlay of over $1,340,000,000.

TOTAL VALUE OF THE MINERAL PRODUCTS OF THE UNITED STATES, BY STATES AND TERRITORIES.

Total	$587,230,662
Alabama	9,828,369
Alaska	926,568
Arizona	7,248,717
Arkansas	567,683
California	19,699,354
Colorado	41,126,610
Connecticut	3,090,161
Delaware	506,754
District of Columbia	40,000
Florida	138,728
Georgia	2,988,935
Idaho	8,385,233
Illinois	17,110,317
Indiana	9,704,949
Indian territory	1,333,807
Iowa	10,267,068
Kansas	5,935,981
Kentucky	4,711,944
Louisiana	480,000
Maine	8,126,493
Maryland	5,089,447
Massachusetts	3,700,634
Michigan	70,880,524
Minnesota	11,542,138
Mississippi	41,174
Missouri	15,931,575
Montana	33,737,775
Nebraska	$257,019
Nevada	10,143,874
New Hampshire	920,164
New Jersey	8,275,936
New Mexico	4,611,764
New York	24,165,206
North Carolina	451,625
North Dakota	61,431
Ohio	26,653,439
Oregon	1,238,114
Pennsylvania	150,876,649
Rhode Island	987,055
South Carolina	3,022,285
South Dakota	3,685,862
Tennessee	6,455,283
Texas	1,985,679
Utah	11,681,019
Vermont	5,674,022
Virginia	6,023,076
Washington	2,998,355
West Virginia	6,969,804
Wisconsin	10,183,861
Wyoming	1,810,515
Mexican lead smelted in the United States	2,343,474
Undistributed copper	389,273
Nickel in imported Canadian matte	21,000
Copper from imported pyrites	603,940
Fuel displaced by natural gas used at pipe lines for drilling and pumping wells and for other uses	1,600,000

MINERAL PRODUCTS OF THE UNITED STATES FOR

	PRODUCTS.	1880.		1881.	
		Quantity.	Value.	Quantity.	Value.
	Grand total		$369,319,000		$406,175,552
	Total value of metallic products		190,039,865		192,892,408
	Total value of nonmetallic mineral products		173,279,135		206,783,144
	Total value of mineral products unspecified		6,000,000		6,500,000
	METALLIC:				
1	Pig iron, value at Philadelphia, long tons	3,375,912	89,315,569	4,144,254	87,029,334
2	Silver, coining value, troy ounces (*b*)	30,320,000	39,200,000	33,077,000	43,000,000
3	Gold, coining value, troy ounces (*c*)	1,741,500	36,000,000	1,676,300	34,700,000
4	Copper, value at New York city, pounds (*d*)	60,480,000	11,491,200	71,680,000	12,175,600
5	Lead, value at New York city, short tons	97,825	9,782,500	117,085	11,240,160
6	Zinc, value at New York city, short tons	23,239	2,277,432	26,800	2,680,000
7	Quicksilver, value at San Francisco, flasks (*e*)	59,926	1,797,780	60,851	1,764,679
8	Nickel, value at Philadelphia, pounds (*f*)	329,968	164,984	265,668	292,235
9	Aluminum, value at Pittsburg, pounds	(*g*)		(*g*)	
10	Antimony, value at San Francisco, short tons (*h*)	50	10,000	50	10,000
11	Platinum, value (crude) at San Francisco, troy ounces	100	400	100	400
	NONMETALLIC (SPOT VALUES):				
12	Bituminous coal, long tons (*i*)	38,242,641	53,443,718	48,179,475	60,224,344
13	Pennsylvania anthracite, long tons (*j*)	25,580,189	42,196,678	28,500,016	64,125,036
14	Building stone		18,356,055		20,000,000
15	Petroleum, barrels (*k*)	26,286,123	24,183,233	27,661,238	25,448,339
16	Lime, barrels (*l*)	28,000,000	19,000,000	30,000,000	20,000,000
17	Natural gas		(*g*)		(*g*)
18	Cement, barrels (*m*)	2,072,943	1,352,707	2,500,000	2,000,000
19	Salt, barrels (*n*)	5,961,060	4,829,566	6,200,000	4,200,000
20	Limestone for iron flux, long tons	4,500,000	3,800,000	6,000,000	4,100,000
21	Phosphate rock, long tons (*o*)	211,377	1,123,823	266,734	1,980,259
22	Mineral waters, gallons sold	2,000,000	500,000	3,000,000	700,000
23	Zinc white, short tons	10,107	763,738	10,000	700,000
24	Gypsum, short tons	90,000	400,000	85,000	350,000
25	Borax, pounds	3,692,443	277,233	4,046,000	304,461
26	Mineral paints, long tons (*p*)	3,604	135,840	6,000	100,000
27	Manganese ore, long tons	5,761	86,415	4,895	73,425
28	Asphaltum, short tons	444	4,440	2,000	8,000
29	Pyrites, long tons	2,000	5,000	10,000	60,000
30	Crude barytes, long tons	20,000	80,000	20,000	80,000
31	Bromine, pounds	404,690	114,752	300,000	75,000
32	Corundum, short tons (*q*)	1,044	29,280	500	80,000
33	Marls, short tons (*r*)	1,000,000	500,000	1,000,000	500,000
34	Precious stones		50,000		60,000
35	Gold quartz, souvenirs, jewelry, etc		50,000		50,000
36	Flint, long tons	20,000	80,000	25,000	100,000
37	Fluorspar, short tons	4,000	16,000	4,000	16,000
38	Graphite, pounds		*s* 49,800	400,000	30,000
39	Novaculite, pounds	420,000	8,000	500,000	8,580
40	Feldspar, long tons	12,500	60,000	14,000	70,000
41	Chromic iron ore, long tons	2,288	27,808	2,000	30,000
42	Mica, pounds	81,669	127,825	100,000	250,000
43	Slate ground as a pigment, long tons	1,000	10,000	1,000	10,000
44	Cobalt oxide, pounds	7,251	24,000	8,280	25,000
45	Sulphur, short tons	600	21,000	600	21,000
46	Rutile, pounds	100	400	200	700
47	Asbestos, short tons	150	4,312	200	7,000
48	Potters' clay, long tons	20,783	200,457	25,000	200,000
49	Grindstones		500,000		500,000
50	Millstones		200,000		150,000
51	Ozocerite, refined, pounds				
52	Infusorial earth, short tons	1,833	45,660	1,000	10,000
53	Soapstone, short tons	8,441	66,665	7,000	75,000
54	Fibrous talc, short tons	4,210	54,730	5,000	60,000
55	Lithographic stone, short tons			50	1,000

a The statistics for 1880 are mainly revisions of the results of the Tenth Census; those for 1881 are estimates by D. T. Day; from 1882 to 1888 the statistics have been taken from the reports of the United States geological survey, with occasional modifications. The statistics of lime, salt, cement, slate ground as a pigment and rutile in 1889 are estimates by D. T. Day.

b $1.2929 per troy ounce.

c $20.6718 per troy ounce.

d Including copper made from imported pyrites.

e Of 76.5 avoirdupois pounds net.

f Including nickel in copper-nickel alloy and in exported ore and matte, except for 1881, for which no returns are available for matte.

g None reported.

THE CALENDAR YEARS 1880 TO 1889, INCLUSIVE. (a)

1882.		1883.		1884.		
Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
.....	$457,595,259	.....	$453,441,073	.....	$412,989,105	
.....	219,755,109	.....	209,128,859	.....	186,109,599	
.....	231,340,150	.....	243,812,214	.....	221,879,506	
.....	6,500,000	.....	6,500,000	.....	5,000,000	
4,623,323	106,336,429	4,595,510	91,910,200	4,097,868	73,761,624	1
36,197,695	46,800,000	35,733,622	46,200,000	37,744,605	48,800,000	2
1,572,186	32,500,000	1,451,249	30,000,000	1,489,949	30,800,000	3
91,646,232	16,038,091	117,151,795	18,064,807	145,221,934	17,789,687	4
132,890	12,624,550	143,957	12,322,719	139,897	10,537,042	5
33,765	3,646,620	36,872	3,311,106	38,544	3,422,707	6
52,732	1,487,042	46,725	1,253,632	31,913	936,327	7
281,616	309,777	58,800	52,920	64,550	48,412	8
(g)	.....	83	875	150	1,350	9
60	12,000	60	12,000	60	12,000	10
200	600	200	600	150	450	11
60,861,190	76,076,487	68,531,500	82,237,800	73,730,539	77,417,066	12
31,358,264	70,556,094	34,336,469	77,257,055	33,175,756	66,351,512	13
.....	21,000,000	.....	20,000,000	.....	19,000,000	14
30,510,880	24,065,988	23,449,633	25,790,252	24,218,438	20,595,966	15
31,000,000	21,700,000	32,000,000	19,200,000	37,000,000	18,500,000	16
.....	215,000	.....	475,000	.....	1,400,000	17
3,250,000	3,672,750	4,190,000	4,293,500	4,000,000	3,720,000	18
6,412,373	4,320,140	6,192,231	4,211,042	6,514,937	4,197,734	19
3,850,000	2,310,000	3,814,273	1,907,136	3,401,930	1,700,965	20
332,077	1,992,462	378,380	2,270,280	431,779	2,374,784	21
5,000,000	800,000	7,529,423	1,119,603	10,215,328	1,459,143	22
10,000	700,000	12,000	840,000	13,000	910,000	23
100,000	450,000	90,000	420,000	90,000	396,000	24
4,236,291	338,903	6,500,000	585,000	7,000,000	490,000	25
7,000	105,000	7,000	84,000	7,000	84,000	26
4,532	67,980	6,155	92,325	10,180	122,160	27
3,000	10,500	3,000	10,500	3,000	10,500	28
12,000	72,000	25,000	137,500	35,000	175,000	29
20,000	80,000	27,000	108,000	25,000	100,000	30
250,000	75,000	301,100	72,264	281,100	67,464	31
500	80,000	550	100,000	600	108,000	32
1,080,000	540,000	972,000	486,000	875,000	437,500	33
.....	75,000	.....	92,050	.....	82,975	34
.....	75,000	.....	115,000	.....	149,000	35
25,000	100,000	25,000	100,000	30,000	120,000	36
4,000	20,000	4,000	20,000	4,000	20,000	37
425,000	34,000	575,000	46,000	.....	(t)	38
600,000	10,000	600,000	10,000	800,000	12,000	39
14,000	70,000	14,100	71,112	10,900	55,112	40
2,500	50,000	3,000	60,000	2,000	35,000	41
100,000	250,000	114,000	285,000	147,410	368,525	42
2,000	24,000	2,000	24,000	2,000	20,000	43
11,653	32,046	1,096	2,795	2,000	5,100	44
600	21,000	1,000	27,000	500	12,000	45
500	1,800	550	2,000	600	2,000	46
1,200	36,000	1,000	30,000	1,000	30,000	47
30,000	240,000	32,000	250,000	35,000	270,000	48
.....	700,000	.....	600,000	.....	570,000	49
.....	200,000	.....	150,000	.....	150,000	50
.....	.....	.....	.....	.....	.....	51
1,000	8,000	1,000	5,000	1,000	5,000	52
6,000	90,000	8,000	150,000	10,000	200,000	53
6,000	75,000	6,000	75,000	10,000	110,000	54
.....	.....	.....	.....	.....	.....	55

h Part of the antimony in 1889 was valued at Philadelphia.
i Except in 1880 and 1889 this includes brown coal and lignite and anthracite mined elsewhere than in Pennsylvania.
j In 1880 and 1889 this includes all anthracite.
k Of 42 gallons.
l Of 200 pounds.
m Of 300 pounds for natural cement and 400 pounds for artificial Portland.
n Of 280 pounds net.
o Except for 1889 this represents only the South Carolina product.
p Ocher and metallic paint.
q Refined corundum from 1881 to 1888, both inclusive.
r Except for 1888 and 1889 this includes only New Jersey marls.
s Value of the crude product.
t Practically nothing.

MINERAL PRODUCTS OF THE UNITED STATES FOR THE

	PRODUCTS.	1885.		1886.	
		Quantity.	Value.	Quantity.	Value.
	Grand total		$427,898,680		$465,504,294
	Total value of metallic products		181,580,587		215,364,825
	Total value of nonmetallic mineral products		241,312,093		245,139,469
	Total value of mineral products unspecified		5,000,000		5,000,000
	METALLIC:				
1	Pig iron, value at Philadelphia, long tons	4,044,525	64,712,400	5,683,329	95,195,760
2	Silver, coining value, troy ounces	39,910,279	51,600,000	39,445,312	51,000,000
3	Gold, coining value, troy ounces	1,538,376	31,800,000	1,881,250	35,000,000
4	Copper, value at New York city, pounds	170,962,607	18,292,999	161,235,381	16,527,651
5	Lead, value at New York city, short tons	129,412	10,469,431	135,629	12,607,749
6	Zinc, value at New York city, short tons	40,688	3,539,856	42,641	3,752,408
7	Quicksilver, value at San Francisco, flasks	32,073	979,189	29,981	1,060,000
8	Nickel, value at Philadelphia, pounds	277,904	179,975	214,992	127,157
9	Aluminum, value at Pittsburg, pounds	283	2,550	3,000	27,000
10	Antimony, value at San Francisco, short tons	50	10,000	35	7,000
11	Platinum, value (crude) at San Francisco, troy ounces	250	187	50	100
	NONMETALLIC (SPOT VALUES):				
12	Bituminous coal, long tons	64,840,668	82,347,648	65,810,676	78,481,056
13	Pennsylvania anthracite, long tons	34,228,548	76,671,948	34,853,077	76,119,120
14	Building stone		19,000,000		19,000,000
15	Petroleum, barrels	21,847,205	19,198,243	28,064,841	19,996,313
16	Lime, barrels	40,000,000	20,000,000	42,500,000	21,250,000
17	Natural gas		4,857,200		10,012,000
18	Cement, barrels	4,150,000	3,492,500	4,500,000	3,990,000
19	Salt, barrels	7,038,653	4,825,345	7,707,081	4,736,585
20	Limestone for iron flux, long tons	3,356,956	1,678,478	4,717,163	2,830,297
21	Phosphate rock, long tons	437,856	2,846,064	430,549	1,872,936
22	Mineral waters, gallons sold	9,148,401	1,312,845	8,950,317	1,284,070
23	Zinc white, short tons	15,000	1,050,000	18,000	1,440,000
24	Gypsum, short tons	90,405	405,000	95,250	428,625
25	Borax, pounds	8,000,000	480,000	9,778,200	488,915
26	Mineral paints, long tons	3,950	43,575	15,800	285,000
27	Manganese ore, long tons	23,258	190,281	30,193	277,636
28	Asphaltum, short tons	3,000	10,500	3,500	14,000
29	Pyrites, long tons	49,000	220,500	55,000	220,000
30	Crude barytes, long tons	15,000	75,000	10,000	50,000
31	Bromine, pounds	310,000	89,900	428,334	141,350
32	Corundum, short tons	600	108,000	645	116,100
33	Marls, short tons	875,000	437,500	800,000	400,000
34	Precious stones		69,900		79,056
35	Gold quartz, souvenirs, jewelry, etc		140,000		40,000
36	Flint, long tons	30,000	120,000	30,000	120,000
37	Fluorspar, short tons	5,000	22,500	5,000	22,000
38	Graphite, pounds	327,883	26,231	415,525	33,242
39	Novaculite, pounds	1,000,000	15,000	1,160,000	15,000
40	Feldspar, long tons	13,600	68,000	14,900	74,500
41	Chromic iron ore, long tons	2,700	40,000	2,000	30,000
42	Mica, pounds	92,000	161,000	40,000	70,000
43	Slate ground as a pigment, long tons	1,975	24,687	3,000	30,000
44	Cobalt oxide, pounds	c68,723	65,373	c35,000	36,878
45	Sulphur, short tons	715	17,875	2,500	75,000
46	Rutile, pounds	600	2,000	600	2,000
47	Asbestos, short tons	300	9,000	200	6,000
48	Potters' clay, long tons	36,000	275,000	40,000	325,000
49	Grindstones		500,000		250,000
50	Millstones		100,000		140,000
51	Ozocerite, refined, pounds				
52	Infusorial earth, short tons	1,000	5,000	1,200	6,000
53	Soapstone, short tons	10,000	200,000	12,000	225,000
54	Fibrous talc, short tons	10,000	110,000	12,000	125,000
55	Lithographic stone, short tons			40	700

a Not including lime in barrels, limestone for iron flux or grindstones.

b Value of the crude product.

CALENDAR YEARS 1880 TO 1889, INCLUSIVE—Continued.

