

GOVERNMENT OF INDIA.
REVENUE AND AGRICULTURAL DE.

Return of Mineral Production in India for 1892.

(PUBLISHED BY ORDER OF THE GOVERNOR GENERAL IN COUNCIL.)

1893.

STATEMENT NO. I.

Notes.

SALT.

The consumption of salt increased considerably for India as a whole in 1892-93, and the revised (Rx. 8,648,600) exceeded the budget estimate (Rx. 8,544,700) by Rx. 103,900. The receipts were lower than in the preceding years in Madras, Bengal, and Burma, and much lower in Bombay. The increase in the receipts of the Northern India Salt Department, however, more than counterbalances the falling off elsewhere, and it is probable that Northern India salt has, in some tracts, displaced Bombay and imported salt.

The total quantity of salt produced in India in 1892 is returned at 898,909 tons, valued at Rs. 4,629,574. 360,042 tons of salt were imported into India in 1892-93. "Salt of Indian manufacture," Mr. J. E. O'Connor says in the 'Review of the Trade of India' 1892-93, "has been to some extent taking the place of imported salt. This displacement must be attributed to the cheapness with which Indian salt can now be placed by railways in localities hitherto more cheaply supplied, notwithstanding the difference in price, with imported salt."

COAL.

The subject of Indian coal has recently been fully dealt with in the Imperial Institute 'hand-book of commercial products,'* No 9, 1893, under the following heads:—

- I.—Geology, statistics, fuel consumption on railways, labour, colliery statistics.
- II.—Collieries.
- III.—Prospective.
- IV.—Royalties.

IRON.

The iron resources and industries of the southern districts of the Madras Presidency were investigated by Mr. T. H. Holland of the Geological Survey of India in 1891-92. The results of his investigations have been published in Imperial Institute 'hand-book of commercial products,' No. 8, 1892.

It is proposed to deal, in further reports, with the iron resources and industries of the remaining districts of the Madras Presidency, as well as of the other important iron bearing localities of India and Burma, and to embody therein the results of examination in the laboratory of the ores and manufactured products collected.

* The hand-books on Iron (8 annas), and Coal (12 annas) can be obtained by application to the Reporter on Economic Products' Indian Museum, Calcutta.

STATEMENT No. I.

**Showing the production of minerals for which approximate statistics are available for the Calendar
years 1890, 1891 and 1892.**

Showing the production of minerals for which approximate

BRITISH PROVINCES AND NATIVE STATES.	SALT						COAL					
	1900.		1901.		1902.		1900.		1901.		1902.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
1	2	3	4	5	6	7	8	9	10	11	12	13
	Tons.	Rs.	Tons.	Rs.	Tons.	Rs.	Tons.	Rs.	Tons.	Rs.	Tons.	Rs.
BRITISH PROVINCES.												
Madras	330,008	22,32,309	307,080	22,46,737	300,000	19,87,953	...	...	20	100	61	(1)306
Bombay (including Sindh and Native States).	394,487	19,90,977	391,074	16,11,778	335,783	11,08,771	...	...	...	...	...	...
Bengal	2,994	21,624	1,223	14,266	2,706	20,041	1,026,345	60,76,006	1,747,123	65,24,124	1,320,080	46,48,727
North-Western Provinces and Oudh.	1,486	14,800	1,275	13,018	1,271	12,903	...	...	...	...	...	...
Punjab	116,207	4,98,200	114,780	4,95,197	100,865	441,573	60,077	2,35,414	60,714	5,20,410	60,282	5,41,241
Central Provinces ... ..	...	...	...	...	...	...	127,026	4,46,494	241,228	292,000	102,402	292,423
Burma	7,243	2,16,019	10,080	4,70,094	11,546	5,32,956	...	...	...	...	2,070	64,040
Assam ... ..	...	...	...	...	...	...	144,708	10,19,088	184,200	10,79,458	164,050	11,48,105
Azam	0	0	26,586	2,10,246	40,800	2,42,937	0	0	...	...	...	...
TOTAL	797,180	64,27,298	811,919	40,32,976	822,400	48,71,923	1,940,052	61,23,480	2,108,000	60,26,186	2,206,180	79,50,426
NATIVE STATES.												
Mysore ... ..	...	...	...	...	...	...	...	...	...	...	...	...
Kashmir ... ..	...	...	2	100	...	...	...	...	...	...	...	...
Baluchistan ... ..	...	...	...	...	...	...	15,541	1,94,268	10,288	1,27,000	12,284	1,50,940
Central India Agency	513	3,495	664	(a)	643	(a)	77,343	2,27,726	60,741	2,26,210	68,023	2,22,065
Rajputana States	264,988	16,27,272	182,427	4,40,700	64,776	4,40,700	...	...	...	...	...	...
Nizam's Dominions ... ..	...	...	...	...	...	...	126,098	6,91,912	144,000	6,45,000	140,801	5,22,000
TOTAL	264,280	16,42,187	108,289	4,40,800	65,419	4,40,800	218,089	12,14,122	224,777	10,72,000	261,604	10,06,916
TOTAL BRITISH PROVINCES AND NATIVE STATES.	1,061,460	80,69,485	1,020,208	44,73,776	887,819	53,12,723	2,158,141	73,37,602	2,332,777	70,98,186	2,467,784	89,57,342

* Not received.
(a) Not available.