1887.		1888.		1889.		
Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
.....	$542,691,374	.....	$564,498,631	.....	$587,230,662	
.....	250,275,054	.....	256,257,517	.....	269,590,487	
.....	287,416,320	.....	303,241,114	.....	307,640,175	
.....	5,000,000	.....	5,000,000	.....	10,000,000	
6,417,148	121,925,800	6,489,738	107,000,000	7,603,642	120,000,000	1
41,269,240	53,350,000	45,783,632	59,195,000	51,354,851	66,396,988	2
1,596,500	33,000,000	1,604,927	33,175,000	1,590,869	32,886,744	3
185,227,331	21,115,916	231,270,622	33,833,954	231,246,214	26,307,800	4
160,700	14,463,000	180,555	15,924,951	182,967	16,137,689	5
50,340	4,782,300	55,903	5,500,855	58,860	5,791,824	6
33,825	1,429,000	33,250	1,413,125	26,484	1,190,500	7
205,566	133,200	204,328	127,632	252,663	151,598	8
18,000	59,000	19,000	65,000	47,468	97,335	9
75	15,000	100	20,000	115	28,000	10
448	1,838	500	2,000	500	2,000	11
78,470,857	98,004,656	91,106,998	101,860,529	85,383,659	94,346,809	12
37,578,747	84,552,181	41,624,611	89,020,483	49,714,721	65,879,514	13
.....	25,000,000	.....	25,500,000	.....	c42,809,706	14
28,278,866	18,877,094	27,612,025	17,947,620	35,163,513	26,963,340	15
46,750,000	23,375,000	49,087,000	24,543,500	68,474,668	33,217,915	16
.....	15,817,500	.....	22,629,875	.....	21,097,699	17
6,942,744	5,674,377	6,503,295	5,021,139	7,000,000	5,000,000	18
7,831,962	4,093,846	8,055,881	4,374,203	8,005,565	4,195,412	19
5,377,000	3,226,200	5,438,000	2,719,000	6,318,000	3,159,000	20
480,558	1,836,818	448,567	2,018,552	550,245	2,937,776	21
8,259,609	1,261,463	9,578,648	1,679,302	12,780,471	1,748,458	22
18,000	1,440,000	20,000	1,600,000	16,970	1,357,600	23
95,000	425,000	110,000	550,000	267,769	764,118	24
11,000,000	550,000	7,589,000	455,340	8,000,000	500,000	25
20,000	310,000	24,000	380,000	32,307	463,766	26
34,524	333,844	29,198	279,571	24,197	240,550	27
4,000	16,000	53,800	331,500	51,735	171,537	28
52,000	210,000	54,331	167,658	93,705	202,119	29
15,000	75,000	20,000	110,000	19,161	106,313	30
199,087	61,717	307,386	95,290	418,891	125,667	31
600	108,000	589	91,620	2,245	195,565	32
600,000	300,000	300,000	150,000	156,265	63,956	33
.....	88,600	.....	64,850	.....	188,807	34
.....	75,000	.....	75,000	.....		35
32,000	185,000	30,000	175,000	11,113	49,137	36
5,000	20,000	6,000	30,000	9,500	45,835	37
416,000	34,000	400,000	33,000	.....	672,662	38
1,200,000	16,000	1,500,000	18,000	5,982,000	32,980	39
10,200	56,100	8,700	50,000	6,970	39,370	40
3,000	40,000	1,500	20,000	2,000	30,000	41
70,000	142,250	48,000	70,000	49,500	50,000	42
2,000	20,000	2,500	25,000	2,000	20,000	43
d18,340	18,774	c8,491	15,782	13,955	31,092	44
3,000	100,000	(e)	.....	1,150	7,850	45
1,000	3,000	1,000	3,000	1,000	3,000	46
150	4,500	100	3,000	30	1,800	47
43,000	340,000	36,750	300,000	294,344	635,578	48
.....	224,400	.....	281,800	.....	439,587	49
.....	100,000	.....	81,000	.....	35,155	50
.....	.....	43,500	3,000	50,000	2,500	51
3,000	15,000	1,500	7,500	3,466	23,372	52
12,000	225,000	15,000	250,000	12,715	231,708	53
15,000	160,000	20,000	210,000	23,746	244,170	54
.....	.....	.....	.....	18	243	55

c Including that contained in ore and matte. d Including cobalt oxide in exported ore and matte. e None reported.

TOTAL MINERAL PRODUCTION OF THE UNITED STATES FROM 1880 TO 1889, INCLUSIVE, WITH VALUES, AMOUNTS, AND PERCENTAGE INCREASE OR DECREASE OF 1889 OVER 1880.

PRODUCTS.	PRODUCTION FOR 10 YEARS.		INCREASE OR DECREASE IN 1889 COMPARED WITH 1880.							
	Quantity.	Value.	Increase in quantity.	Percentage of increase.	Decrease in quantity.	Percentage of decrease.	Increase in value.	Percentage of increase.	Decrease in value.	Percentage of decrease.
Grand total		$4,687,343,630					$217,911,662	59.00		
Total value of metallic products		2,165,000,310					79,550,622	41.86		
Total value of nonmetallic products		2,461,843,320					134,361,040	77.54		
Total value of mineral products unspecified.		60,500,000					4,000,000	66.67		
METALLIC:										
Pig iron, value at Philadelphia, long tons	51,075,249	957,187,116	4,227,730	125.23			30,684,431	34.36		
Silver, coining value, troy ounces (*a*)	390,836,236	505,541,988	21,034,851	09.38			27,196,988	69.38		
Gold, coining value, troy ounces (*b*)	16,143,106	329,861,744			150,631	8.65			$3,113,256	8.65
Copper, value at New York city, pounds (*c*).	1,466,122,116	192,237,714	170,766,214	282.35			15,416,609	134.16		
Lead, value at New York city, short tons.	1,420,917	126,169,791	85,142	87.04			6,355,189	64.96		
Zinc, value at New York city, short tons.	407,652	38,705,108	35,621	153.28			3,514,392	154.31		
Quicksilver, value at San Francisco, flasks (*d*).	407,760	13,311,274			33,442	55.81			607,280	33.78
Nickel, value at Philadelphia, pounds (*e*).	2,156,055	1,587,890			77,305	23.43			13,386	8.11
Aluminum, value at Pittsburg, pounds.	87,984	253,110	47,468				97,335			
Antimony, value at San Francisco, short tons (*f*).	655	136,000	65	130.00			18,000	180.00		
Platinum, value (crude) at San Francisco, troy ounces.	2,498	8,575	400	400.00			1,600	400.00		
NONMETALLIC (SPOT VALUES):										
Bituminous coal, long tons (*g*)	675,157,603	804,440,113	47,140,418	123.27			40,903,091	76.53		
Pennsylvania anthracite, long tons (*h*).	341,950,398	712,729,621	15,134,532	59.17			23,682,836	50.12		
Building stone		229,665,761					24,453,051	133.22		
Petroleum, barrels (*i*)	273,092,712	223,066,388	8,877,390	33.77			2,780,107	11.50		
Lime, barrels (*j*)	404,811,608	220,785,515	40,474,668	144.55			14,217,015	74.83		
Natural gas		76,563,674					21,097,099			
Cement, barrels (*k*)	45,108,982	38,716,973	4,927,057	237.08			3,147,293	169.88		
Salt, barrels (*l*)	69,919,743	43,983,873	2,044,505	34.30					634,154	13.13
Limestone for iron flux, long tons	46,773,322	27,431,076	1,818,000	40.40					641,000	16.87
Phosphate rock, long tons (*m*)	3,968,122	21,253,754	338,868	160.31			1,813,953	161.41		
Mineral waters, gallons sold	76,462,197	11,864,884	10,780,471	539.02			1,248,458	249.69		
Zinc white, short tons	143,077	10,801,338	6,863	67.90			593,862	77.76		
Gypsum, short tons	1,113,424	4,582,743	177,769	197.52			364,118	91.03		
Borax, pounds	69,842,024	4,469,852	4,307,557	116.66			222,767	80.35		
Mineral paints, long tons (*n*)	126,661	1,991,181	28,703	796.42			327,926	241.41		
Manganese ore, long tons	172,893	1,764,196	18,436	320.01			154,144	178.38		
Asphaltum, short tons	127,479	587,477	51,291	11,552.03			167,097	3,763.45		
Pyrites, long tons	388,036	1,469,777	91,705	4,585.25			197,119	3,942.38		
Crude barytes, long tons	191,161	864,313			839	4.20	26,313	32.89		
Bromine, pounds	3,200,588	918,404	14,201	3.51			10,915	9.51		
Corundum, short tons (*o*)	7,873	926,655	1,201	115.04			76,285	260.54		
Marls, short tons (*p*)	7,658,265	3,814,956			843,735	84.37			436,044	87.21
Precious stones		851,298					88,807	88.81		
Gold quartz, souvenirs, jewelry, etc.		760,000								
Flint, long tons	258,113	1,149,137			8,887	44.44			30,863	38.58
Fluorspar, short tons	50,500	232,335	5,500	137.50			29,835	186.47		
Graphite, pounds	2,959,408	358,935					22,862	45.91		
Novaculite, pounds	13,762,000	145,560	5,562,000	1,324.29			24,980	312.25		
Feldspar, long tons	119,870	614,194			5,530	44.24			20,630	34.38
Chromic iron ore, long tons	22,988	362,808			288	12.59	2,192	7.88		
Mica, pounds	842,579	1,774,600			32,169	39.39			77,825	60.88
Slate ground as pigment, long tons	19,475	207,687	1,000	100.00			10,000	100.00		
Cobalt oxide, pounds (*q*)	174,789	256,840	6,704	92.46			7,092	29.55		
Sulphur, short tons	10,665	302,725	550	91.67					13,150	62.62
Rutile, pounds	6,150	19,900	900	900.00			2,600	650.00		
Asbestos, short tons	4,330	131,612			120	80.00			2,512	58.26
Potters' clay, long tons	592,877	3,036,035	273,561	1,316.27			435,121	217.06		
Grindstones		4,565,787							60,413	12.08
Millstones		1,306,155							164,845	82.42
Ozocerite, refined, pounds	93,500	5,500	50,000				2,500			
Infusorial earth, short tons	15,999	130,532	1,633	89.09					22,288	48.81
Soapstone, short tons	101,156	1,713,373	4,274	50.63			165,043	247.57		
Fibrous talc	111,956	1,223,900	19,536	464.04			180,440	346.14		
Lithographic stone, short tons	108	1,943	18				243			

a $1.2929 per troy ounce.
b $20.6718 per troy ounce.
c Including copper made from imported pyrites.
d Of 76.5 avoirdupois pounds net.
e Including nickel in copper-nickel alloy and in exported ore and matte, except for 1881, for which no returns are available for matte.
f Part of the antimony for 1889 was valued at Philadelphia.
g Except for 1880 and 1889 this includes brown coal and lignite and anthracite mined elsewhere than in Pennsylvania.
h For 1880 and 1889 this includes all anthracite.
i Of 42 gallons.
j Of 200 pounds.
k Of 300 pounds for natural cement and 400 pounds for artificial Portland.
l Of 280 pounds net.
m Except for 1880 this represents only the South Carolina product.
n Ocher and metallic paint.
o Refined corundum from 1881 to 1888, both inclusive.
p Except for 1888 and 1889 this includes only New Jersey marls.
q Including cobalt oxide in exported ore and matte.

IRON ORES.

35 M——1

MAP OF THE UNITED STATES.

SHOWING THE LOCALITIES PRODUCING IRON ORE IN 1889
AND THE VARIETIES OF ORE PRODUCED.

BY JOHN BIRKINBINE.

LEGEND.

- RED HEMATITE
- BROWN HEMATITE
- MAGNETITE
- CARBONATE

GEO. S. HARRIS & SONS, LITH. PHILA.

ED BY U.S.G.S.

cale

IRON ORES.

BY JOHN BIRKINBINE.

PRODUCTION.

During the year ended December 31, 1889, the production of iron ore amounted to 14,518,041 long tons, which was contributed by 26 states and 2 territories, and this output represented a value on cars or carts at the mines of $33,351,978, an average of $2.30 per long ton.

The stock of ore on hand at the commencement of the census year was 1,966,824 long tons, while at its close this amount was augmented to 2,256,973 tons, an increase for the entire country of 290,149 tons, or nearly 15 per cent The stock of iron ore carried over is equivalent to 15.55 per cent of the production for the census year, but the increased stock, representing the amount of ore mined during the year, but not consumed, is but 2 per cent of the total output for 1889. Owing to the fact that the census year for the mining industries corresponded with the calendar year 1889, the stocks of iron ore on hand at the commencement and end of the year represented a larger amount than would have been the case a few months earlier, the practice of mine managers whose products must reach a market by means of water transportation encouraging a depletion of stock at the mines during the shipping season and an augmentation during the winter months, when navigation is suspended.

The statistics of production are given by states, except where the names or operations of individuals would be disclosed. As the iron ore in several of the states is mined, respectively, by a single firm or corporation, the figures of these states are grouped with those of other states.

Some of the large mines reporting adopt a fiscal year, which, while not corresponding with the census year, offered more detailed information in regard to labor, wages, supplies, etc., than could be obtained for the calendar year 1889. Therefore, wherever the data furnished did not materially affect the figures of production the reports were accepted for a few mines for the fiscal year which corresponded closely with the census year.

The returns made to this office for the various states and territories were compared with the publications and reports of state officials wherever these were obtainable, and any discrepancies were carefully investigated.

Michigan was by far the largest producer of iron ore in the census year 1889, a total of 5,856,169 long tons having been mined, the value of which was $15,800,521 at the mines, an average of $2.70 per ton. The tonnage from Michigan therefore represents 40.34 per cent of the total, while the aggregate value is 47.38 per cent of that of the entire country.

The credit of holding second rank lies between the states of Alabama and Pennsylvania, the former, from the figures collected, having apparently a slightly greater output than the latter. This uncertainty is owing to the fact that the reports obtained from 2 of the larger Alabama mines covered operations commencing May 1, 1889, and ending May 1, 1890, and no detailed record of the amount of ore produced and labor employed during the 3 months of 1890 was obtainable. The position of Pennsylvania is also affected by the refusal of one large producer to supply absolute figures. Alabama is therefore placed second as a producer of iron ore, with 1,570,319 long tons, valued at $1,511,611, an average of 96 cents per ton. These figures represent 10.82 and 4.53 per cent, respectively, of the total output and value.

Pennsylvania closely follows Alabama, its output being 1,560,234 long tons, valued at $3,063,534, an average of $1.96 per ton, and 10.75 and 9.19 per cent, respectively, of the total output and value; but in the shipment or apparent consumption of iron ores Pennsylvania takes precedence of Alabama.

The other state which produced over 1,000,000 tons in the census year was New York, which is credited with 1,247,537 long tons, valued at $3,100,216, an average of $2.49 per ton, the figures representing, respectively, 8.59 and 9.30 per cent of the total output and value.

These 4 states therefore produced a total of 10,234,259 long tons, or 70.49 per cent of the entire output of the iron-ore mines of the United States, while the value of the ore aggregates $23,475,882, or 70.39 per cent of the total.

The following table shows the number of iron-ore mines reported and producing in 1889, the amount of iron ore produced, the average value per long ton, the total valuation of iron ore produced and consumed, the stock on hand at the commencement and end of the census year, and the apparent consumption or shipments of iron ore:

PRODUCT AND VALUE OF IRON ORE IN 1889, BY STATES AND TERRITORIES.

[Long tons.]

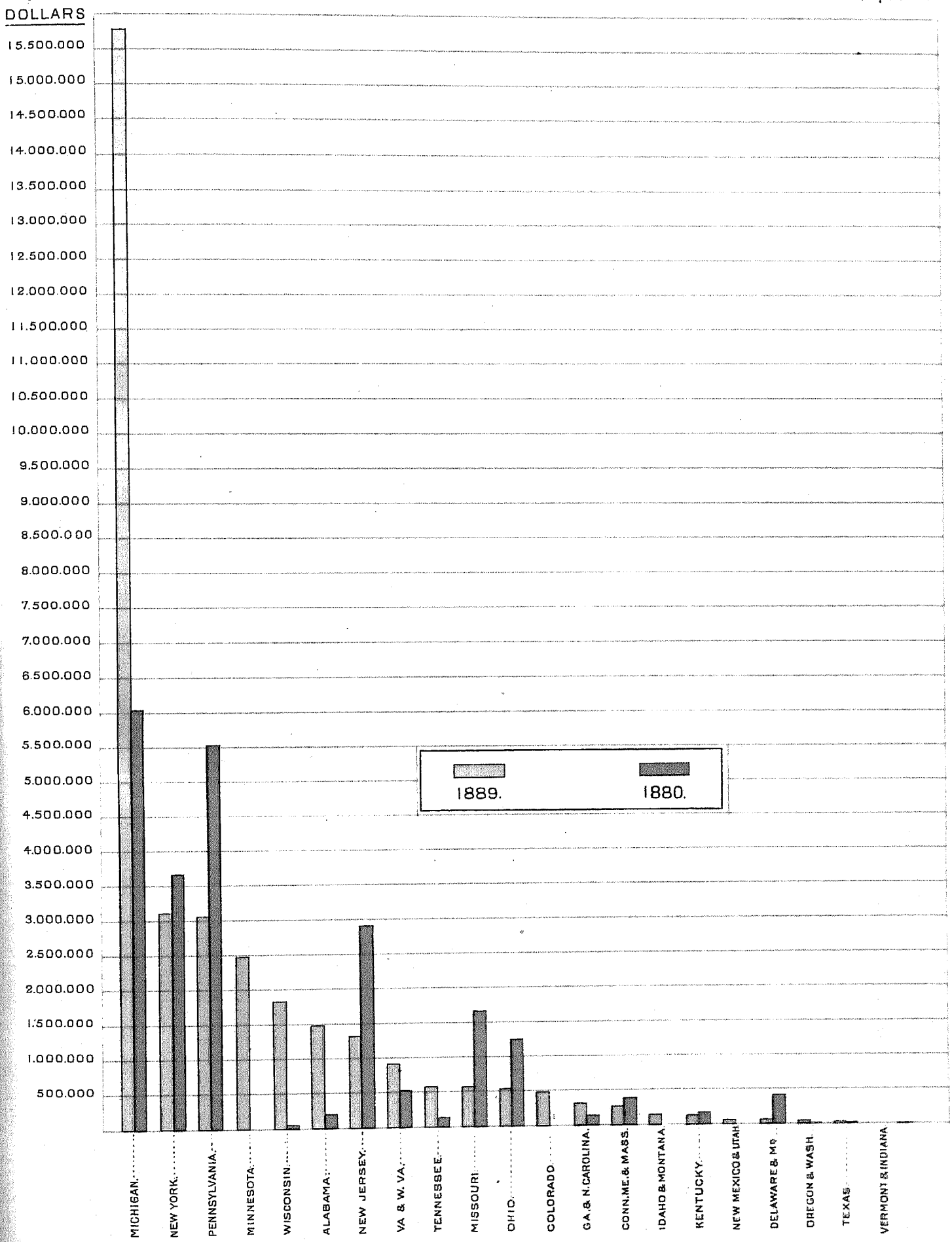
STATES AND TERRITORIES.	Number of mines reporting.	Number of mines producing.	Amount produced.	Stock on hand January 1, 1889.	Stock on hand January 1, 1890.	Total value of production.	Value per ton.	Total shipments.	Total value of shipments.
Total	685	592	14,518,041	1,966,824	2,256,973	$33,351,978	$2.30	14,227,892	$32,766,506
Alabama	48	45	1,570,319	61,125	104,462	1,511,611	0.96	1,526,982	1,457,314
Colorado	19	18	109,136	1,628	7,193	487,433	4.47	103,571	469,546
Connecticut, Maine, and Massachusetts	11	7	88,251	22,279	18,723	265,901	3.01	91,807	278,888
Delaware and Maryland	16	14	29,380	7,298	14,476	68,240	2.32	22,202	54,469
Georgia and North Carolina	20	17	258,145	19,443	32,148	334,025	1.29	245,440	317,372
Idaho and Montana	9	7	24,072	1,893	4,216	158,974	6.60	21,749	140,647
Kentucky	6	4	77,487	17,290	16,491	135,559	1.75	78,286	133,885
Michigan	99	73	5,856,169	803,700	903,499	15,800,521	2.70	5,756,370	15,588,369
Minnesota	4	4	864,508	273,395	278,936	2,478,041	2.87	858,967	2,464,419
Missouri	8	8	265,718	251,091	291,790	561,041	2.11	225,019	470,457
New Jersey	32	24	415,510	98,249	94,890	1,341,543	3.23	418,869	1,352,509
New Mexico and Utah	3	2	36,050	500	1,000	70,956	1.97	35,550	69,956
New York	42	35	1,247,537	158,223	185,890	3,100,216	2.49	1,219,870	3,028,676
Ohio	74	70	254,294	58,209	71,083	532,725	2.09	241,420	515,148
Oregon and Washington	3	3	26,283	3,575	2,740	39,234	1.49	27,118	40,389
Pennsylvania	198	189	1,560,234	82,322	91,989	3,063,534	1.96	1,550,567	3,045,100
Tennessee	19	16	473,294	29,863	16,844	606,476	1.28	486,313	629,454
Texas	3	2	13,000	200	4,300	19,750	1.52	8,900	16,554
Virginia and West Virginia	54	38	511,255	53,184	69,634	935,290	1.83	494,805	894,951
Wisconsin	17	16	837,399	23,357	46,669	1,840,908	2.20	814,087	1,798,403

The above statement is tabulated from actual returns, verified as far as possible, except by individual visitations to all of the iron-ore mines. The figures of production are probably below the actual results, for in some localities farmers gather ore at odd times and sell to blast furnaces in small lots, but wherever this amount could be obtained it is included in the table. No returns have been secured from a few mines; hence their outputs were omitted where they could not be closely estimated. Some persons who mine ore on a small scale keep such insufficient records that allowances had to be made from the figures reported. In other mines the practice of recording the output by the number of cars or skips handled has a tendency to underestimate the actual product.

Making allowance for all of the above, and possibly also for some scattered iron-ore mining of which the Census Office had no knowledge, the total amount of iron ore produced in the United States in the year 1889 probably exceeded 14,650,000 long tons. In the discussion of distribution, value, cost, etc., however, the actual figures as determined, viz, 14,518,041 long tons, will be used.

VALUE.—The value of iron ore given in the table represents averages only, for the locations of mines in relation to blast furnaces, etc., and the character of the ores won so influence their values that, except in a few instances, detailed information as to specific values can not be given without violating the promise to protect those who contributed information for the census. The amounts produced multiplied by the average value per ton gave the value of iron ore for each mine, and the products so obtained when added show the total value of the ore produced by the various mines. Dividing this total by the number of tons mined gave the average value per ton. The returns from the various mines were tabulated, and the difference between the stock on hand January 1, 1889, and January 1, 1890, was either added or subtracted, as the case might be, to or from the total amount of ore mined, giving the apparent shipments from each mine, which, multiplied by the average value per ton, gave the value of the shipments. These amounts added together gave the total shipments and the valuation of the same.

With the exception of a few mines in Wisconsin, the value of iron ore at the mines and the costs of mining in the states of Michigan, Minnesota, and Wisconsin may be taken as representing the iron-ore mining operations of mines in the Lake Superior region, which are wrought principally under ground, producing ores rich enough in iron to withstand heavy transport charges to distant points. On the other hand, the figures for Alabama, Tennessee, and Virginia and West Virginia represent the winning of leaner iron ores, which are chiefly consumed close to the mines. While much of this ore is obtained from underground workings, a considerable portion is won from open-cut operations. The value given for iron ores obtained from mines which may properly be considered in the Lake Superior region averaged $2.66 per ton, and the value of ores taken from mines in the states of Alabama, Tennessee, and Virginia and West Virginia averaged $1.20 per ton.



TOTAL VALUE OF THE IRON ORE PRODUCT OF EACH STATE IN 1889 AND 1880. SEE PAGES 14-16.

The highest average value per ton is reported in the returns from Idaho and Montana, where a limited amount of iron ore is won for fluxing ores of the precious metals. The lowest average value for any state is that of Alabama, where new but liberal underground exploitations of limited depths, or large open workings and facilities of mining, due to the character and the location of the ore deposits, contribute to place the value of iron ore at the mines at a low figure. Similar reasons also influenced to a greater or less extent the results in other states.

NUMBER OF MINES.—The number of persons, firms, or corporations reporting to this office as having iron-ore mines which may be considered as active is 685, of which 592 were producers in the census year 1889. Compared with the returns made in 1880, when the number of regular mining establishments was 805, besides a large number of irregular producers, aggregating, according to the compiled directory, 1,325, there has been a material decrease in the number of operators, which is accounted for by the fact that iron-ore mining as a business has assumed such proportions as to command greater capital and more intelligent management. Many producers mined but a few tons in 1880; but this class has in the 10 years which have elapsed become practically extinct except in a few localities. In the returns for the Eleventh Census there were but 81 mines reported which produced under 300 tons, while in the returns for the previous census 1,125 of the irregular producers furnished less than 300 tons.

All the mines reported in 1880 which were known or believed to have continued operations were supplied with schedules of the present census, and numerous new enterprises were sought out and data collected from them.

The growing demand for, and the appreciation of, the value of ores rich in iron have caused the abandonment or suspension of operations at numerous mines which produce ores carrying relatively small percentages of iron or high percentages of phosphorus, sulphur, etc. The development of the bessemer steel industry, which in the Tenth Census reported a production of 879,650 long tons of steel and in the Eleventh Census of 3,382,654 long tons, is also largely responsible for the exploration on a liberal scale of numerous mines from which ores were obtained specially valuable to this industry because they were low in phosphorus.

The number of operations reported is also affected by consolidation of adjoining properties, so as to work them under one management; and in a number of cases several mines which, though adjacent, are practically distinct workings are operated as a single plant, and hence separate reports of each mine were not required nor obtained.

Of the 65 mines mentioned, 31 produced between 50,000 and 100,000 tons, 17 between 100,000 and 200,000 tons, 11 between 200,000 and 300,000 tons, 2 between 300,000 and 400,000 tons, 2 between 500,000 and 600,000 tons, 1 produced 769,000 tons, and 1 produced 809,000 tons. Of these mines Michigan held the largest number, 29, 11 producing between 50,000 and 100,000 tons, 9 between 100,000 and 200,000 tons, 6 between 200,000 and 300,000 tons, 1 over 300,000 tons, 1 over 500,000 tons, and 1 over 800,000 tons. These figures give an indication of the development of large plants in the past decade, for deducting the 19 mines which each exceeded 50,000 tons output in 1880, and their aggregate production from the 805 regular and 1,325 irregular producers which contributed to make up the total of 7,120,362 long tons for the year 1880, there is a remainder of 786 regular and 1,325 irregular operations, producing a total of 4,923,179 tons or 2,332 tons per operation per annum. Similarly, deducting from the 592 mines which produced in 1889 14,518,041 long tons the 65 large operations and their aggregate output of 10,391,493 tons, the remainders show that 527 mines furnished 4,126,551 tons or 7,830 tons of iron ore per operation.

The apparent discrepancy between the number of producing mines and mines reported in the tables is accounted for by the fact that inquiries were directed to all known mines in process of practical development or temporarily idle but equipped with mining machinery and appliances, or which were inactive by reason of recent flooding or other exceptional causes. As all mining enterprises must first go through a course of development, and as a majority of mines are at times temporarily inactive from one cause or another, it seemed proper that as far as possible the labor employed in practical development work, with the cost of supplies for the same purpose, should be noted, and also that the figures tabulated should embrace as nearly as practicable the valuation of the plants and machinery at most of the mines which were temporarily inactive. The number of such operations which can not be included in the list of producing mines was not proportionately greater in the census year than during other years of the past decade, nor was the capital invested in equipment, machinery, and labor for development in excess of what is generally so employed.

The mines reported do not include any that were abandoned prior to December 31, 1888, or those concerning which it was impossible to obtain specific information. The actual number of reports received, viz, 685, was for producing mines or mines in position for immediate or future work, and these, as before indicated, in a number of cases represent several adjacent openings under a common management and operated as one mine. Mines which have for years been idle, numerous small openings which have been exploited to a greater or less extent, and scattered exploratory work in progress would considerably augment the number of apparent mining operations without increasing the quantity of iron ore won. These have not been considered, as it is impracticable to obtain full data of all such operations, and their figures of capital and labor would be misleading.

Placing the states in the order of the number of producing mines in 1889, the rank for the larger producers is as follows:

The number of productive mining operations (189) places Pennsylvania first, while the state ranks third in the amount of ore produced, viz, 1,560,234 tons.

Michigan, which had the largest output of iron ore for the year 1889, viz, 5,856,169 tons, had for this product but a comparatively small number of mines, viz, 73, many of which, however, were large operations.

Ohio follows next, with 70 producing mines, but as a producer of 254,294 tons it occupied eleventh position.

The fourth place is taken by Alabama, with 45 producing mines, while the state occupied second position as to the amount of ore won, 1,570,319 tons, the average output of the mines being large.

Virginia and West Virginia combined, with 38 mines, come next, and stand seventh as to the amount of ore won, viz, 511,255 tons.

New York ranks sixth in regard to the number of mines, viz, 35, many of which are large operations, and contributed to place the state in fourth place as a producer, with 1,247,537 tons.

New Jersey follows with 24 producing mines, while its 1889 output of 415,510 tons gave it ninth rank.

Minnesota reports but 4 active mines, and occupies a low rank in this respect. It, however, was fifth in the amount of ore produced, viz, 864,508 tons, indicating large mines.

Colorado produced but a small amount of ore (109,136 tons) during the year 1889, holding thirteenth position in this respect, and had 18 active iron-ore mines, showing but a small average from each.

Wisconsin, which held a high rank as a producer, with an output of 837,399 tons, had but 16 mines, most of which were large operations.

The following statement, exhibiting the average output per mining operation, is presented as illustrating one of the causes which influence the labor employed and the average cost of producing iron ore in each state:

AVERAGE PRODUCT PER IRON-ORE MINING OPERATION IN 1889.

	LONG TONS.		LONG TONS.
The United States	24,524	Missouri	33,215
		New Jersey	17,313
Alabama	34,896	New Mexico and Utah	18,025
Colorado	6,063	New York	35,644
Connecticut, Maine, and Massachusetts	12,607	Ohio	3,633
Delaware and Maryland	2,099	Oregon and Washington	8,761
Georgia and North Carolina	15,185	Pennsylvania	8,255
Idaho and Montana	3,439	Tennessee	29,581
Kentucky	19,372	Texas	6,500
Michigan	80,221	Virginia and West Virginia	13,454
Minnesota	216,127	Wisconsin	52,337

In comparing this statement with that of the tons of ore won per employé, on page 18, it is noted that, with the exception of Tennessee, each of the seven states which show an output per mining operation above the average for the United States is among those which mined the largest quantity of ore per man in 1889.

In the preceding census year 19 mines were reported as producing over 50,000 long tons each, of which 10 furnished red hematite and 9 magnetite. These 19 mines contributed 2,197,183 long tons, or 30.86 per cent of the total amount of iron ore produced, in the year 1880 valued at $8,222,640, or 35.51 per cent of the total valuation. The largest production of any individual operation in that year was 250,000 tons. Another mine had an output of 200,000 tons, and 8 additional mines produced between 100,000 and 200,000 tons each in 1880.

In 1889 there were 65 mining operations, each of which reported a product exceeding 50,000 long tons. Of these, 46 furnished red hematite, 9 magnetite, 8 brown hematite, and 2 carbonate ores. These 65 mines aggregated a production of 10,391,490 long tons, representing 71.58 per cent of the total output of the country for the census year. The ore was valued at $24,340,611, or 72.98 per cent of the total valuation.

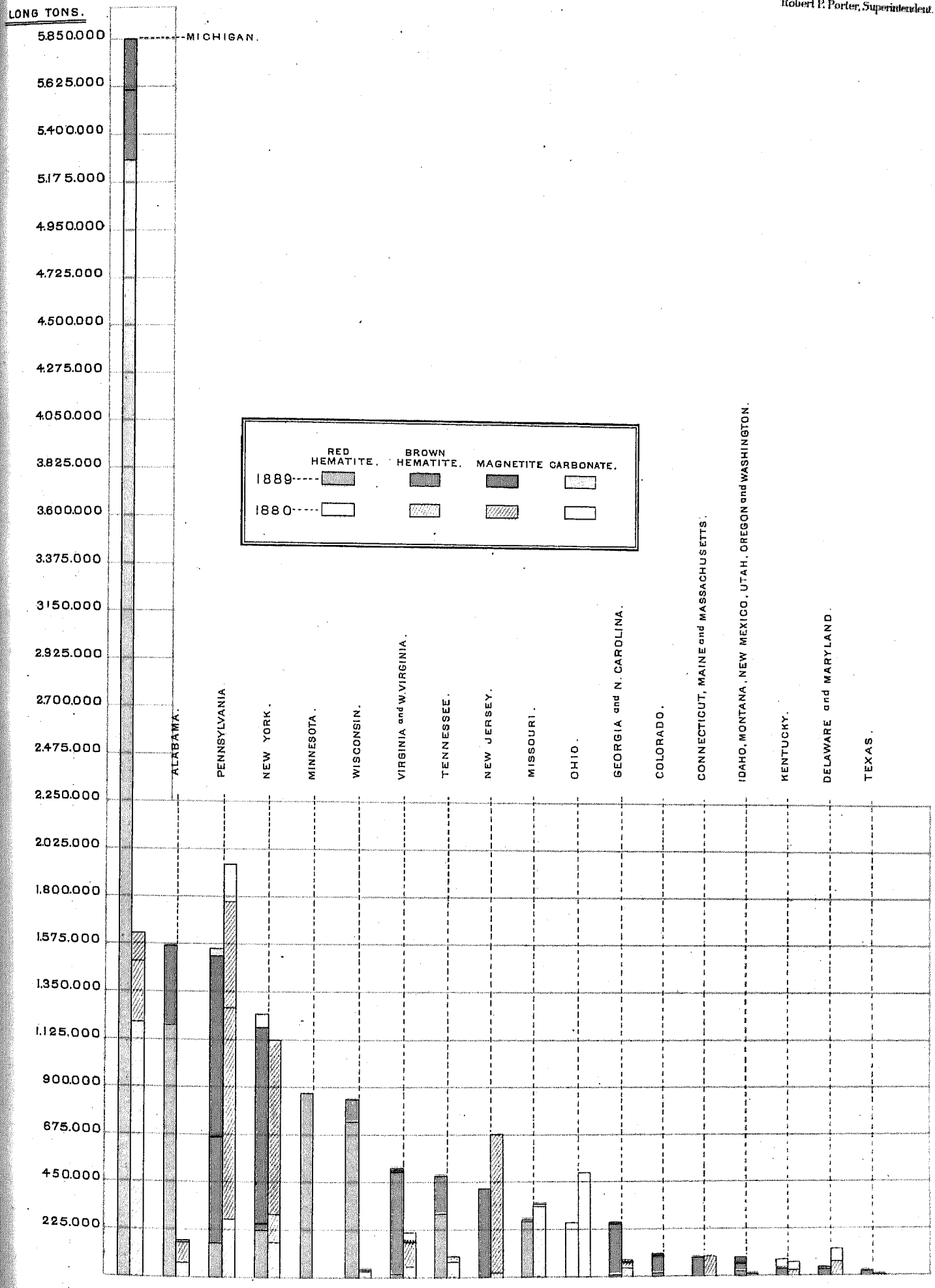
CHARACTER OF IRON ORE MINED.

In classifying the iron ores produced in the year 1889, 4 general divisions were made, without particular reference to the geological occurrence of the ores, as follows: brown hematite, including limonite and bog ores; red hematite, including specular and fossil ores; magnetite ore; carbonate, including siderite, spathic, and blackband ores.

The formation and geological distribution of iron ores were considered at length by Professor Raphael Pumpelly in the reports of the Tenth Census (*a*), and the chemical and physical characteristics of each class and of many individual deposits were thoroughly discussed. In that census the ores were divided into 5 classes, viz, limonite, hematite, fossil, magnetite, and carbonate. The purpose of the present inquiry has been confined to the commercial features of the iron ore supply, and in order to simplify the classification for this report the hematite and fossil ores are combined under one head as red hematite. The gradations from one class of ore to another are so close that the divisions adopted can not be considered as perfect, but they approach within narrow limits the commercial classification generally accepted in the sale and purchase of American iron ores. The classification adopted may be defined as follows:

BROWN HEMATITE.—In this class are included all varieties of hydrated sesquioxide of iron, such as limonite, göthite, turgite, bog ores, pipe ores, etc. There are also included some manganiferous iron ores and most of the

a See Tenth Census reports, volume XV, pages 3 to 22, inclusive.


LONG TONS.
5.850.000
5.625.000
5.400.000
5.175.000
4.950.000
4.725.000
4.500.000
4.275.000
4.050.000
3.825.000
3.600.000
3.375.000
3.150.000
2.925.000
2.700.000
2.475.000
2.250.000
2.025.000
1.800.000
1.575.000
1.350.000
1.125.000
900.000
675.000
450.000
225.000
MICHIGAN.
RED HEMATITE.
BROWN HEMATITE.
MAGNETITE
CARBONATE.
1889
1880
ALABAMA.
PENNSYLVANIA.
NEW YORK.
MINNESOTA.
WISCONSIN.
VIRGINIA and W. VIRGINIA.
TENNESSEE.
NEW JERSEY.
MISSOURI.
OHIO.
GEORGIA and N. CAROLINA.
COLORADO.
CONNECTICUT, MAINE and MASSACHUSETTS.
IDAHO, MONTANA, NEW MEXICO, UTAH, OREGON and WASHINGTON.
KENTUCKY.
DELAWARE and MARYLAND.
TEXAS.

ores mined in the Rocky mountain region specially for smelting argentiferous ores, but does not embrace the ores obtained from the coal measures, which are merely outcrops or portions of deposits of carbonate ores under light covering which have been weathered into limonite. The brown hematites are the most widely distributed of the classes, and are won chiefly from open workings, but the deposits are seldom localized in great masses.

RED HEMATITE.—This division embraces all practically anhydrous hematites recognized as red hematite, specular, micaceous, fossil, and slate iron ore, martite, blue hematite, etc. The terms "hard and soft hematite", "flaxseed ore", etc., used locally or in trade journals, are, like "blue hematite", merely expressions indicating physical characteristics. In the quantity of red hematite ore reported there are also included some hydrated ores, which, occurring in the same workings, are not separable. The same holds true, to a less extent, however, of those deposits in which red hematites occur closely associated with magnetite.

MAGNETITE.—Magnetite embraces all ores in which the magnetic oxide of iron (Fe_3O_4) is the predominant constituent, and the reports of this ore necessarily include some martite occurring in the same workings with magnetite.