MENT NO. I.

statistics are available for the calendar years 1890, 1891 and 1892.

Iron ore.						Petroleum.						BRITISH PROVINCES AND NATIVE STATES.
1890.		1891.		1892.		1890.		1891.		1892.		
Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
14	15	16	17	18	19	20	21	22	23	24	25	
Tons.	Rs.	Tons.	Rs.	Tons.	Rs.	Gallons.	Rs.	Gallons.	Rs.	Gallons.	Rs.	
280	7,501	450	4,214	300	2,804	—	—	—	—	—	—	Madras.
—	—	175	87	—	—	—	—	—	—	—	—	Bombay (including Sind and Native States).
17,000	21,300	20,000	20,517	10,000	20,573	—	—	—	—	—	—	Bengal.
12	4,504	—	—	—	—	—	—	—	—	—	—	North-Western Provinces and Oudh.
23	50	10	187	7	83	2,001	1,004	2,151	704	2,300	683	Punjab.
5,000	13,003	9,073	(c) 17,000	200	(d) 7,000	—	—	—	—	—	—	Central Provinces.
—	—	3	200	—	—	4,641,200	2,00,000	2,072,204	4,81,707	2,000,000	(e) 2,70,000	Burma.
—	—	—	—	—	—	12,000	4,075	22,745	5,000	21,751	5,200	Assam.
0	0	—	—	—	—	—	—	—	—	—	—	Adeo.
20,700	26,302	20,073	20,800	20,000	20,253	4,653,200	2,70,000	2,000,200	4,80,000	2,720,001	2,70,007	TOTAL.
200	20,141	200	10,000	(b) 200	(b) 2,707	—	—	—	—	—	—	MYNOR STATES.
—	—	—	—	5	200	—	—	—	—	—	—	Mysore.
—	—	—	—	—	—	272,001	15,000	100,000	7,000	2,000	200	Kashmir.
1,007	21,203	1,773	20,200	1,077	1,00,200	—	—	—	—	—	—	Baluchistan.
2,110	20,200	1,141	24,000	100	27,200	—	—	—	—	—	—	Central India Agency.
(c)	4,001	(c)	2,000	(d)	4,014	—	—	—	—	—	—	Rajputana States.
4,000	1,00,014	2,000	1,00,007	2,011	1,00,000	272,000	15,000	100,000	7,000	2,000	200	Nizam's Dominions.
20,200	1,00,107	20,200	1,00,000	20,101	1,00,114	4,925,200	2,81,207	2,100,000	4,70,010	2,720,001	2,70,007	TOTAL.
20,200	1,00,107	20,200	1,00,000	20,101	1,00,114	4,925,200	2,81,207	2,100,000	4,70,010	2,720,001	2,70,007	TOTAL BRITISH PROVINCES AND NATIVE STATES.

(b) Estimates.

(c) The falling off is due to the increased output.

(d) The large difference between the average value rates per ton is due to an error in the figures for 1891.

STATEMENT NO. II.

Showing the distribution, production and working of some of the most important minerals for which reliable statistics are not available.

(Corrected up to 31st December 1892.)

I.—GOLD.

The localities in which gold is to be found in India are the following:—

- (1) *Madras*.—Travancore, Madura, Salem, Malabar, Wynaad, Bellary, Coimbatore, Nilgiris, and South Canara.
- (2) *Mysore*.
- (3) *Hyderabad*.
- (4) *Bengal*.—Orissa, Midnapur, Bankura, and Champaran districts; Chutia Nagpur, Manbhum, Singbhum, Udaipur, and Darjeeling.
- (5) *Central Provinces*.—Chhattiagarh, Nagpur, Jabalpur divisions and Upper Godavari district.
- (6) *Central India*.—Ajmere-Merwara district.
- (7) *Bombay*.—Dharwar, Belgaum, and Kaladgi districts, and Kathiawar.
- (8) *Punjab*.—Bannu, Peshawar, Hazara, Rawalpindi, Jhelum, Kangra, Umballa, and Gurgaon districts.
- (9) *North-Western Provinces*.—Bijnor, Naini Tal and Garhwal districts.