CARBONATE.—Carbonate ore includes all ores in which protoxide of iron is found associated with a considerable percentage of carbonic acid, such as spathic ore, blackband, siderite, etc. In this class are embraced some carbonates which having been "weathered", are practically brown hematite as won from the earth. The term "kidney ore" and other similar appellations merely indicate physical characteristics.

The following table, exhibiting the amounts of each kind of ore mined in the different states, has been prepared upon the above classification, from which it is evident that 9,056,288 long tons, or 62.38 per cent of the iron ores produced in the United States in the census year, was of the red hematite variety; 2,523,087 long tons, or 17.38 per cent, was brown hematite; 2,506,415 long tons, or 17.26 per cent, was magnetite, and 432,251 long tons, or 2.98 per cent, was carbonate:

PRODUCTION OF VARIETIES OF IRON ORES.

[Long tons.]

STATES AND TERRITORIES.	Brown hematite.	Per cent of total.	Red hematite.	Per cent of total.	Magnetite.	Per cent of total.	Carbonate.	Per cent of total.	Total production 1889.	Per cent of total.	Total production 1880.
Total	2,523,087	100.00	9,056,288	100.00	2,506,415	100.00	432,251	100.00	14,518,041	100.00	7,129,362
Percentage of total output		17.38		62.38		17.26		2.98			
Alabama	379,334	15.03	1,190,985	13.15					1,570,319	10.82	171,139
Colorado	100,421	3.98	4,821	0.05	3,894	0.15			109,136	0.75	
Connecticut, Maine, and Massachusetts	88,251	3.50							88,251	0.61	92,549
Delaware and Maryland	18,061	0.72					11,319	2.62	29,380	0.20	127,192
Georgia and North Carolina	235,057	9.32	12,963	0.14	10,125	0.40			258,145	1.78	84,584
Idaho and Montana	10,479	0.42	12,089	0.14	1,504	0.06			24,072	0.17	
Kentucky	25,212	1.00					52,275	12.09	77,487	0.53	57,865
Michigan	332,257	13.17	5,272,915	58.22	250,997	10.01			5,856,169	40.34	1,940,814
Minnesota			864,508	9.55					864,508	5.95	
Missouri	400	0.02	265,318	2.93					265,718	1.83	344,819
New Jersey					415,510	16.58			415,510	2.86	676,225
New Mexico and Utah	4,033	0.16	2,017	0.02	30,000	1.20			36,050	0.25	
New York	30,374	1.20	224,438	2.48	927,269	37.00	65,456	15.14	1,247,537	8.59	1,126,899
Ohio							254,294	58.83	254,294	1.75	488,753
Oregon and Washington	26,283	1.04							26,283	0.18	6,225
Pennsylvania	496,555	19.68	162,957	1.80	860,916	34.35	39,806	9.21	1,560,234	10.75	1,951,496
Tennessee	174,192	6.90	299,102	3.30					473,294	3.26	93,272
Texas	13,080	0.51							13,080	0.09	3,214
Virginia and West Virginia	487,208	19.31	8,746	0.10	6,290	0.25	9,101	2.11	511,255	3.52	217,448
Wisconsin	101,970	4.04	735,429	8.12					837,399	5.77	37,000
Indiana and Vermont											958
Output in 1880	1,918,622		2,243,993		2,134,276		823,471		7,129,362		
Percentage of total output in 1880		26.95		31.52		29.97		11.56			
Amount of increase or decrease in 1889	a604,465		a6,812,295		a372,139		b391,220		a7,387,679		
Percentage of increase or decrease in 1889		a31.51		a303.58		a17.44		b47.51		a103.59	

a Increase. b Decrease.

Of the states, the largest producer of red hematite was Michigan, which is credited with 5,272,915 long tons, or 58.22 per cent of the total. In this class of ore Alabama comes next, with 1,190,985 long tons, or 13.15 per cent. Minnesota follows with 864,508 long tons, or 9.55 per cent; Wisconsin with 735,429 long tons, or 8.12 per cent, and Tennessee with 299,102 long tons, or 3.30 per cent. These 5 states contributed 8,362,939 long tons, or 92.34 per cent of the total output of red hematite mined in the census year 1889.

Nearly equal proportions of brown hematite and magnetite were produced, the former representing 2,523,087 long tons, or 17.38 per cent, and the latter 2,506,415 long tons, or 17.26 per cent, of the total iron ore output.

Pennsylvania contributed 496,555 long tons, or 19.68 per cent; Virginia and West Virginia together, 487,208 long tons, or 19.31 per cent; Alabama, 379,334 long tons, or 15.03 per cent, and Michigan 332,257 long tons, or 13.17 per cent, of the brown hematite mined in 1889. These 5 states therefore are credited with 1,695,354 long tons, or 67.19 per cent of the total output of brown hematite ore.

New York is the largest producer of magnetite, with an output of 927,269 long tons, or 37 per cent of the total of that class of ore mined, Pennsylvania coming next, with 860,916 long tons, or 34.35 per cent, followed by New Jersey, with 415,510 long tons, or 16.58 per cent, and Michigan, with 250,997 long tons, or 10.01 per cent. These 4 states produced 2,454,692 long tons, or 97.94 per cent of all the magnetic iron ore mined in 1889.

The carbonate iron ores mined in 1889 amounted to but 432,251 long tons, or 2.98 per cent of the total output, of which Ohio contributed 254,294 long tons, or 58.83 per cent; New York, 65,456 long tons, or 15.14 per cent; Kentucky, 52,275 long tons, or 12.09 per cent, and Pennsylvania, 39,806 long tons, or 9.21 per cent. These 4 states produced 411,831 long tons, or 95.28 per cent of the total of this kind of ore mined.

New York and Pennsylvania are the only states reported as producing the 4 kinds of ore. Colorado, Michigan, and Virginia each produced 3 kinds of ore.

Comparing the relative rank of the states as producers of the various characters of ore with their positions a decade before, it is found that of red hematite producers Michigan, with a largely increased output, still heads the list. Alabama has risen from sixth place in 1880 to second place in 1889. Pennsylvania and New York, which occupied third and fourth places, respectively, in the Tenth Census, have fallen to eighth and seventh places, respectively, while Minnesota, which did not produce ore in 1880, has taken third place and Wisconsin fourth place in 1889 as producers of red hematite iron ore.

In the brown hematite class Pennsylvania still occupies first place. Virginia and West Virginia combined have risen from fourth place in 1880 to second in 1889; Alabama, which was fifth in 1880, takes third place, and Michigan has fallen from second to fourth place.

The relative rank of the first 4 states producing magnetite in the year 1889 remains the same, with the exception that Pennsylvania and New Jersey have changed places, the former now taking precedence of the latter, New York heading and Michigan closing the list.

Ohio still contributes more than one-half of the output of carbonate ores, outranking other states in this particular, followed by New York, which is reported as not producing any carbonate ores in 1880. Kentucky and Pennsylvania, which held, respectively, fifth and second places in 1880, take third and fourth places in 1889.

While the total amount of iron ore produced in 1889, 14,518,041 long tons, is more than double (an increase of 103.89 per cent) that given in the census of 1880, viz, 7,120,362 long tons, the increase has been most marked in the amount of red hematite, the product of which in 1889 was 9,056,288 long tons, or over four times that of 1880, when the output amounted to 2,243,993 long tons. The amount of magnetite increased from 2,134,276 long tons in 1880 to 2,506,415 long tons in 1889 (17.44 per cent), and the brown hematite class was augmented in production nearly one-third (31.51 per cent), from 1,918,622 long tons in 1880 to 2,523,087 long tons in 1889. The production of carbonate ore, however, showed a decline of about one-half (47.51 per cent) from the production of the Tenth Census, viz, 823,471 long tons, to 432,251 long tons.

The production of the various kinds of ore mined at the Tenth and Eleventh Censuses shows that in relation to the total amount of iron ore won the red hematite produced in 1889 was 62.38 per cent, or nearly double the proportion reported in 1880, viz, 31.52 per cent. The proportion of magnetite decreased from 29.97 per cent in 1880 to 17.26 per cent in 1889; the brown hematite similarly fell from 26.95 per cent in 1880 to 17.38 per cent in 1889, and the carbonate from 11.56 per cent in 1880 to 2.98 per cent of the total in 1889.

The division by states does not fairly represent the importance of the iron-mining industry locally. Taking the figures from the preceding table, they show that the red hematite ore produced in Michigan, Minnesota, and Wisconsin, amounting together to 6,872,852 long tons, represents 75.89 per cent of the total amount of the output, all of which, with the exception of a small amount obtained from the fossil ore deposits of eastern Wisconsin, was taken from the portions of the 3 states named, which are recognized as the Lake Superior region.

Similarly, the production of this class of ore in Alabama, Georgia, and Tennessee should be grouped, giving a total of 1,503,050 long tons, or 16.6 per cent of the total red hematite ore production. The output of this class of ore in New York is divided between the red hematites of the northern portion and the fossil ores of the central portion of the state; that of Missouri is divided between the specular ores of the Iron Mountain and Pilot Knob district and the softer ores of central Missouri.

The brown hematite or limonite ores credited to Michigan and most of those reported from Wisconsin are found with the red hematite in the Lake Superior region. A portion of the brown hematite, however, is obtained from the southern and western central portions of the latter state. It is proper to group the brown hematites of Alabama and Georgia, and also most of those credited to Tennessee, as one district. Taking the total of the 3 states named, their output aggregates 788,583 long tons, or 31.25 per cent of the total brown hematite production.

RED HEMATITE MINING AT IRON MOUNTAIN, MISSOURI.

(See page 23.)

Of the magnetite ore of New York the major portion came from the Lake Champlain district, the balance being from the vicinity of the lower Hudson river. Most of the magnetite from Pennsylvania is obtained from the Cornwall ore hills, the balance being distributed among numerous mines along the South mountain, while the New Jersey magnetites come chiefly from the mines grouped in the center of the state. Michigan's contribution of magnetic ore was obtained from a limited area in the Marquette range of the Lake Superior region.

The limonite of Pennsylvania covers a considerable area, and embraces several districts, a broad belt carrying this ore passing through the state into Maryland, Virginia, Tennessee, Alabama, and Georgia.

The entire product of Ohio consists of carbonate ores, which are produced chiefly in 2 contiguous districts in the central and southern portions of the state. The carbonate ores obtained from Kentucky are from a district separated from a similar producing territory in southern Ohio by the Ohio river, the portions of the 2 states being generally grouped under the name of the Hanging Rock region. At the outcrops or under light covering many carbonate ores are weathered into limonite, but no attempt has been made to subdivide the weathered from the unweathered ores. The carbonate ores of New York are found near the Hudson river, 110 miles from its mouth, and those in Pennsylvania are mostly in the western section of the state.

In discussing the character of the ores mined, attention is called to the fact that most of the ores imported from foreign countries are hematites, the red hematites predominating. No actual subdivision, however, is authentically published.

GEOGRAPHICAL DISTRIBUTION OF IRON-ORE MINES.

Although the iron ores of the United States are liberally distributed, the production in the year 1889 came from comparatively limited areas, as illustrated by the outputs of various portions of the country and by the accompanying map.

If the United States be divided into eastern and western sections by the most prominent physical feature, namely, the Mississippi river and the headwaters of this stream are connected by an imaginary line with the Lake of the Woods, the figures show that the output in 1889 of the portion of the United States east of this division was 14,043,782 long tons, or 96.73 per cent of the total production of the United States, and that of the western division 474,259 long tons, or 3.27 per cent. If the eastern division is again subdivided by a line nearly east and west, following the Ohio and Potomac rivers, uniting these along the southern boundary of Pennsylvania, the product of the northern portion was 11,153,282 long tons in 1889, or 79.42 per cent of the output of the eastern division and 76.82 per cent of the total for the United States, and the southern portion 2,890,500 long tons, or 20.58 per cent of the product of the eastern division and 19.91 per cent of the total for the United States.

While the above sections include practically state divisions as far as output is concerned, and show groupings of iron-ore producers in but limited portions of the territory, they would, if subdivided into districts, demonstrate how small were the areas actually contributing to the supply of iron ore. To illustrate this, a few of the prominent producing centers may be instanced. The 4 districts or ranges embraced in the Lake Superior region are none of them of great extent geographically, and if a circle was struck from a center in Lake Superior with a radius of 135 miles, all of the present iron-ore producing territory of that region would be embraced within one-half of the circle, and most of the deposits would be near the periphery. The output of this section in 1889 was 7,519,614 long tons. A parallelogram 60 miles in length and 20 miles in width would embrace all of the mines now producing in the Lake Champlain district of northern New York, whose output in 1889 aggregated 779,850 long tons. A circle of 50 miles radius, embracing portions of eastern Alabama and western Georgia, included mines which in 1889 produced 1,545,066 long tons. A single locality, Cornwall, in Lebanon county, Pennsylvania, contributed 769,020 long tons in 1889.

There are other important centers of iron-ore production, and large amounts are obtained locally at various points, but the above sufficiently demonstrates that in the areas named, which are only occupied to a limited extent by iron-ore mines, there were produced in 1889 a total of 10,613,550 long tons, or 73.11 per cent of the entire output of iron ore for the United States.

CONSUMPTION.

Adding to the stock of iron ore on hand January 1, 1889, 1,966,824 long tons, the production for the year, 14,518,041 tons, and deducting the stock on hand January 1, 1890, 2,256,973 long tons, there is an apparent total consumption of 14,227,892 tons, valued at $32,766,506. To this apparent consumption, however, should be added (1) the materials which are charged into blast furnaces as ore, but which are products coming from the puddling and heating furnaces and the rolls and hammers of rolling mills; (2) the charges drawn from the retorts in which the franklinite of New Jersey is treated for the removal of zinc, leaving as a residuum a mixture of iron and manganese oxides, employed in blast furnaces for producing spiegeleisen, and (3) the blue billy or purple ore, the residuum of pyrites burned to produce sulphuric acid, and some of the silicates of iron, which, as slag, result from the treatment of copper ores, may also be utilized and smelted as iron ores.

The approximate amounts of these materials consumed (most of which were fed to blast furnaces) in 1889 are as follows (the figures being partly from estimates and partly from data specially collected for this report):

APPARENT CONSUMPTION OF IRON ORE.

	LONG TONS.
Domestic iron ore	14,227,892
Rolling-mill cinder, roll and hammer scale, residuum from treating zinc ores, blue billy, and slags	652,000
Imported iron ore, mostly for producing pig iron	853,573
Total consumption of iron ore or other material used as iron ore in the United States	15,733,465

This consumption can not be distributed with accuracy, for the census inquiries did not include following the ore to the consumers; but approximate figures obtained from other sources permit of giving a general idea as to the extent to which iron ore is used for special purposes.

The rolling mills of the country consumed in the year 1889 for "fix" or "fettling" about 375,000 long tons of iron ore, mostly from domestic mines. The silver smelters used for flux, as reported by operators of mines to this office, 157,908 long tons of iron ore. This does not include any ores which were high enough in silver to encourage their use independent of their iron contents. In the open-hearth steel furnaces, and in making blooms direct from ore in forges or by other direct processes, the consumption approximated 49,500 long tons. This leaves for the consumption of blast furnaces in the United States, say, 15,151,057 long tons of iron ore, mill cinder, etc.

Making allowances for mill cinder, roll and hammer scale, etc., used, there is a total consumption of iron ore of, say, 14,499,057 long tons in the blast furnaces in the United States, or, if the foreign ores (of which 7,500 tons are estimated as used in rolling mills, forges, etc.) are omitted from the calculation, the consumption in American blast furnaces of iron ore produced from domestic mines was 13,652,984 long tons.

Allowing for discrepancies in the figures presented as mentioned under the head of "Production", there were supplied to American blast furnaces in the year 1889 fully 13,780,000 long tons of domestic ore.

The following résumé illustrates the apparent consumption of iron ore and materials used as iron ore in the year 1889:

APPROXIMATE CONSUMPTION OF IRON ORE, ETC., BY VARIOUS INDUSTRIES IN 1889.

[Long tons.]

ITEMS.	Total.	Used in rolling mills, forges, etc.	Used in silver smelting.	Used in blast furnaces.
Total	15,733,465	424,500	157,908	15,151,057
Domestic iron ore	14,227,892	417,000	157,908	13,652,984
Foreign iron ore	853,573	7,500	.....	846,073
Mill cinder, scale, residuum, blue billy, etc.	652,000	.....	.....	652,000

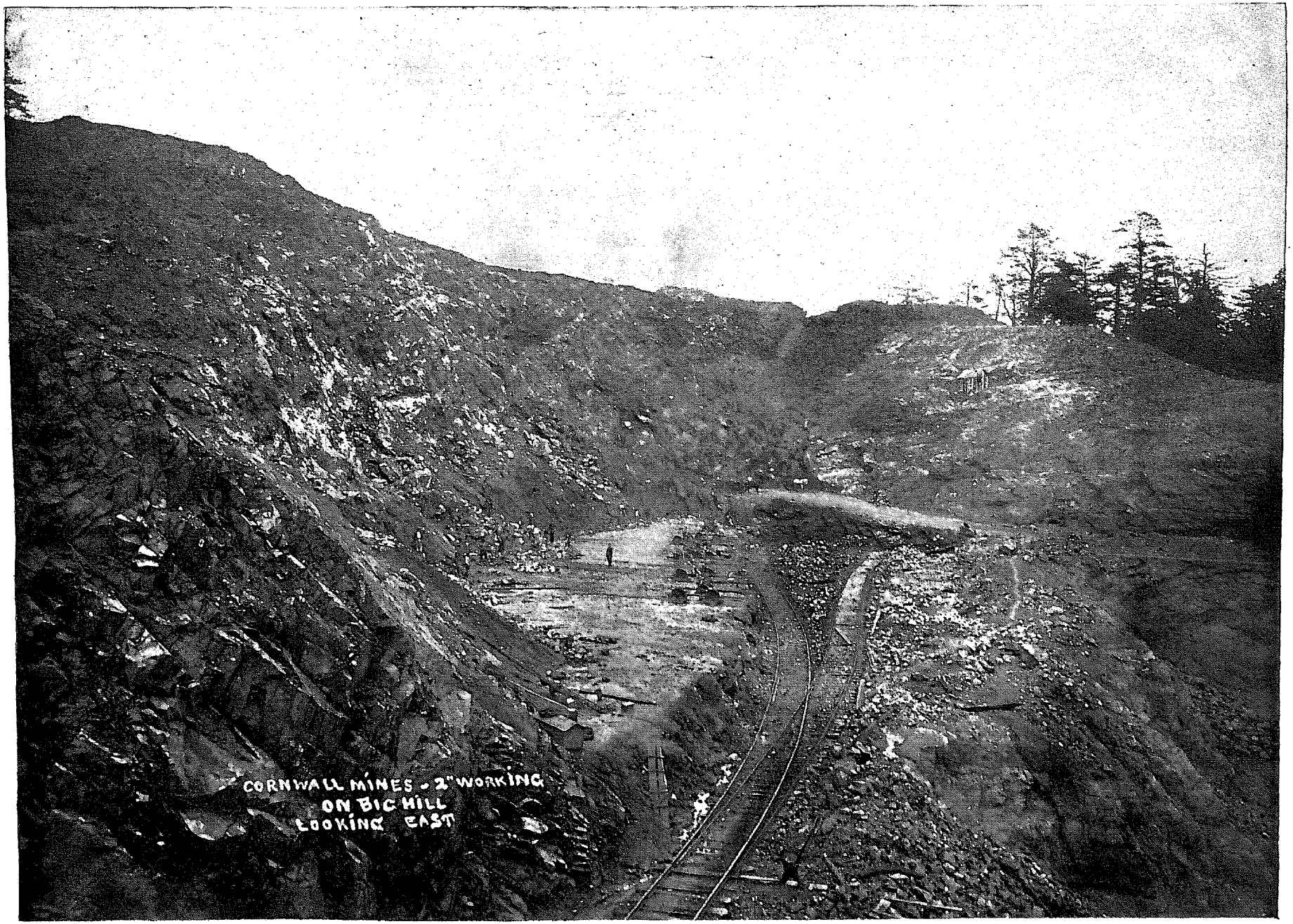
YIELD OF METAL FROM IRON ORES USED.