Gold of considerable purity is found throughout nearly the whole of Lower Burma, especially in the beds of the rivers in Tenasserim. Specimens have been found of quality equal to average Australian gold. Gold occurs also in the Mawnaing township of the Kawlin subdivision, Katha district, in the Mawnaing, Gyodaung and Mawha circles of Upper Burma. The field was visited at the beginning of 1893 by Dr. Nestling who reported that gold in paying quantities was to be found over a considerable area. His report was confirmed by two private explorers. Specimens supposed to contain gold which were collected by Dr. Nestling were sent for analysis, some to the Chemical Examiner, Rangoon, some to the Director of the Geological Survey, Calcutta. The Chemical Examiner, Rangoon, reported that the samples contain no gold, while the Geological Survey Department reported that of the three specimens examined, one yielded a minute trace of gold, the second 1 dwt. 7 grains, and the third 4 dwt. 14 grains to the ton.

Record also exists of gold in Assam.

The production is nowhere considerable except in Mysore and the Wynaad, where mining operations have been started under European management. The estimated production in 1890 is given below, later statistics not being available:—

				Quantity.	Value.
				oz.	Rs.
Madras	...	...	...	*961	*50,565
Mysore	...	...	...	*163,187	*98,94,021
North-Western Provinces	...	...	...	*76	*4,460
Punjab	...	...	...	447	22,612
Kashmir	...	...	...	101	4,281
Hyderabad	...	...	...	57	316
Burma	...	...	...	22	1,800
Bengal	...	...	...	1	100

The native method of obtaining gold is almost universally the washing of auriferous sands from the beds of rivers. In Upper Burma the natives wash the alluvial gold-bearing deposit in shallow round troughs known as 'ins'. These washings are generally carried on in the beds of hill streams. The working season is in the rains when water is plentiful in them. These 'ins' are manipulated by experts on the surface of the water by giving them a gentle circular rocking motion by which the dross, earth, &c., is separated and washed off, leaving the heavier particles of gold behind in the form of dust. The outturn of gold varies according to the locality and luck of the worker. Three or four men working and washing regularly can, it is said, obtain from one-half to one tical† of gold a month, sometimes not even that.

The present state of the industry may be described as follows.—Two gold mines in the Lohardugga district of Bengal were worked in 1891, but the results of the operations are not known as those in charge of the mines have not allowed them to become public. Mining operations were started in 1891 at the Rajgir hills in Patna, but they

* For 1892.

† One tical = 252 grains troy.

have been discontinued. There is only one prospecting and no mining concern in Manbhūm. Speculative enterprises have been started in certain places of the Madras Presidency, but they are still in the prospecting stage, and no gold has yet been found. The operations in Coimbatore have been temporarily suspended for want of funds while in the Nilgiris there were three Companies working during 1892, one of which, however, has since been suspended. The industry is stated to be in a decayed condition in South-East Wynaad. The practice of washing for gold in the streams of the Seoni district has of late been abandoned. Operations were initiated for gold mining in the Sonakhan tract at the South-East corner of the Bilaspur district, but have, it is understood, proved fruitless. Prospecting operations in the Sambalpur district have shewn that no large veins exist. The auriferous tracts in Mysore have been surveyed and reported upon by Mr. R. Bruce-Foote and leases for mining for gold and licenses for prospecting for gold and other metals have been granted in twenty-two tahsils. The Hyderabad (Deccan) Company have carried on extensive prospecting operations at certain places in the Rhichur-Doab, Hyderabad, proving the existence of the mineral in paying qualities. Several persons have applied for mining or prospecting licenses in Burma and mining leases will soon be issued to applicants eligible to receive them.

II.—GEM STONES.

The only locality in India where amber is known with certainty to occur is the Hukong valley in Upper Burma. Since Upper Burma was annexed the right to collect the duty on amber (5 per cent. *ad valorem*) has been sold by auction together with the jade license.

(i) Amber. The working out of amber is thus described. By some superstitious rite a lucky place to dig in is selected and a shaft made about 70 or 80 feet deep. If a vein is struck, a side passage is made tracing it; at certain points lumps are found, which are alleged to reach 1,000 lbs. in weight. A shaft is usually dug over these lumps, and the amber is extracted and sawn into the required sizes. A variety of amber called *payinswe* used to be sold by the miners to the Chinese and taken to China for use in making medicine. The price at the mines in former times used to vary from Rs. 6 to Rs. 15 a viss of 3.65 lbs., and in Mandalay bazar from Rs. 15 to Rs. 40, the yellow being rarer than the red variety. It is said that the mines were nearly exhausted many years ago. They are at present worked in a fitful and haphazard manner by the Kachins.

There is a famous old mine in the Coimbatore district of the Madras Presidency but it is not now worked. It is also to be found in the Punjab Himalayas and in Rajputana. There is no industry at present.