From the apparent consumption, of 13,652,984 long tons of domestic iron ore in blast furnaces it is possible to estimate the average yield of American iron ore fed to these furnaces. As near as can be estimated, the average yield in blast furnaces of foreign iron ore, domestic mill cinder, residuum, blue billy, etc., was 57 per cent, producing 853,902 long tons of pig iron.

Dr. William M. Sweet, special agent, announced the total production of pig iron for the census year ended June 30, 1890, as 9,579,779 short tons, equivalent to 8,553,374 long tons, and Mr. James M. Swank, general manager of the American Iron and Steel Association, reported the production for the calendar year 1889 to be 8,516,079 short tons, or 7,603,642 long tons. The difference of nearly 1,000,000 tons between these two statements is due to the two periods covered by the tables of statistics; that of Mr. Swank, however, being for the same period as the inquiry into the production of iron ore under direction of the Census Office, would seem to be the fairer basis for calculation. A considerable portion of iron ore mined in the Lake Superior district and in northern New York is accumulated at docks and at blast furnaces toward the close of the calendar year and held there on account of the suspension of navigation during the winter months. It would seem equitable, therefore, in determining the percentages of iron in the ores used, to base the calculation upon an amount of pig iron somewhat greater than that reported by Mr. Swank, and yet not so much as that given by Special Agent Sweet, for the reason that the first half of the year 1890 showed a much larger output than the first six months of 1889.

Taking 853,902 long tons as the amount of pig iron obtained from foreign ore, mill cinder, etc., from 7,603,642 long tons, as reported by Mr. Swank, there is a balance of 6,749,740 long tons, to produce which 13,652,984 long tons of domestic iron ore were used. If, however, for the reason above mentioned, a total production of 7,000,000 long tons of pig iron is allowed from a total of 13,652,984 tons of iron ore, the average yield would be 51.27 per cent.

In the Tenth Census the average yield of iron ore was determined by analyzing samples collected and multiplying the product in tons by the approximate percentage of iron so found. The result was an apparent average



MAGNETIC IRON-ORE MINING AT CORNWALL, PENNSYLVANIA.

(See page 22.)

yield of 51.22 per cent. This would indicate that slightly richer mixtures were used in 1889 than in 1880, but had the estimates for the Tenth Census been made upon the same basis as those above given for the Eleventh Census the difference would be more apparent. The tendency to use richer ores has fostered the liberal development of mines in the Lake Superior region, encouraged an enrichment of ores by sorting, separating, and concentration, and also affected the importation of foreign iron ore. The result has been the abandonment of many mines producing ores carrying low percentages of iron which were active in the year 1880. The large increase in blast furnace capacity and necessarily augmented demand for iron ores in some of the southern states, where comparatively lean ores abound, has not, however, been sufficient to keep the average yield of iron ore below what it was in 1880.

In order to check up the totals of the different kinds of iron ore reported and obtain approximately their actual yield in blast furnaces, letters were mailed to the furnace managers, inclosing schedules which they were requested to fill out. On these schedules the amounts of the different classes of ore, viz, red hematite, brown hematite, magnetite, carbonate, and the general localities from which they were obtained, as well as the amount of foreign ores, mill cinder, etc., used and the pig iron produced in 1889, were given. Full returns were obtained from most of the states, and in instances where parties failed to supply the desired information it was possible to estimate closely from other data accessible the amounts of iron ore used and pig iron made.

From these reports and supplementary information the following statement was prepared concerning the pig iron producing value of the iron ores used in or obtained from the various states.

The returns received from Alabama blast furnaces represent 90 per cent of its output, and show that a great majority of the ores used were obtained from local mines, although some ore was brought in from Georgia and Tennessee. The average yield in the blast furnaces of the iron ores used was 44.4 per cent. Over 70 per cent of these ores was red hematite, the balance being brown hematite, with the exception of 2,100 long tons of mill cinder, etc. The blast furnace reports show that the ores used ranged from 30.5 to 51.6 per cent of iron.

The ores used in Colorado are all local, and show an average yield of 55 per cent of iron.

The New England states which supplied iron ores, Maine, Connecticut, and Massachusetts, used local ores entirely, and full reports have been received from that section showing an average of 44 per cent of iron in the brown hematites smelted, this being the only character of ore at present mined in these states.

Most of the ores used in Georgia and North Carolina blast furnaces are local, in approximate proportions of 0.3 brown hematite, 0.5 red hematite, and 0.2 magnetite and mill cinder, the average yield being 40.7 per cent of iron.

Illinois produced no iron ores and obtained the supply for its furnaces from the Lake Superior region, the returns showing a yield of 60 per cent, which is practically a fair indication of the character of iron ore shipped to points of consumption distant from the Lake Superior region. 94 per cent of the ore charged to the Illinois furnaces was red hematite, 2.5 per cent magnetite, and 3.5 per cent mill cinder, etc.

Kentucky blast furnaces depended upon local ores, chiefly roasted carbonates and brown hematites. These ores gave a yield of 46.2 per cent in the blast furnaces of the state.

The yield in Maryland blast furnaces using chiefly local and Virginia ores averaged 41 per cent, but others consuming ores imported from Cuba and Mediterranean ports bring the average for the state up to 47.7 per cent.

The location of the majority of the Michigan blast furnaces within convenient distances of the ore supply gave these plants, which use charcoal as fuel, some ores of lower grade than could stand transportation to distant points, and hence the yield of ore in these furnaces, viz, 58 per cent of iron, is lower than that of Lake Superior ores in furnaces at greater distances. Red hematites formed the bulk of the supply, but some magnetites and brown hematites were also used.

The Missouri blast furnaces used local ores, yielding 56.4 per cent of iron, principally red hematite, with a small admixture of brown hematite.

The blast furnaces in New Jersey, while depending chiefly upon the local magnetites, receive portions of their supply from the Lake Superior region, from New York, a small amount from Pennsylvania, and also some foreign ores, the yield for the state being 50.9 per cent.

About one-half of the ores used in New York were local magnetites; over 30 per cent were red hematite from that state and the Lake Superior region, the balance being brown hematite from New York and the New England states, carbonates from New York, foreign ores, mill cinder, etc. The average yield was 52.7 per cent of iron.

Ohio obtains the bulk of its ores from the Lake Superior region and from its local carbonate deposits, although some magnetite from New York, carbonate ores from Kentucky, and red hematite from Missouri are smelted. These ores yielded, on an average, 56.7 per cent of iron.

Oregon supplies the brown hematite ore used in its blast furnace, which yielded about 32 per cent of iron.

Pennsylvania was the largest consumer of foreign ores in 1889, fully 85 per cent of the reported total of this class of ore being shipped into that state, and several furnaces obtained their entire supply from this source, with occasional admixture of local mill cinder. It is also the heaviest consumer of Lake Superior ores, drawing most of its red hematite from that region, supplemented by some of the local ores. In addition to its liberal supply of magnetite from the Cornwall ore hills, Dillsburg, etc., it obtains this class of ore from New York, New Jersey, and the Lake Superior region. The brown hematites are mostly obtained from local mines, although some were

brought from Virginia. Local carbonates and some from New York and Ohio are also used. Instances of dependence upon one class of ore show a yield from hematites obtained from Spain, Greece, and Africa of 63.6 and 60.2 per cent; of all Lake Superior ores, 61.5, 61.8, 62.6, 60.8, 60, and 59.5 per cent; of all Pennsylvania magnetites, 51, 50.9, 49.1, 48.9, and 48.5 per cent; of Pennsylvania brown hematite, 45.6 and 41.2 per cent; of local fossil ores, 36.9 per cent, and of hematite ore from Cuba and Mediterranean ports, 56.6 per cent. The average for the state is 55.3 per cent.

The brown and red hematites which are the base of supply for Tennessee furnaces come from local mines, with additions from Alabama and Georgia. Some carbonate ore and mill cinder are also used, the yield for the state being 41.6 per cent. Furnaces using brown hematites only show an average iron contents of 38.8 per cent.

The Texas brown hematites (bog ores), the only character of ore used in that state, yielded 45.8 per cent of iron when roasted.

Virginia depends principally upon her brown hematite mines, which supplied about 90 per cent of the ore used in that state, the balance coming from local red hematite mines, magnetites mined in North Carolina, and a small amount of mill cinder. These gave an average yield of 43.4 per cent of iron. Several furnaces depend entirely upon the brown hematites, which showed percentages of 48.6, 43.3, and 41.4 of iron, respectively.

Local brown hematite (bog ores) and magnetite from British Columbia were used in the Washington blast furnace, the latter yielding 64 per cent of iron when roasted.

West Virginia obtains all of the ore for its furnaces from the Lake Superior district and Missouri, with the exception of some local brown hematite and carbonate ores, a small amount of magnetite, and mill cinder. This raises the average close to 60 per cent of iron.

Wisconsin's blast furnaces also draw their supply from the Lake Superior district, and with the exception of some mill cinder, local red and brown hematites, these were the only ores used, the average yield for the state being 57.2 per cent of iron.

The above averages are presented as indicating the general character of iron ores used in the localities mentioned during the year 1889, but constant changes in mixtures of ores and the introduction of supplies from sources heretofore untried may materially change the figures given. The furnaces which depend upon and have in reserve large quantities of local ores, or those built to rely upon certain ores brought to them over long distances, will probably show the least change.

BENEFICIATING AND CONCENTRATING IRON ORE.

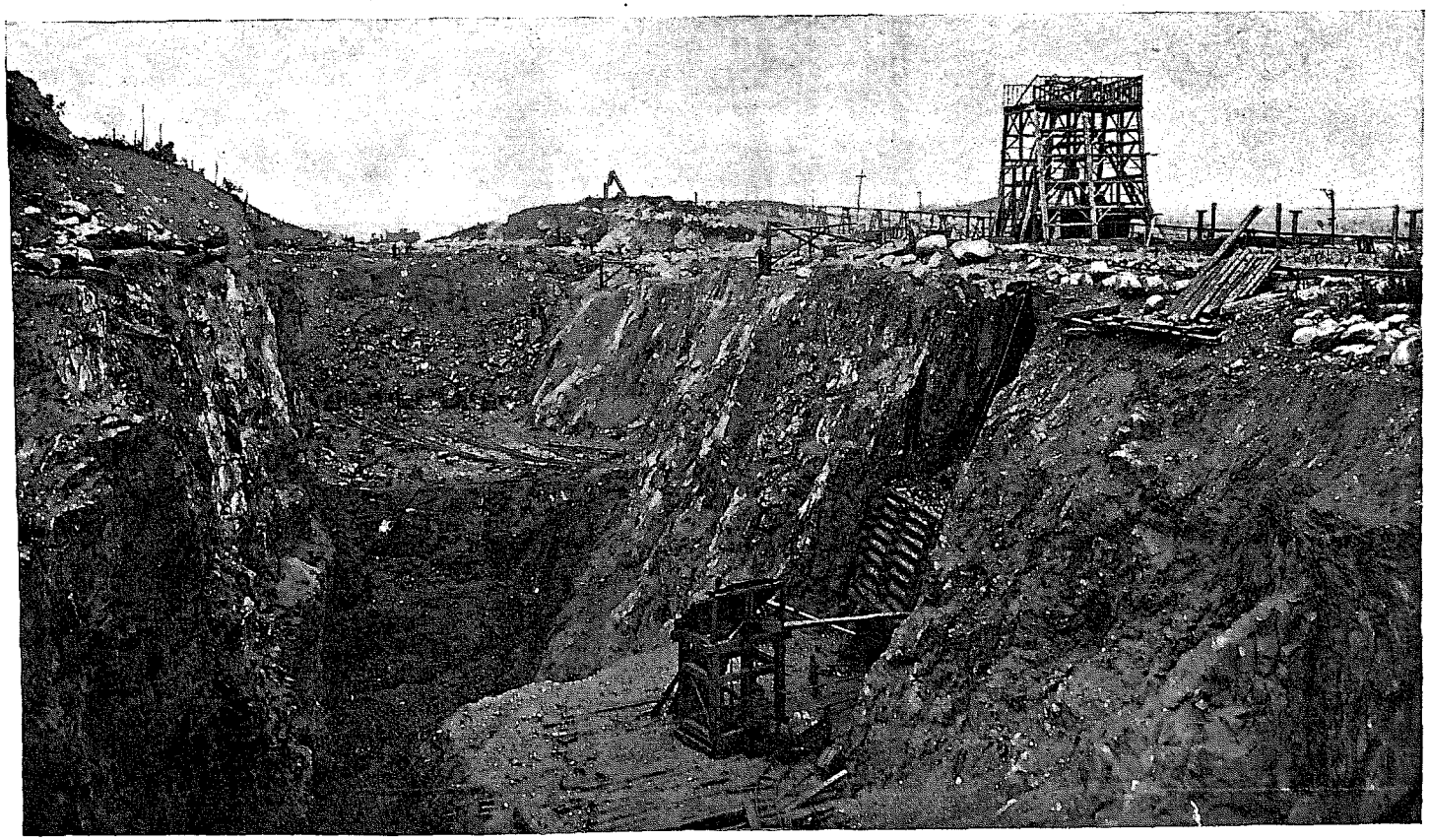
The figures given in this report are for the ores as shipped to consumers, and therefore the actual amount mined aggregates considerably greater than the tonnage named, because in a number of instances the ores are treated at the mines to enrich them. Thus most of the carbonate ores which are produced are roasted at or close to the mines to drive off the carbonic acid. Some of the sulphurous ores are similarly treated, but as a rule those which carry sufficient sulphur to require roasting are delivered to blast furnaces or other consumers as mined, and the roasting is done at the point of consumption. Limited amounts of brown hematites are also roasted to facilitate crushing lumps, or to drive off an excess of water. Most of the mines which produce brown hematite are equipped with washing appliances for removing the clay, sand, etc., from the ores, so that the material is shipped to the furnaces comparatively free from these objectionable features, which decrease the value of the ore. Jigs are employed to a limited extent to cleanse some of the red hematites and magnetites, and in Missouri lean specular ores or old dumps are hydraulicked before the material is jigged.

The year 1889 marked a revival in magnetic concentration, whereby ores carrying smaller percentages of iron than would pay for their exploitation and shipment, or iron ores which have an excess of phosphorus, as apatite, or of sulphur in the shape of pyrites, are granulated and passed over various forms of apparatuses, in which are currents of electricity or fixed magnets to attract the magnetic material, allowing the nonmagnetic to pass away as tailings. This revival in 1889 was confined largely to the construction and equipment of plants for treating ores on a liberal scale or experiments with various machines under different conditions. As a result of this the amount of such ore produced was small, but subsequently the completion of plants, aggregating a cost of over $500,000, their operation and the results of experiments made this feature an important one, and one which will probably grow with each year. The amount of iron ore which was prepared and passed through water jigs or magnetic separators in 1889 amounted to 95,425 long tons. This does not include red or brown hematite ores which were washed or hydraulicked, or any sulphurous or carbonate iron ores which were roasted at the mines where they were produced, nor does it include ore which had been cobbed or sorted at mines by hand.

COMPARISONS WITH THE TENTH CENSUS.

Comparing the returns for the census year ended December 31, 1889, with those of the census year 1880, it is found that 7,120,362 long tons of ore were mined in 1880, valued at $23,156,957, while the census year 1889 shows an output of 14,518,041 long tons, valued at $33,351,978, an increase of 7,397,679 long tons, or 103.89 per cent, over the production of 1880, and an augmented value at the mines of $10,195,021, or 44.03 per cent.

The average value per ton of iron ore at the mines, excluding interest on invested capital, has been reduced from $3.25 per long ton in 1880 to $2.30 per ton in 1889. This is due to the increased average output for mining



RED HEMATITE MINING NEAR TOWER, MINNESOTA.

(See page 23.)

operation, and in a number of instances to the consolidation of several mines which have been grouped under one management, thus reducing the cost of superintendence, office force, administration, etc., encouraging the use of improved machinery, systematic and advanced methods of mining to meet the keener competition resulting from lower freight rates, improved facilities, such as shipping and receiving docks and special vessels or cars built for ore handling and transportation. The cost of mining large quantities of ore and new developments in some of the southern states also contributed to the diminution of the average value at the mines.

Iron ore was obtained from 23 states in 1880, and all of these, with the exception of Indiana and Vermont, were producers as reported to the Eleventh Census. To the states which mined ore as reported to the Tenth Census there are added Colorado, Idaho, Minnesota, Montana, New Mexico, Utah, and Washington as new producers for the Eleventh Census. Of these, Colorado and Minnesota were the only states which contributed largely to the output of 1889. California produced iron ores between the years 1880 and 1889, but none was reported in either of the years named. The states which have augmented the output of iron ore, including the new producers mentioned and those which show decreased production, and the percentages of such increase or decrease, are as follows:

STATES AND TERRITORIES WITH AN INCREASED PRODUCT OF IRON ORE AT THE ELEVENTH CENSUS.

[Long tons.]

STATES AND TERRITORIES.	1889.	1880.	Percentage of increase.	STATES AND TERRITORIES.	1889.	1880.	Percentage of increase.
Alabama	1,570,319	171,139	817.57	New Mexico and Utah (a)	36,050	.....	.....
Colorado (a)	109,136	.....	.....	New York	1,247,537	1,126,899	10.71
Georgia and North Carolina	258,145	84,584	205.19	Oregon and Washington	26,283	6,225	322.22
Idaho and Montana (a)	24,072	.....	.....	Tennessee	473,294	93,272	407.43
Kentucky	77,487	57,865	33.91	Texas	13,000	3,214	304.48
Michigan	5,856,169	1,640,814	256.91	Virginia and West Virginia	511,255	217,448	135.12
Minnesota (a)	864,508	.....	.....	Wisconsin	837,399	37,009	2,163.24

a Not reported at the Tenth Census as producing iron ore. b For Oregon only; Washington not reported as a producer at the Tenth Census.

STATES WITH A DECREASED OUTPUT OF IRON ORE AT THE ELEVENTH CENSUS.

[Long tons.]

STATES.	1889.	1880.	Percentage of decrease.	STATES.	1889.	1880.	Percentage of decrease.
Connecticut, Maine, and Massachusetts	88,251	92,549	4.64	New Jersey	415,510	676,225	38.55
Delaware and Maryland	29,380	127,102	76.88	Ohio	254,294	488,753	47.97
Indiana (a)	.....	458	.....	Pennsylvania	1,560,234	1,951,496	20.05
Missouri	265,718	344,819	22.94	Vermont (a)	.....	500	.....

a No report on iron ore mined was made for this state at the Eleventh Census.

COMPARISON OF THE IRON ORE PRODUCT WITH OTHER CENSUS REPORTS.

An examination of the iron ore product of various states as reported at the censuses of 1880 and 1889 emphasizes the changes due to improved transportation facilities, larger smelting plants, and a development of the iron-ore industry in keeping with national advancement. This may be further illustrated by a table in which the various states are placed in their order of prominence as producers of iron ore in the Seventh, Eighth, Ninth, Tenth, and Eleventh Censuses. Up to 1850 little iron ore was transported except for such distances as could be conveniently covered by wagons. The blast furnaces and forges, depending chiefly on charcoal for fuel, were located close to their supplies of raw material.

The advance in the use of mineral fuel encouraged the erection of iron works at more convenient centers, but generally near ore deposits or within reach of them by water transportation; but in the subsequent development of the industry iron works were constructed where raw materials could be assembled advantageously and market facilities also secured. The report of 1870 indicated the growing use of railroads, which was greatly increased, as shown by the report of 1880, and the rank exhibited by the returns of 1889 illustrates to what an extent the appreciation of market facilities and the character of the ore have influenced consumers. In late years the growth of the bessemer steel industry and the demand of large blast furnace plants for quantities of ore are responsible for the exploitation of numerous iron-ore mines on a scale not previously attempted, and the transportation of vast volumes of mineral over great distances.

The table following gives the rank of states as producers of iron ore in the census years 1850, 1860, 1870, 1880, and 1889. 2 states produced over 100,000 long tons of iron ore in 1850. This number was increased to 5 states in 1860, to 7 in 1870, to 9 in 1880, and to 13 in 1889. 1 state exceeded 500,000 tons in 1850 and 1860, 2 in 1870, 4 in 1880,

and 6 in 1889. Pennsylvania is the only state reported as reaching an output exceeding 1,000,000 tons until 1880, when 3 states exceeded this amount, and in 1889 4 states were numbered among the great producers. In 1870 and 1880 Pennsylvania reported about 2,000,000 tons, but in 1889 fell below that figure. In the latter year Michigan produced nearly 6,000,000 tons. In the census reports for 1850, 1860, and 1870 the statistics of the production of iron ore were obtained largely from reports made by the various blast furnaces as to the amount of ore consumed; the tables did not specify in what states the ore was produced, but merely gave the amounts reported as being used by blast furnaces. It was, however, deemed advisable, except where reliable local statistics were accessible, to use the data as given in previous census reports, although in several instances states are evidently placed in positions different from that which they should actually assume as producers of iron ores, particularly in the Ninth Census. As iron ores were used elsewhere than at blast furnaces, the error can not be corrected by states, for the record shows that the blast furnaces in 1860 used 2,309,975 short tons, and, in addition, 908,300 short tons were produced by mining companies, making a total of 3,218,275 short tons, but no distribution of the ore to points of production is mentioned.

RANK OF STATES AS PRODUCERS OF IRON ORES IN THE CENSUS YEARS.

1850.	1860.	1870.	1880.	1889.
1 Pennsylvania.	1 Pennsylvania.	1 Pennsylvania.	1 Pennsylvania.	1 Michigan.
2 Ohio.	2 Ohio.	2 Michigan.	2 Michigan.	2 Alabama.
3 Maryland.	3 New York.	3 Ohio.	3 New York.	3 Pennsylvania.
4 Tennessee.	4 New Jersey.	4 New York.	4 New Jersey.	4 New York.
5 Kentucky.	5 Michigan.	5 Maryland.	5 Ohio.	5 Minnesota. 1,000,000
6 Virginia.	6 Kentucky.	6 Kentucky.	6 Missouri.	6 Wisconsin.
7 New Jersey.	7 Maryland.	7 Missouri.	7 Alabama.	7 Virginia. 500,000
8 New York.	8 Tennessee.	8 New Jersey.	8 Virginia.	8 Tennessee.
9 Missouri.	9 Massachusetts.	9 Tennessee.	9 Maryland.	9 New Jersey.
10 Connecticut.	10 Missouri.	10 Indiana.	10 Tennessee.	10 Missouri.
11 Massachusetts.	11 Virginia.	11 Wisconsin.	11 Georgia.	11 Ohio.
12 Vermont.	12 Connecticut.	12 Virginia.	12 Kentucky.	12 Georgia.
13 Illinois.	13 Wisconsin.	13 Connecticut.	13 Massachusetts.	13 Colorado.
14 Indiana.	14 Illinois.	14 West Virginia.	14 West Virginia.	14 Kentucky. 100,000
15 Georgia.	15 Alabama.	15 Massachusetts.	15 Wisconsin.	15 Massachusetts. 50,000
16 Wisconsin.	16 Vermont.	16 Alabama.	16 Connecticut.	16 New Mexico.
17 Maine.	17 Georgia.	17 North Carolina.	17 Oregon.	17 Connecticut.
18 Michigan.	18 Indiana.	18 Vermont.	18 Maine.	18 Maryland.
19 Alabama.		19 Georgia.	19 Texas.	19 Oregon.
20 North Carolina.		20 Mississippi.	20 North Carolina.	20 Montana.
21 New Hampshire.		21 South Carolina.	21 Delaware.	21 West Virginia.
			22 Vermont.	22 Texas.
			23 Indiana.	23 Maine.
				24 North Carolina.
				25 Utah.
				26 Delaware.
				27 Idaho.
				28 Washington.

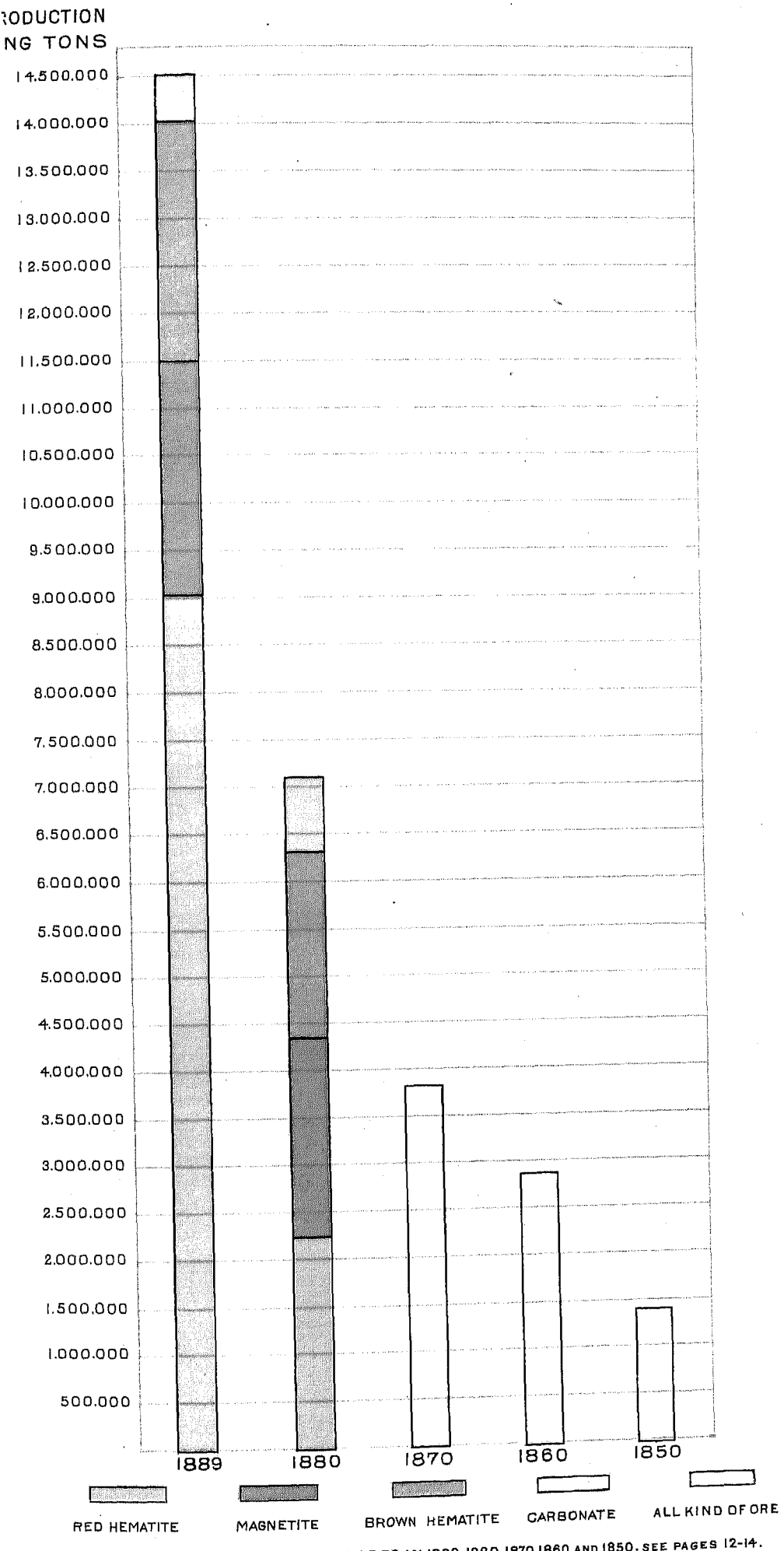
CAPITAL.

The total value of the iron-ore mines in the United States December 31, 1889, was $109,766,199, as against $61,782,287 invested in 1880 in regular mining establishments, an increase of $47,983,912, or 77.67 per cent, divided as follows:

TOTAL VALUE OF THE IRON-ORE MINES IN THE UNITED STATES.

ITEMS.	1889.	1880.
Total	$109,766,199	$61,782,287
Land	78,474,881	48,274,140
Buildings and fixtures	7,073,520	8,057,375
Tools, implements, live stock, machinery, etc.	8,045,545	
Cash and stock on hand	15,572,253	4,850,763

The state of Michigan has advanced from second place in 1880, with a total reported capital of $17,496,775, to first position in 1889, with an investment of $41,958,571, an increase of $24,461,796, or nearly 140 per cent. The iron-ore mines of Michigan therefore represent 38.23 per cent of the total capital employed in iron-ore mining in the United States, subdivided as shown in the table on the following page.



TOTAL PRODUCT OF IRON ORES IN 1889, 1880, 1870, 1860 AND 1850. SEE PAGES 12-14.

VALUE OF IRON-ORE MINES IN MICHIGAN.

ITEMS.	1889.	1880.
Total	$41,958,571	$17,496,775
Land	27,032,732	12,452,311
Buildings and fixtures	2,819,107	2,789,944
Tools, implements, live stock, machinery, etc.	3,732,410	
Cash and stock on hand	8,374,322	2,254,520

Pennsylvania occupies second place, with a valuation of $16,249,313, or 14.80 per cent of the total, a decrease of $1,372,388, or 7.79 per cent from the 1880 valuation of $17,621,701, when it occupied first place.

New York follows next, having the same relative rank as in 1880, with $12,489,481, or 11.38 per cent of the total valuation for the United States, an increase in capital of $4,226,342, or 51.15 per cent.

Minnesota, which produced no ore in 1880, Alabama, Missouri, and Wisconsin follow in the order named, the last 3 occupying, respectively, ninth, fifth, and fourteenth places in 1880.

The valuation of the iron-ore mines of the above 7 states as reported is $93,422,218, or 85.11 per cent of the total capital invested in ore mining in 1889.

The following table shows, by states and territories, the amount and distribution of capital invested in iron-ore mining in the year 1889, as reported by the various individuals, firms, or companies to the Census Office:

CAPITAL INVESTED IN IRON-ORE MINING IN 1889, BY STATES AND TERRITORIES.

STATES AND TERRITORIES.	Total.	Land.	Buildings and fixtures.	Tools, implements, live stock, machinery, etc.	Cash and stock on hand.	Total capital invested in mines in 1880.
Total	$109,766,199	$78,474,881	$7,673,520	$8,045,545	$15,572,253	$61,782,287
Alabama	5,244,906	4,258,645	306,713	382,548	297,000	536,442
Colorado	2,480,445	2,241,672	68,015	74,948	94,810	
Connecticut, Maine, and Massachusetts	551,365	322,240	97,743	66,163	65,219	798,800
Delaware and Maryland	355,074	223,075	35,500	65,450	31,049	538,814
Georgia and North Carolina	1,634,434	1,230,430	194,148	149,422	60,434	184,225
Idaho and Montana	342,879	301,500	4,000	11,350	25,429	
Kentucky	405,868	302,201	23,237	16,712	63,718	779,829
Michigan	41,958,571	27,032,732	2,819,107	3,732,410	8,374,322	17,496,775
Minnesota	8,481,282	4,280,000	526,504	451,904	3,222,874	
Missouri	4,613,396	3,531,817	95,569	178,335	807,675	5,598,556
New Jersey	8,168,891	2,180,380	194,564	349,944	444,003	6,201,761
New Mexico and Utah	152,000	139,000	8,500	2,500	2,000	
New York	12,489,481	9,093,455	1,603,982	990,364	801,680	8,263,139
Ohio	1,311,918	917,035	135,375	64,675	194,833	1,248,725
Oregon and Washington	86,285	56,630	6,396	19,409	3,850	16,975
Pennsylvania	16,249,313	14,812,357	547,010	639,427	250,519	17,621,701
Tennessee	1,897,895	1,394,774	185,314	253,206	64,601	473,920
Texas	51,678	45,500		2,620	3,558	
Vermont						2,000
Virginia and West Virginia	3,905,249	2,881,441	567,544	253,195	203,069	1,924,825
Wisconsin	4,385,269	3,229,997	252,899	340,963	561,610	186,000

The inquiry concerning the capital invested in iron-ore mines has presented difficulties which made it practically impossible in many cases to obtain valuations on the basis of the questions presented in the schedules prepared by the Census Office. In the Lake Superior region a large proportion of the mines are leased, and in other districts mines are worked under leases, a stipulated sum per ton, with a minimum yearly royalty provision, being paid to the owners of the fee. The lessor in a majority of instances owns tracts of greater or less extent as yet unproved, of which the mines occupy but a limited portion. Some of the large deposits in other sections have been in the hands of the present owners for a number of years, and have grown from small operations to great enterprises. During this time no actual appraisement of values has been made, as the properties have not been offered for sale, nor have propositions of purchase been entertained. In these instances the assessors' valuation gave an approximate basis for formulating an estimate.

A number of iron-ore mines are connected with blast furnace plants, and the properties are valued as entire enterprises, no division of the capitalization being attempted by the owners. Other properties have the ore distributed over large areas, from which it is won by stripping or benching, and in some of these the value is partly dependent upon a deposit of coal lying close to the iron ore. Similarly, the timber upon some areas worked for iron ore affects the valuation. An attempt has been made, where valuations could not be reported, to arrive at a basis of estimate by using the rate of tax assessment, or by calculating a value by capitalizing an assumed royalty, necessarily depending upon the location and character of the ore, multiplied by the product for the year 1889. This

explanation will indicate that the capital invested, as reported in the table, is considerably less than that actually employed in the mining of iron ore, but it is as close an approximation as can be made.

The total capital as given in this report does not include the cost of shipping and receiving docks, built and maintained solely for handling iron ores, nor the equipment of locomotives, cars, and tram roads, or of steam vessels which are devoted exclusively to the iron-ore trade. Exceptions are made in a few cases where the handling facilities are within the property actually exploited. Mention of the ore docks, etc., and notes of some of the railway equipment appear under the head of "Transportation and handling iron ores," page 26.

An instance of liberal expenditure for the development of iron-ore mines is in the construction and equipment of a standard gauge railroad from Lake Superior for 70 miles through an uninhabited country in Minnesota to the deposit of iron ore near Lake Vermilion, and the subsequent extension of this road 30 miles to other deposits. The equipment of cars, docks, etc., mentioned under the subhead of "Shipping docks", the locomotives, the buildings, and the entire expenditure for locating and constructing this railroad were solely for the purpose of developing the iron-ore mines, and the handling of iron ore to-day represents the business done by this line of transportation. Millions of dollars returned in the census figures of railway and vessel transportation, and also for workmen's homes, could with propriety be added to the capital demanded for the iron-ore mining industry.

LABOR AND WAGES.

Returns show that the mining of iron ore gave continuous employment directly to 38,227 persons engaged in or immediately at the mines, an increase of 6,559 men, or 20.71 per cent, over the Tenth Census, when the number was 31,668 engaged in work connected with breaking down, raising, and delivering the ore in cars or carts or on stock piles at the mines. This force in 1889 was divided as follows: 1,366 foremen (680 employed above and 686 below ground), 2,079 mechanics, 12,432 miners, 21,010 laborers (14,531 above and 6,479 below ground), 820 boys (709 being employed above and 111 below ground), and 520 men in offices. Omitting the latter, the total number actually employed in handling the ore was 37,707, and the amount paid in wages direct to miners and mining contractors reached a total of $15,458,118. This shows an average earning capacity for each man so employed of $409.95 per annum, including the contractors' profits and the additional pay allowed to foremen. This is an increase over the figures for 1880 of $101.01 per annum, or 32.7 per cent, which is due principally to the fact that a larger number of the mines are now wrought under ground, permitting the men to be constantly employed throughout the year and demanding better skill.