(ii) Beryl.

Diamonds are known to occur over five areas, *viz.*—

(iii) Diamond.

- (1) The Kistna valley side of the Deccan.
- (2) The Madras Presidency, in the districts of Anantapur, Cuddapah, Kurnool, and near Ellore in the Godavari district.
- (3) Chutia Nagpur and the Central Provinces.
- (4) Bundelkhand.
- (5) Hyderabad.

The Chutia Nagpur diamonds are untraceable, and are probably fabulous. Diamonds were formerly found in the neighbourhood of Hirakhoond in the Sambalpur district of the Central Provinces where, in the days of native rule operations were regularly taken by damming and washing to search for them. The work was in the hands of professional diamond-washers known as *Jharias*, who were liberally rewarded by grants of land for valuable finds. No statistics of any production are available. A lease was granted to a syndicate of capitalists to search for diamonds in and near the Mahanadi above the town of Sambalpur, but its operations proved a failure. It is thought that diamonds may also be found in some of the crystal pits near Gorpur, Kobra, Dhundee Towa in the Betul district, and near Pattan in the Multai tahsil of the same district, but no precise information is available. The Hyderabad (Deccan) Company have carried on exploratory workings at certain localities in the Hyderabad State with partial success. From the partial workings alone over 8,000 diamonds were washed, but the stones being minute, their value bears no proportion to the outlay incurred by the company. The company claim to have found old workings at certain places in the Ghanpura Circle, but the nature and capacity of these deposits remain to be found.

Diamonds are obtained to a small amount by working or mining in the areas mentioned above. From the Kistna Valley side of the Deccan the output for the two years 1888 and 1889 is recorded as 93 carats, valued at Rs. 108. Later operations have, however, increased this considerably. No statistics are obtainable from the other districts of the Madras Presidency or from Chutia Nagpur and the Central Provinces. It is said that the supply from the Ramakotta and Banganapalle washings in the Madras Presidency is unremunerative. The value of the diamonds extracted from the mines in Bundelkhand during the

year 1892 was Rs. 9,231, and the official report from Hyderabad for 1891, gives the outturn for the Hyderabad State at 862½ carats, valued at Rs. 15,530.

The industry has declined and is unimportant, contractors often losing heavily and the labourers earning a precarious living.

It is common in various parts of India. The stones found in the South Canara district of the Madras Presidency have been found on examination to be practically of no value, and those found in the Monghyr district of Bengal are much fractured, and do not appear to be marketable. The mines at Sarwar in the Kishengarh State in Rajputana are being constantly worked, yielding an average annual revenue of Rs. 2,500. These mines are generally worked by the local Jogees and Malees, who are great experts at prospecting for garnet mines. The Sarwar garnets are considered the best in Rajputana, and are greatly prized on account of their deep pink brilliant colour for making jewellery, of which there is a flourishing industry at Sarwar. There are some fifteen manufactories of carbuncle jewellery worked by the local Mahomedans, who sell to the mahajan traders, from whom the European firms and exporters receive their supplies. The revenue derived in 1892 was Rs. 1,640.

A stone, known in commerce as jade, is extensively worked in the Mogoung sub-division of the Bhamo district, and in the Upper Chindwin and Katha districts of Upper Burma. Its colour varies from pearly grey to dark green. It is in universal demand throughout China. A variety highly prized by the Chinese is pale grey, with bright apple-green spots, clouds, and veins. A block of less than a cubic yard in size was some years ago valued at £10,000 in Rangoon, and the Chinese are said to have offered £8,000 for it. The Bhamo jade-producing country is far the most important. It may be described as the district lying between the 25th and 26th parallels of latitude and shut in by the Chindwin and Mu rivers on the west and east respectively. The mines now being worked are known as Tawmaw, Paungmo, Iku, Martiemmo, and Nienmo. The Tawmaw quarries have been worked for several years, but the stone is by no means exhausted. The jade quarries of Katha district are situated about 12 miles north of the Maw-hun hill, some 60 miles from the head-quarters of the district. The jade extracted from these quarries is inferior to the Bhamo jade. A royalty of 33½ per cent. is levied on all jade-stone extracted in Upper Burma. The right to collect this duty, together with the duty on amber, is sold annually by auction. The licensee for the present year, a Chinaman, has purchased the license for Rs. 36,000. A fine green stone, probably jadeite or jasper, is found at Mohgaon in the Sausor tahsil of the Chhindwara district of the Central Provinces, and appears to have been worked at some distant period.

The declared exports of jade stone from Rangoon by sea for the year 1892-93 amounted to 3,508 cwt., valued at Rs. 6,70,250, and the average yearly value of the exports for the past five years amounted to nearly Rs. 6,31,065.

This mineral, which includes rock-crystal, amethyst, cornelian, jasper, onyx, etc., occurs in the Monghyr district of Bengal, and is extremely common in the Hyderabad State. It is also found in veins of very pure quality unstained by iron in the Salem district of Madras, and the Elephant Rock in the lower slopes of Shevaroy is a magnificent mass of pure white quartz. The stones found in Coorg are mainly used for metalling roads. Gold-bearing quartz occurs in the Katha district of Upper Burma.

Onyxes are found plentifully in the crystal pits in the Betul district, and there is a band of coarse onyx near Amerwara in the Chhindwara district. Agates, Onyxes, etc., are found in the beds of the Nerbada, Bhima, Godavari and Kistna rivers. Rock-crystals occur in the Patna feudatory State in the Sambalpur district, and there are some good specimens in the Nagpur Museum.

A small industry in rock-crystal of different colours called "Vallam stone" is carried on at Trichinopoly and in the Palladam taluk of the Coimbatore district of the Madras Presidency, the stones being brought from Vallam in Tanjore. Spectacles and dolls are made out of them. The "Godavari pebbles" which were formerly eagerly sought for, are not now in demand, being most probably out of fashion. The most important industry in quartz stones, such as cornelian, etc., is developed in the Bombay Presidency as at Cambay, the stones being brought from Rajkot and Rajpipla. Broach is also another centre for this industry. Smaller centres of lapidary work are Jabalpur and Banda.

The chief ruby mines of Upper Burma are situated in the neighbourhood of Mogòk and Kyatpyin in the Ruby Mines district and are mined for by the Burma Ruby Mines Company and by native workers. Spinel and sapphires are not intentionally worked for, but are merely obtained associated with the ruby. These stones are also found near the villages of Wapadaung, Kaukgyi, and Yingan in the Twiangé township and near Sagadaung in Momeik. The principal ruby bearing region, i.e., that of Mogòk and Kyatpyin, extends over an area of 66 square miles,

but the area in which the Ruby Mines are now actually worked is about 45 square miles in extent. The mines are situated in a mountainous tract some 90 miles north-west of Mandalay and 50 miles by road east of Thabeikkyin on the Irrawaddy at an elevation of 5,000 feet above the sea. These mines are at present leased to the Ruby Mines Company, Limited, who pay a rent of Rs. 4,00,000 a year to Government. The stones occur over a mountainous area in small patches in the valleys or in the fissures of the rock, and on the surface soil of the hillsides. In the valleys the stones are obtained by sinking pits through the overlying soil until the stone-bearing stratum (byön) is reached at depths varying from 3 to 20 feet; the earth obtained from these pits is washed through sieves and the stones separated. In the fissures of the rock a similar process is followed except that no pit-sinking is required. The earth is simply dug out of the crevices and washed. The hillside deposits are worked by washing away the surface soil by means of streams of water diverted for the purpose and then separating the stones from the surrounding earth by the same agency. Another method of winning rubies and the one which is now principally employed by the Ruby Mines Company, is tunnelling into hills which are believed to contain byön. Tunnels are pierced towards the centres of the hills, and as fissures containing byön are met the byön is dug out, conveyed to washing station, and there washed. The stones are more hardly won than in former years as the more easily worked deposits are being gradually exhausted, but it is probable that at least 10 lakhs worth of stones are extracted annually. The revenue of the Ruby Mines under the Burmese Kings is said to have been about £12,000 to £15,000 a year. Another ruby tract is that known as the Sagyin Ruby Mines *Mandalay*. These are situated in a narrow range of hills rising from the plain of the Irrawaddy valley 24 miles north of Mandalay and 8 miles from Madaya. These mines are at present reserved by Government and are not being worked. The mines lie in crevices in the limestone (alabaster) of which the hills are mainly composed.

In India itself tracts of rubies are reported from the Salem district, but the Collector of the District says that garnets are mistaken for rubies, and that, if there be rubies at all, they are not true rubies, but spinels.

III.—MISCELLANEOUS MINERALS.

Alum shales occur in several parts of India, but are more particularly worked and treated

(i) Alum. at Madh in Kach, at Kalabag and Kutki in the Punjab, and in Behar. In the Shikarpur district alum is said to be manufactured on the Khirthar range in large quantities and of fair quality. In 1867 the yearly outturn of Kach alum was estimated at 294 tons, but after that time it fell off. About 1,200 maunds of alum are made annually at Kalabagh and 10,000 maunds at Kutki.

Good lodes of stibnite occur at Shigri in Lahoul (North-Western Himalaya), in the Tenasserim district of Lower Burma, and in the Jhelum district of the Punjab. The mines in Jhelum are annually leased by the District Forest Officer. The industry is poor.