Allowing for Sundays and holidays, necessary stoppages of machinery for repairs, and for personal loss of time by employés by reason of illness, etc., it is found in practice that in the trades or employments where continuous labor is possible in protected buildings or mines full time approximates 24 days per month or 288 days per annum. The average total days worked by employés in mining iron ore during the year 1889 amounted to 247 per annum, notwithstanding that in open pit mining operations are largely suspended during inclement weather, and at some of the underground mines the working force is considerably reduced during the winter months, as the ore is stocked. The number of individuals who obtained employment in iron-ore mines exceeded the figures given, as the inquiries covering the labor in mining was formulated as follows: average number employed, average wages per day, and average number of days worked per year; otherwise the total number of employés would have been much greater.

The compensation paid the 520 persons employed in offices at the mines amounted in the aggregate to $529,043, an average annual earning of $1,017.39. The office force above mentioned does not include officers, agents, or employés connected with general offices at commercial centers, where accounts are kept or sales and collections made, nor does it include the ore samplers or inspectors employed at shipping or distributing points. The inquiry as to labor and wages does not extend beyond the working force at the mine.

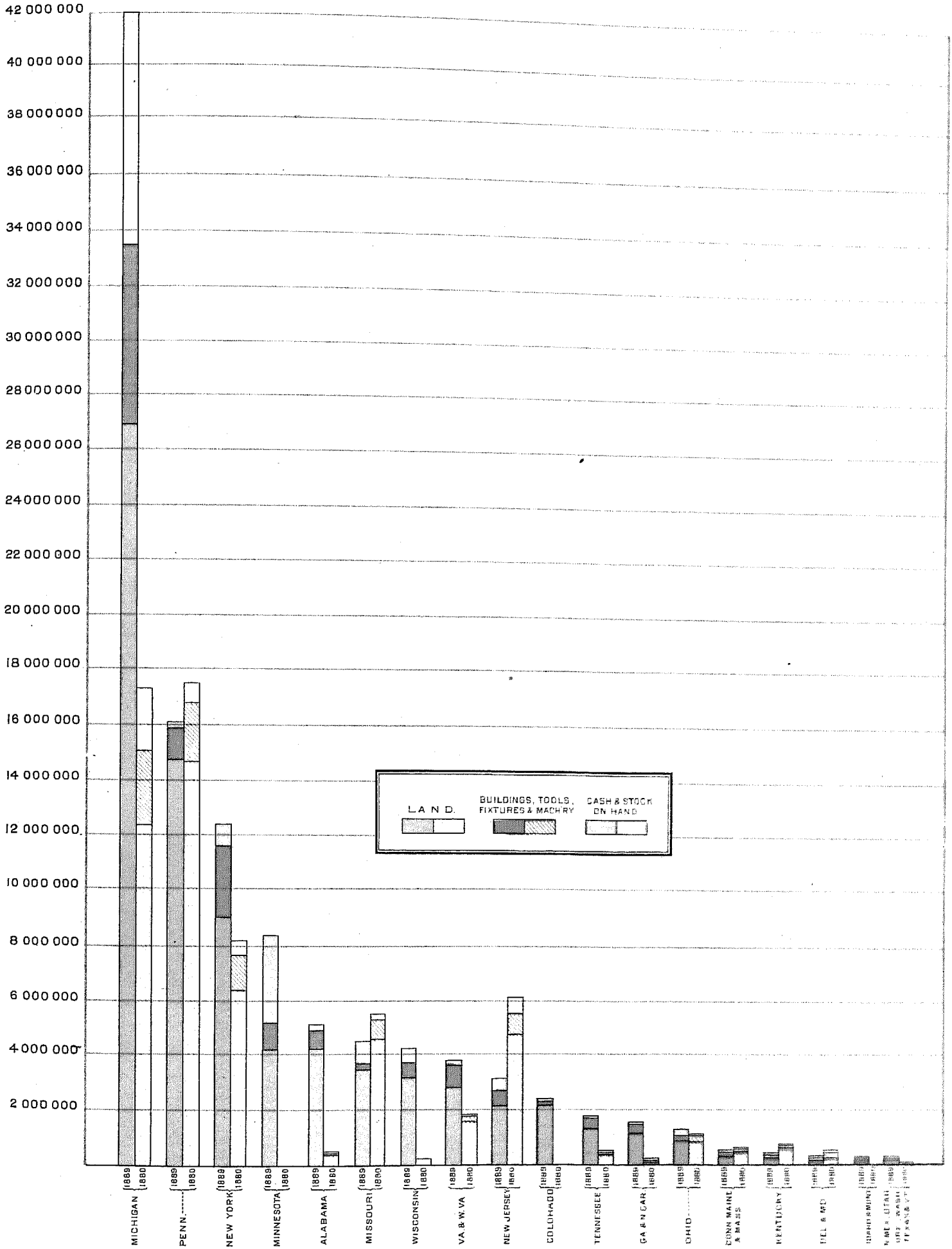
The following statement shows the expenditure per ton of iron ore won for labor above and below ground in 1889 at the mines in the various states and territories, not including the compensation paid officers or office attendants, but including contractors' profits:

AVERAGE EXPENDITURES FOR WAGES PER LONG TON OF IRON ORE.

The United States	$1.06	Missouri	$0.97
		New Jersey	1.71
Alabama	0.69	New Mexico and Utah	1.22
Colorado	2.48	New York	1.00
Connecticut, Maine, and Massachusetts	1.82	Ohio	1.40
Delaware and Maryland	1.65	Oregon and Washington	1.20
Georgia and North Carolina	0.71	Pennsylvania	0.75
Idaho and Montana	2.21	Tennessee	0.76
Kentucky	0.87	Texas	0.91
Michigan	1.19	Virginia and West Virginia	1.09
Minnesota	1.10	Wisconsin	1.09

It will be seen that the lowest expenditure for labor per ton of ore at the mines was in the states of Alabama and Georgia and North Carolina, where it amounted to 69 and 71 cents per ton, respectively, due to large open workings and modern and systematic systems of mining, and in Alabama and Georgia to the soft character of the ore, etc.

DOLLARS.



CAPITAL USED IN IRON ORE PRODUCTION IN EACH STATE IN 1889 AND 1880. SEE PAGES 14 AND 16.

In Pennsylvania one-half of the iron ore credited to the state comes from the Cornwall ore hills, where the soft character of the magnetite and its accessibility assist in reducing the average cost of labor employed in mining for the entire state to 75 cents per long ton. The expense of mining the hard Lake Superior ores is best illustrated in the state of Michigan, where $1.19 was expended for wages at the mines per ton of ore won. The cost in Colorado, Idaho, and Montana is due to the higher rates of wages prevailing in those states and the small amount of ore won.

In the New England states, New Jersey, Ohio, Delaware, and Maryland the exploitation of old workings or of scattered deposits causes a high cost per ton for wages. The use of improved machinery and the predominance of large mines assist in reducing the cost for labor in Wisconsin, Minnesota, Alabama, New York, and other states, and the partial employment of convicts in Tennessee, Texas, and Georgia affects the figures for these states.

In order to obtain the average wages paid the men in the different classes and the average number of days which they worked during the year, the average number of each class of men employed in each mine was multiplied by the average number of days worked during the year at that mine, thus giving the total number of days made by each of the different classes of men. These products, multiplied by the average wages per day paid to each class at the various mines, gave the total amount of wages earned. Adding the totals for the different mines and classes gave the grand total for each state or district, and dividing the total number of days worked by each class by the total number of workmen in the subdivision gave the average number of days made by each workman in that class during the year, and the total number of days worked divided into the calculated wages gave very closely the average wages paid to each man per day.

In this manner it has been possible to calculate the average wages and the average number of days worked by each class for the various states, and also the average for the United States. Tables are appended which will be found to agree closely with the amounts actually paid to the various work men and contractors, any differences being due to the fact that, where a large number of men are employed at various wages and for different times, it is impossible to have the calculated and actual wages paid agree exactly, and also because a certain amount representing contractors' profit is not included in the average wages.

The 680 foremen above ground received wages averaging from $1.25 per day in Kentucky to $4.88 per day in Colorado, the mean for the United States being $2.40, and the average number of days during the year which they worked 258. The total calculated wages which they received amounted to $421,610. The mechanics' wages varied from $0.50 per day in Texas, where convict labor was employed, to $3.86 per day in Colorado, the average for the entire country being $1.90, and the average number of days worked during the year 274. The total calculated wages which were received by mechanics during the year 1889 was $1,080,406. The average wages received by the 14,531 laborers employed above ground was $1.29, ranging from $0.53 in Texas to $3.50 in New Mexico and Utah. These laborers worked on an average 228 days during the year, and received a total compensation of $4,277,199. The 709 boys under 16 years of age received a total compensation of $97,279, and worked 221 days during the year. They therefore received an average of $0.62 per day, the wages varying from $0.49 in Missouri to $2 in Colorado.

EMPLOYÉS AT IRON-ORE MINES IN 1889.

STATES AND TERRITORIES.	Total number employés above and below ground.	ABOVE GROUND.											
		Total number employés.	Foremen and overseers.			Mechanics.			Laborers.			Boys under 16 years.		
			Number employed.	Average wages per day.	Average number of days worked.	Number employed.	Average wages per day.	Average number of days worked.	Number employed.	Average wages per day.	Average number of days worked.	Number employed.	Average wages per day.	Average number of days worked.
Total	37,707	17,999	680	$2.40	258	2,079	$1.90	274	14,531	$1.29	228	709	$0.62	221
Alabama	3,081	1,762	54	2.36	259	79	1.94	241	1,533	1.20	227	96	0.53	236
Colorado	391	143	14	4.88	177	26	3.86	219	101	2.99	180	2	2.00	74
Connecticut, Maine, and Massachusetts	424	183	8	2.44	313	26	1.65	308	149	1.36	277	.....	.....	.....
Delaware and Maryland	232	232	10	1.52	224	.....	.....	.....	208	1.00	200	14	0.57	225
Georgia and North Carolina	780	675	41	1.93	214	24	1.49	214	573	1.03	208	37	0.57	219
Idaho and Montana	83	70	5	3.15	253	1	3.00	150	64	3.03	171	.....	.....	.....
Kentucky	375	375	5	1.25	212	5	1.50	275	340	1.03	189	25	0.75	212
Michigan	12,947	4,081	147	2.98	289	948	2.00	285	2,904	1.60	255	82	0.83	283
Minnesota	1,755	742	21	3.27	276	93	2.26	275	611	1.90	233	17	0.86	219
Missouri	706	373	11	2.10	297	41	1.80	289	310	1.20	254	11	0.49	253
New Jersey	1,872	492	24	2.61	308	152	1.48	289	289	1.21	272	27	0.62	274
New Mexico and Utah	47	12	2	3.75	306	.....	.....	.....	10	3.50	286	.....	.....	.....
New York	3,132	1,348	50	2.44	296	257	1.66	293	1,020	1.20	268	21	0.64	284
Ohio	1,610	842	36	1.93	264	42	1.44	223	755	1.03	186	9	0.59	154
Oregon and Washington	47	12	1	4.50	273	4	3.50	273	7	2.44	253	.....	.....	.....
Pennsylvania	4,370	3,038	110	1.69	241	159	1.70	240	2,599	1.10	214	170	0.56	207
Tennessee	1,515	1,313	32	2.15	259	31	1.93	257	1,162	1.05	217	88	0.58	245
Texas	87	87	2	2.29	170	2	0.50	224	82	0.53	253	1	0.50	44
Virginia and West Virginia	2,436	1,666	86	1.98	210	74	1.65	183	1,402	1.02	201	104	0.52	146
Wisconsin	1,817	553	21	2.77	262	115	2.09	292	412	1.68	257	5	1.20	265

EMPLOYÉS AT IRON-ORE MINES IN 1889—Continued.

STATES AND TERRITORIES.	BELOW GROUND.											
	Total number employés.	Foremen and overseers.			Miners.			Laborers.			Boys under 16 years.	
		Number employed.	Average wages per day.	Average number of days worked.	Number employed.	Average wages per day.	Average number of days worked.	Number employed.	Average wages per day.	Average number of days worked.	Number employed.	Average wages per day.	Average number of days worked.
Total	19,708	686	$2.46	282	12,432	$1.91	261	6,479	$1.60	261	111	$0.82	216
Alabama	1,319	8	2.95	274	598	1.92	245	706	1.47	256	7	0.67	161
Colorado	248	11	3.99	283	205	3.00	248	29	2.68	208	3	1.69	129
Connecticut, Maine, and Massachusetts	241	8	2.13	256	193	1.40	257	40	1.33	264	.....	.....	.....
Delaware and Maryland	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Georgia and North Carolina	105	3	2.12	308	10	1.20	202	91	0.68	297	1	0.40	244
Idaho and Montana	13	2	3.69	180	11	3.14	102	.....	.....	.....	.....	.....	.....
Kentucky	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Michigan	8,866	304	2.69	291	5,341	2.23	274	3,199	1.73	272	22	1.17	277
Minnesota	1,013	37	3.00	296	498	2.55	259	478	1.96	255	.....	.....	.....
Missouri	333	17	2.16	284	238	1.58	265	73	1.36	236	5	0.45	276
New Jersey	1,380	68	1.90	295	944	1.39	268	353	1.24	280	15	0.68	288
New Mexico and Utah	35	.....	.....	.....	35	3.50	259	.....	.....	.....	.....	.....	.....
New York	1,784	71	2.15	280	1,085	1.47	278	623	1.37	261	5	0.79	106
Ohio	768	9	1.95	222	674	1.25	192	60	1.25	161	25	0.51	100
Oregon and Washington	35	.....	.....	.....	35	2.56	235	.....	.....	.....	.....	.....	.....
Pennsylvania	1,332	41	1.67	224	1,065	1.39	230	216	1.12	227	10	0.90	300
Tennessee	202	5	3.04	214	176	1.20	204	20	1.00	288	1	1.00	200
Texas	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Virginia and West Virginia	770	43	1.74	252	514	1.13	252	201	1.00	176	12	0.50	262
Wisconsin	1,264	59	2.69	304	810	2.00	273	390	1.81	251	5	1.14	219

The number of foremen or overseers working under ground was 686, although at a number of mines foremen had direct charge both above and below ground, proportionate time being charged to each. They received in wages a total of $476,233, working on an average 282 days per year, and earned $2.46 per day. The highest average wages were paid in Colorado, viz, $3.99 per day, and the lowest in Pennsylvania, $1.67 per day. The 12,432 miners received $6,189,308 for their labor during the year, an average per man of $1.91 per day during the days worked, viz, 261. The wages ranged from $3.50 in New Mexico and Utah to $1.13 in Virginia and West Virginia. The highest wages paid laborers under ground was in Colorado, $2.68 per day, and the lowest in Georgia and North Carolina, $0.68 per day. In Georgia, however, some convict labor was employed, reducing the general average for the state. The 6,479 laborers under ground received as wages $2,716,424, working on an average 261 days per year, and earned an average of $1.60 per day. The 111 boys under ground received $19,617, working on an average 216 days and earning $0.82 per day.

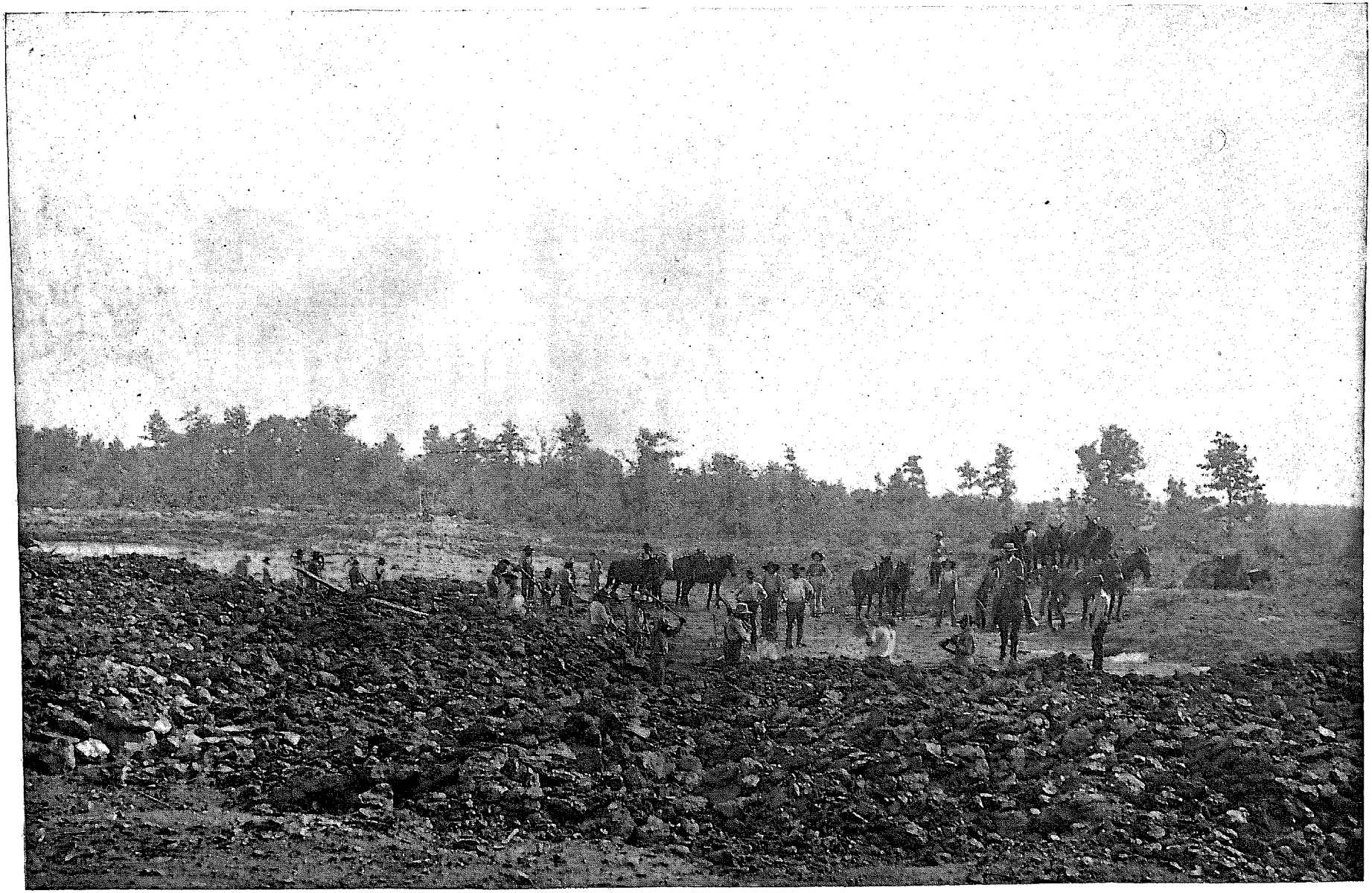
Michigan, as the largest producer, requires the services of the greatest number of persons, viz, 13,120, or 34.32 per cent of all the employés at the iron-ore mines in the United States; Pennsylvania follows with 4,410 employés, or 11.54 per cent; New York ranks third, its iron-ore mining industry giving employment to 3,178 persons, or 8.31 per cent of the total number of employés, and Alabama occupies fourth place, which state reported a total of 3,122 employés, or 8.17 per cent. These 4 states had 23,830 persons, or 62.34 per cent of the total employed in their iron-ore mines. Omitting the office force, the same relative positions are held by the states named.