This mineral has been found in Chutia Nagpur, Afghanistan, Punjab, and Garhwal. Only lately a very promising sample is reported from Western Malwa in Central India. There is no industry at present.

These ores are widely distributed. They occur in Singbhum and Dalbhum, and are said to be found also in the Banka sub-division of the Bhagalpur district, Bengal; but no mines in the latter place have ever been worked. Azurite and other carbonates of copper are found at Kakwara in south Bhagalpur. Copper ores occur in several places in the Chanda district of the Central Provinces, and there are at least three places in the Mul tehsil, where it was worked in ancient times. These ores are also found near Birman in the Narsingpur district and Gosalpur and Khetola in the Jabalpur district, but in the latter place it has not been worked as an industry. In Rajputana they are found in several of the independent States and in the British district of Ajmere, where mining was practised on a large scale, but is now almost extinct. Unsuccessful attempts hitherto have also been made to work the ores of Kumaun, Garhwal, the Western Duars, and in the Darjeeling district. Copper mines are said to exist in Hyderabad, but no valuable ores in any quantity have as yet been discovered.

Statistics regarding production are not available except for Bengal, where the outturn during the year 1891 was estimated at 2,500 tons, valued at Rs. 1,32,500. In 1888, 218 tons of refined copper were turned out.

The industry has long been dormant, and has only been revived to any important extent at Baraganda in Singbhum and Dalbhum, Bengal, where a company is working the ores.

Corundum or emery stone is very freely distributed among the crystalline rocks of Southern India, as in the Travancore State, the Mysore State, Hyderabad, and the districts of Coimbatore, Salem, Anantapur, and North Arcot of the Madras Presidency. An immense deposit of corundum exists near Pipra and Kadopani in South Rewa, and some fine specimens have been found near the Kazipet station of the Nizam's Guaranteed State railway.

One hundred and sixty six tons are said to have been quarried during the year in the Anantapur and Coimbatore districts of the Madras Presidency, and one hundred and eight tons in the Mysore State.

In Anantapur the industry is said to be active during the rainy season, especially in one taluk. In Coimbatore and North Arcot the right of collecting has been leased out, for Rs. 1,625 per annum and for Rs. 2-4 per Indian maund respectively from the year 1893, while in the Mysore State it is sold by public auction.

It occurs in the following places:—(1) Trichinopoly, Madras; (2) Kach and the Kirthar range of Sindh, Bombay Presidency; (3) near Nagore in the Jodhpore State, Rajputana; (4) Central India; (5) Bannu, Kohat, and the Salt range near Kalka, Punjab; (6) Kumaun and Garhwal, North-Western Provinces. The mines in the Trichinopoly district are not worked and the quality of the gypsum found in the neighbourhood of Nagore is not good as a general rule, but in the excavation of a well in the Falodi pargana some finest specimens were found, but at too great a depth to be workable.

Statistics of production in 1892 are not available, except for Rajputana and Central India where the outturn is estimated at 1,565 tons, valued at Rs. 1,004, and 84 tons, valued at Rs. 300, respectively.

Gypsum is not much utilized. It sells in Bombay at about Rs. 2 per cwt.

The mines in the neighbourhood of Nagore are worked in the following manner:—Depressions where the gypsum is found are cleared of the surface sand and earth, and trenches are dug from which it is removed in the form of clods. The trenches, being left untouched for two or three years and exposed to rain, fill up with gypsum, which is again removed. It is used generally as a cement, where it is not much exposed to atmospheric changes. The cement is prepared by burning. At present little gypsum is extracted, but better results are now hoped for since the opening of the railway to Nagore which will cheapen the carriage.

Extensive old workings occur at Guzalpali in the Kurnool district of Madras, but the mines are not worked now. In the Bombay Presidency lead ores are found in the Pauch Mahale and Narakot (Rewakantha) near the iron ores. In Bengal deposits of galena occur in the Bhagalpur district, and have been more or less worked at various times; whilst others show at Dhadka in Manbhum; in the Monghyr district lead ore is met with in the stream beds of the Kharakpur hills near Gungta in the estate of the Maharajah of Durbhanga. This ore resembles *luskur* in appearance, the outer surface being carbonated, and evidently has its origin from a bed or vein of sulphide, which has not, however, been searched for and located. In the Central Provinces lead ores have been found in the Sambalpur and Raipur districts. Galena occurs, and has been mined, in Ajmere, Alwar, and Udaipur. Lead mines and works were started many years ago near Subathu in the Simla district, and mines have for long been worked by natives in Sirmur.

Lead mining is at present practically in a dormant condition. Some years ago a European gentleman entered into agreement with the proprietor of the Lachmipur estates in the Banka sub-division of the Bhagalpur district of Bengal, and commenced mining operations, but very soon gave up the work.

The very extensive occurrence of Magnesite in the Chald hills close to Salem in the Madras Presidency, as yet undeveloped, is alone noteworthy. Veins of this mineral are met with in Arakan and Manipur, also traces near Mussoorie.

Manganese deposits exist along the East Coast Railway in the Vizianagram estate, Vizagapatam district, and are found in large quantities in the Chipurapalle taluk of that estate. They are chiefly found in "pockets," close to the surface and are reported to be of good quality. His Highness the Maharaja of Vizianagram has commenced to work them, and some experimental shipments are reported to have lately been made to England. Manganese ores are found also in the trap rock in Belgaum, Dharwar, and Ratnagiri districts of the Bombay Presidency. The most famous and likely locality for development is Gosalpur in the Jabalpur district of the Central Provinces.

It is commercially called talc, though mica and talc are different minerals; the first being

(x) Mica. elastic and cleavable into sheets, while the latter is flexible and seldom in sheets or scales. The main region of mica production is in the Hazaribagh district of Bengal. It is also found in the Gya, Monghyr, and Bhagalpur districts of the same province; but only two mines, *vis.*, Sapahi and Singar in the Gya district, are now at work. Mica also occurs in the Nellore and Coimbatore districts of the Madras Presidency, but the mines in the latter district are not worked as the industry is not remunerative. The mines in the Nellore district have been favourably reported on by Dr. Warth. It is found in the Shabbabunda taluk of the Karachi district of Sind, in the Kishengarh state of Rajputana, and near Jambagaun, 20 miles west of Chota Udaipur in Rewakantha. The Kishengarh mica is, it is said, not very pure, nor is it found in pieces large enough for trade. The Hyderabad mines have been considerably worked by the Hyderabad (Deccan) Company, and the variety of mica chiefly met with is biolite, and is generally largely impregnated with iron and of inferior commercial value.

Statistics of production are not available except for Bengal, where 120 tons, valued at Rs. 98,154, were turned out in 1892. The quantity of mica exported by sea during the year 1892-93 is 3,329 cwt., valued at Rs. 4,34,348, and the value of the average annual exports for the past five years amounted to Rs. 4,82,522.

The method of working is not the same in all the mica producing districts of Bengal. In Gya the mines are worked by manual labour and blasting, while in Monghyr quarries are formed by means of iron bars and other instruments, and sometimes rocks are blasted by dynamite, and strata of mica are taken out, and where the surface shows indication of mica pits are made. In Hazaribagh the mines are being worked in the native fashion by making pits, and no machinery or other apparatus are used.

The industry is not in a flourishing condition in Bengal.

The localities where plumbago has perhaps been found most abundantly in India are in the Madras Presidency, especially in Travancore, where the mineral is of better quality than elsewhere, although still inferior to that worked in Ceylon. Poorer graphite occurs in the Vizagapatam district. In Bengal it is found at Kakwara in south Bhagalpur, and is said to occur in the Banka subdivision of the same district. The search made at Kakwara to find larger deposits has not been successful. Masses of several pounds weight, much mixed with earthy matters, have been met with in places wide apart, but no vein or shoot of any extent has been met with. Plumbago has been found to occur in a considerable bed at a place called Mulkanoor in Hyderabad.

Or steatite, or even massive talc. Potstone is the common coarse variety. The finer form of rock, for which there is a demand in England, is not so commonly distributed: the best occurs near Betum-berla in the Kurnool district of the Madras Presidency. Following this, come other Madras localities in the Anantapur, Bellary, Cuddapah, Salem, Malabar, Nellore, and South Kanara districts, but there is no industry in Anantapur and Kurnool, the localities being included in a forest reserve and in fuel and fodder reserves respectively. The stone has been worked for several years past under forest permits in Sydapuram village of the Nellore district, where the yield is said to be inexhaustible, and forms the only source of living to a large number of families in the village. Some speculators applied for mining under the lease system; but, in consideration of the stone affording living to the villagers, the permit system is kept in force. Vessels made of this stone are exported to many places. The trade in Bellary has not been flourishing as there is not much demand for the articles. The stone in Malabar is said to be very grifty. Soapstone is found in the Dharwar, Belgaum, Kolhapur, Ratnagiri, and Kanara districts of the Bombay Presidency and in the Jhansi district of the North-Western Provinces. The marble rocks in the Jabalpur district and Kanheri in the Bhandara district of the Central Provinces give capital stone. The next best places are in the Jaipur State of Rajputana. There are mines in the Prome, Pakokku, Katha, Bhamo, Kyaukpyu, and Minbu districts of Burma. On the hills round Prome it lies about a foot and a half below the surface. The Minbu quarries and those in Kyaukpyu district are all in a group on the borders of Arakan and Upper Burma, and a partition of them is about to be made. They have hitherto been worked from the Upper Burma side. The steatite occurs in veins of from 6 inches to a foot thick. In Bhamo district soapstone occurs to the north and north-east of the jade and amber mines and in another distant locality far up the Irrawaddy. Several of the Minbu quarries are annually leased to Burmans, the leases being disposed of by auction. In some cases besides a lump sum down, a royalty on the outturn varying from 10 to 20 per cent. is reserved to Government. The stone is also found in the Manbhum district of Bengal and in the Hyderabad and Mysore States. The estimated outturn in Pakokku and Minbu in 1891 was 585 cwt., valued at Rs. 18,700, and that in Manbhum 1,054 cwt., valued at Rs. 2,250. The production at Minbu in 1892 was 62½ tons, valued at Rs. 31,250.