The number of persons employed above and below ground, that is, in actual mining, divided into the tons of iron ore produced in some of the important states, furnishes the data for the following table:

TONS OF IRON ORE PRODUCED PER EMPLOYÉ IN 1889.

[Long tons.]

STATES.	Amount produced.	Number of employés above and below ground.	Tons of ore per employé.	STATES.	Amount produced.	Number of employés above and below ground.	Tons of ore per employé.
The United States	14,518,041	37,707	385.02	Virginia and West Virginia	511,255	2,436	209.87
				Tennessee	473,294	1,515	312.41
Michigan	5,856,169	12,947	452.32	New Jersey	415,510	1,872	221.96
Alabama	1,570,319	3,081	509.68	Missouri	265,718	706	376.37
Pennsylvania	1,560,234	4,370	357.03	Georgia and North Carolina	258,145	780	330.96
New York	1,247,537	3,132	398.32	Ohio	254,294	1,610	157.95
Minnesota	864,508	1,755	492.60	Colorado	109,136	391	279.12
Wisconsin	837,399	1,817	460.87				



BROWN HEMATITE (BOG IRON ORE) MINING NEAR NEW BIRMINGHAM, TEXAS.

(See pages 21, 22.)

Alabama returns the largest output per employé per annum, Minnesota, Wisconsin, Michigan, New York, Missouri, Pennsylvania, Georgia and North Carolina, Tennessee, Colorado, New Jersey, Virginia and West Virginia, and Ohio following in the order named. The preceding table emphasizes the influence which large mines and improved mining appliances exert upon the labor requisite, and also shows the advantages which some of the newer developed sections have in mining iron ore at low cost.

SUPPLIES AND OTHER EXPENDITURES.

The supplies and materials for mining iron ore were generally furnished by the owners or lessees of mines, but in some cases the amounts so expended could not be learned, as powder, fuel, tools, etc., were furnished by contractors, whose work had been completed and who were not accessible. A total of $4,998,988, or 34 cents per ton of iron ore mined, represents the average cost of supplies and materials per ton of iron ore won, a decrease of 12 cents per ton, or 26.09 per cent, from the figures for the Tenth Census, when the cost was 46 cents per long ton.

In the southern states the prevailing soft character of the ore and moderate depths of the workings reduce the cost of supplies and materials, while a larger quantity is required for winning the harder ores of the Lake Superior region, New York, and New Jersey from deeper mines. Thus in Alabama the amount expended for supplies and materials is but 8 cents per ton, while in Michigan it amounted to 41 cents, in New York 46 cents, and in New Jersey 76 cents.

Other expenditures reported include taxes and royalties amounting to $3,795,509. As royalty is only paid on a portion of the ore mined, and as the system of owners charging up a rate per ton against the mine as a sinking fund does not prevail to any great extent, it would be unfair to form any conclusions as to the average royalties, namely, so much per ton on the basis of the reports made.

TOTAL COST OF MINING IRON ORE.

The following table shows the expenditures of all kinds in the production of iron ore in the United States in 1889:

EXPENDITURES AT IRON-ORE MINES IN 1889, BY STATES AND TERRITORIES.

STATES AND TERRITORIES.	OFFICE FORCE.		Grand total employés.	Grand total wages.	Amount paid for contract work during 1889.	Total value of supplies and materials of all kinds during 1889.	Total of all other expenditures for the mines or works.	Grand total of all expenditures.
	Number.	Amount of wages.						
Total	520	$529,043	38,227	$14,409,151	$1,578,010	$4,998,988	$3,795,509	$24,781,658
Alabama	41	37,170	3,122	1,032,392	87,322	128,924	38,680	1,287,318
Colorado	23	26,425	414	297,297	.....	58,504	25,327	381,128
Connecticut, Maine, and Massachusetts	2	1,200	426	161,894	.....	60,939	18,103	240,936
Delaware and Maryland	1	1,200	233	49,416	400	5,203	4,436	59,455
Georgia and North Carolina	16	14,725	796	144,921	54,032	46,004	50,128	295,085
Idaho and Montana	.....	.....	83	53,112	.....	15,669	3,295	72,076
Kentucky	8	7,500	383	72,456	2,248	4,000	22,094	100,798
Michigan	173	217,283	13,120	6,353,741	834,234	2,402,443	2,528,123	12,118,541
Minnesota	15	25,299	1,770	978,483	.....	419,192	158,340	1,556,015
Missouri	23	29,874	729	283,847	2,934	45,563	63,623	395,967
New Jersey	21	14,440	1,893	568,591	157,536	316,199	96,676	1,129,002
New Mexico and Utah	1	1,000	48	45,052	.....	7,822	3,344	56,218
New York	46	43,050	3,178	1,087,252	204,969	572,501	185,679	2,050,401
Ohio	34	17,560	1,644	367,855	4,568	23,929	28,367	424,719
Oregon and Washington	.....	.....	47	31,542	.....	4,237	1,041	36,820
Pennsylvania	40	26,814	4,410	1,141,239	55,425	299,429	215,036	1,711,129
Tennessee	19	12,460	1,534	355,332	17,551	86,318	49,666	508,867
Texas	2	365	89	12,188	.....	987	440	13,615
Virginia and West Virginia	32	23,257	2,468	575,061	7,936	128,323	128,452	839,772
Wisconsin	23	29,421	1,840	797,480	148,855	372,802	174,659	1,493,796

The total cost of the ore mined, as represented by schedules returned, aggregates $24,781,658, equivalent to an average cost of $1.71 per ton of ore mined, against $2.21 in 1880, a decrease of 50 cents per ton, or 22.62 per cent. The cost similarly determined for each state is set forth in the statement on the following page, which can be compared with the table on page 16, showing the expenditure for labor per ton of iron ore produced, and also compared with the table on page 18, indicating the quantity of ore won per employé. The difference includes more than supplies and materials. These figures indicate the advance made in labor-saving appliances and improved facilities for mining and handling the product of the mines. In the total cost of producing iron ore, and delivering it on cars or carts at the mines, Alabama is the only state which averages less than $1 per ton, viz, 82 cents. Next in order of low cost come Texas, $1.05; Tennessee, $1.08; Pennsylvania, $1.10; Georgia and North Carolina, $1.14. In Colorado, for reasons before given, the cost of producing one long ton of ore, $3.49, is greater than in any other state.

TOTAL COST OF PRODUCING ONE LONG TON OF IRON ORE IN THE VARIOUS STATES AND TERRITORIES.

The United States	$1.71	Missouri	$1.49
		New Jersey	2.74
Alabama	0.82	New Mexico and Utah	1.56
Colorado	3.49	New York	1.64
Connecticut, Maine, and Massachusetts	2.73	Ohio	1.67
Delaware and Maryland	2.02	Oregon and Washington	1.40
Georgia and North Carolina	1.14	Pennsylvania	1.10
Idaho and Montana	2.99	Tennessee	1.08
Kentucky	1.30	Texas	1.05
Michigan	2.07	Virginia and West Virginia	1.64
Minnesota	1.80	Wisconsin	1.78

The costs do not include interest on capital invested, expenses of marketing the ore, or the maintenance of administrative offices elsewhere than at the mines.

The figures in the table on page 4 give the total value of the iron ore product at the mines in the year 1889 as $33,351,978, and the table of expenditures shows that the total cost of mining during the same year was $24,781,658, indicating an apparent profit of $8,570,320, or 34.58 per cent of the total expenditure during the year for labor, supplies and materials, superintendence, incidentals, taxes, etc., and also in some cases royalties. But in addition to these expenses there are interest on capital invested, royalties, cost of betterments, renewals, replacements, and additions to machinery, fixtures, live stock, general management and offices, sinking fund, etc., to be accounted for.

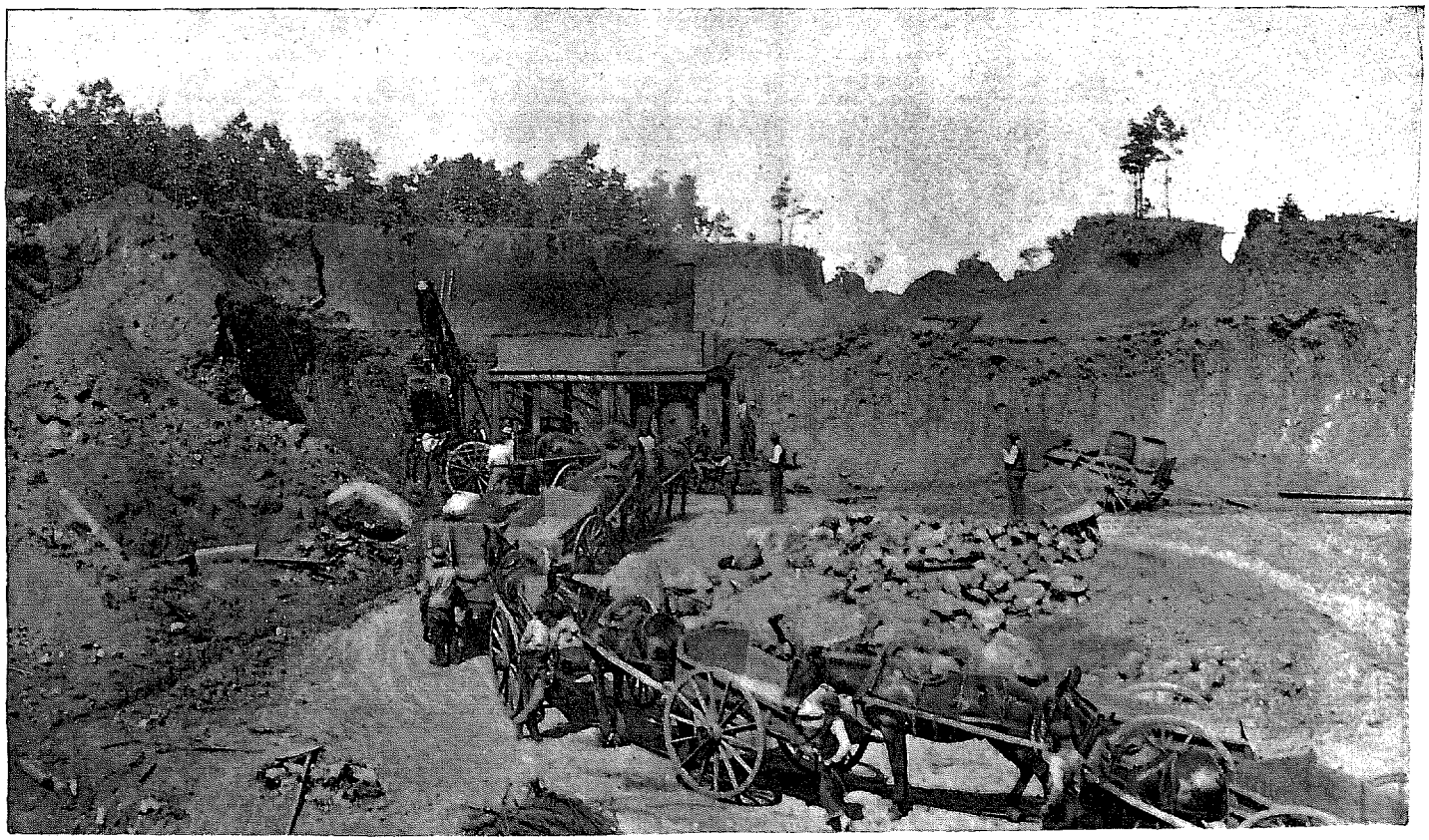
The apparent profit of $8,570,320 represents 7.81 per cent of the total capital invested, viz, $109,766,199, but from this apparent profit allowances for depreciation, betterments, general management, etc., must be made, and, as before mentioned, the total capital reported is below that actually employed, the average investment in iron-ore mining will therefore appear to yield less satisfactory results than the figures above given suggest.

POWER USED IN IRON-ORE MINING IN THE UNITED STATES.

The schedules returned from the various active iron-ore mines report a total of 1,109 steam boilers, with an aggregate horse power of 57,976. These boilers furnished steam to 1,093 steam engines, including air compressors, hoisting machinery, engines for driving washers, crushers, etc., some of which are of large size. The steam engines reported, however, do not in most instances include the motive power for pumps, because pumps are rated independently of steam engines, as a locomotive would be. As the printed inquiry did not specifically cover this point, it was thought best not to follow it in detail as far as pumps were concerned. In the returns made, however, there were 79 pumps mentioned independent of steam engines; also 20 locomotives, used in and about the mines; 4 steam shovels, employed in digging or handling ore or stripping; 8 turbine wheels driving machinery, and 10 air compressors worked by water power. The application of steam and compressed air has largely reduced the number of animals employed in and about iron-ore mines, and as the queries in the census schedules especially provided for the value of the ore delivered on cars or carts at the mine, only animals actually employed in the mines were enumerated.

Michigan, as the largest producer of iron ore, and having numerous deep mines, has the greatest number of steam engines, a total of 387 engines, etc., and an aggregate of 332 boilers being in use, with a total of 24,180 horse power. As most of the iron ore obtained in Michigan is from underground workings (and there they are the deepest in the country), it is not surprising that 41.71 per cent of the total horse power of boilers connected with active iron-ore mines is utilized in that state.

Much of the iron ore of Alabama, Georgia, and Tennessee is from open cuts or from new exploitations. Therefore the large output of these states was won with a comparatively small number of steam engines and boilers. On the other hand, New York, New Jersey, and Pennsylvania obtained a large portion of their ores from underground operations, which had been worked for many years, requiring a greater proportion of power than in some other states.



BROWN HEMATITE MINING WITH STEAM SHOVEL, NEAR ANNISTON, ALABAMA.

(See page 22.)

The following table shows the power used in the mining of iron ores during the year 1889:

POWER USED IN MINING IRON ORE.

STATES AND TERRITORIES.	STEAM BOILERS.		Steam engines.	Animals.	STATES AND TERRITORIES.	STEAM BOILERS.		Steam engines.	Animals.
	Number.	Total horse power.				Number.	Total horse power.		
Total	1,109	57,976	1,093	2,796	Missouri	32	1,082	37	112
					New Jersey	96	5,428	87	55
Alabama	46	1,971	40	283	New Mexico and Utah				
Colorado	14	378	12	7	New York	134	6,839	89	163
Connecticut, Maine, and Massachusetts	30	1,471	34	25	Ohio	9	450	3	430
Delaware and Maryland	5	250	4	102	Oregon and Washington	4	300	6	5
Georgia and North Carolina	25	885	25	235	Pennsylvania	220	7,414	210	498
Idaho and Montana				7	Tennessee	29	855	22	130
Kentucky	3	85	3	20	Texas				19
Michigan	332	24,180	387	368	Virginia and West Virginia	49	1,813	49	238
Minnesota	33	1,610	30	42	Wisconsin	48	2,965	64	57

RÉSUMÉ.

The following table presents a résumé of the figures detailed in the preceding pages as far as comparisons can be made between the Tenth and Eleventh Censuses:

COMPARISON OF THE TENTH AND ELEVENTH CENSUSES, WITH PERCENTAGES OF INCREASE.

ITEMS.	1889.	1880.	Percentage of increase.
PRODUCTION.			
	Long tons.	*Long tons.*	
Total	14,518,041	7,120,362	103.89
Red hematite	9,056,288	2,243,993	303.58
Magnetite	2,506,415	2,134,276	17.44
Brown hematite	2,523,087	1,918,622	31.51
Carbonate	432,251	823,471	*a*47.51
VALUE OF PRODUCT.			
Total value	$33,351,978.00	$23,156,957.00	44.03
Value per ton	2.30	3.25	*a*29.29
EMPLOYÉS.			
Number	*b*38,227	*c*31,668	20.71
TOTAL WAGES.			
Amount paid as wages (*d*)	*b*$14,409,151	*d*$9,538,117	51.07

ITEMS.	1889.	1880.	Percentage of increase.
WAGES PER ANNUM (OFFICE FORCE EXCLUDED).			
Wages per man (*e*)	*f*$409.95	*e*$308.94	32.70
CAPITAL.			
Total	$109,766,189	*e*$61,782,287	77.67
Land	78,474,881	*e*48,274,149	62.56
Buildings and fixtures	7,673,520	*e*8,657,375	81.57
Tools and implements	8,045,545		
Cash and stock on hand	15,572,253	*e*4,850,763	221.03
SUPPLIES, ETC.			
Supplies and materials	$4,998,988	*e*2,894,011	72.74
Other expenditures	3,795,509	*g*1,020,429	271.95
POWER USED IN MINING.			
Number of boilers reported	1,109	*e*1,093	1.46
Horse power of boilers	57,976	*e*28,422	103.98
Steam engines	1,093	*e*821	33.13

a Decrease.
b Including office force.
c In regular establishments.
d Not including amount paid to contractors.
e Excluding office force.
f Includes amount paid to contractors.
g This amount does not include taxes, insurance, etc.

ILLUSTRATIONS OF IRON-ORE MINES.

The accompanying plates are introduced to represent some of the methods of exploiting for various kinds of iron ore, the illustrations being selected to show deposits in different states. As a rule, the larger mines are worked under ground, and it is difficult to secure satisfactory views of the occurrence of the ores or the methods pursued in winning them. As operations continue the appearances of the workings are constantly changing and the mines illustrated will present aspects somewhat different from those shown.

BROWN HEMATITE MINING AT NEW BIRMINGHAM, TEXAS.—The illustration shows the method employed in winning the bog ores of eastern Texas, where the deposits exhibit a regularity of occurrence unusual in brown