These are only known as yet to occur in any very promising quantity in the Maliwun sub-division of the Mergui district of Lower Burma, where the mines form a portion of the great stanniferous belt

(xiii) Tin ores.

stretching along the granitic backbone of the Malay peninsula with scarcely an interruption. In the Mergui district they stretch continuously from the Siamese frontier along the whole sea-board to at least the latitude of Tavoy, beyond which the great granitic axials disappear below the greater overlying deposits of more recent stratified rocks sweeping southward. The interior is but little known; and it seems that the heaviest out-crops of the granite with which the tin is associated are the more plentiful towards the coast. Judging, however, from the fact that heavy tin is worked on a commercial scale at Thibawleik in the Tenasserim valley, and that tin is found in the Siamese States of Bantaphan, of Chomphon and Faungswan, along the Gulf of Siam, it is hoped that the main watershed may be found to throw off spurs of stanniferous granite at least as valuable as the out-crops in the secondary axials along the coast. In the Maliwun sub-division there are four main centres at which tin is worked, though these form practically the four earliest points of attack along a practically continuous stanniferous belt running for 200 miles north and south with a mean width of perhaps 20 miles. The main points give their names to the four principal fields:—

- | | | |
|---------------------------|--|-----------------------------|
| (1) Maliwun. | \| | (3) Bôkpyin. |
| (2) Karathuani, Banhuani. | \| | (4) Migyaungchaung, Yaygon. |

In these and all fields the tin occurs in more or less imperfect fissure lodes, frequently shattered and distorted by more recent movements, which (as at Maliwun and Renaung) are not uneldom accompanied by silicious hot springs, probably rising on lines of fault through which the tin has risen from below, occasionally permeating the metamorphic rock through which the granite has been upheaved. The lodes, except Khowmaung near Maliwun, where a few Chinese have been for some time picking at the out-crop with crow-bars, are not worked commercially; specimens of heavy tin ores received from Hangpôn, Bôkpyin, Sadein, and Thibawleik prove these lodes to be widely distributed. The alluvial tin has been derived from these lodes by the gradual denudation of the hills containing them and is now deposited in the form of a more or less coarse sand mingling with the gravels and other alluvial deposits in the river valleys and gentle slopes at the foot of the granitic hills.

In these the working is carried out by a simple process of alluvial working, ranging from the rude methods of the "Tampan" (hill, a Chinese word) worker, who contents himself with "fossicking" in the narrow hill valleys to the larger open mines on the plains, where immense gravel pits are opened, and the Karang (or pay dirt) is raised from depths of sometimes as much as 30 feet. This Karang contains the tin oxide, which is separated from it by working. The ore is then smelted with charcoal in a small open blast furnace of the pattern known as the Pon-kah furnace. The total present output for the sub-division is about 70 tons of metallic tin per annum.

The industry, which has been for many years in a depressed, neglected, and utterly miserable condition, is reviving. It is very hard to say how many persons are actually employed in it as the bulk of the extra hands employed in the rains are as much fishermen or agriculturists as miners or persons actually deriving their main subsistence from mining pure and simple. The number of miners solely employed as such is, however, rapidly and satisfactorily increasing. A great stimulus has been given to the tin industry by the grant of a lease to Captain Menzell of Singapore. The lease was granted in March 1898 and conveyed to Captain Menzell the exclusive right for five years of mining for tin in the Maliwun township, except in areas occupied by native miners. On the expiry of this period a lease for 20 years will be granted to Captain Menzell if he has worked his five years concession in a satisfactory manner. Captain Menzell has begun operations by importing a number of Chinese miners from the Straits Settlements and he hopes to increase the number of miners and develop his concession rapidly. The exports of tin from Mergui in 1891 were returned as 1,008 cwt. valued at Rs. 51,220 and in 1892 as 1,368 cwt. valued at Rs. 75,019.

Mineral paint of a slaty colour is found in a vein technically termed a "Fault" commencing from the Northern extremity of the Kishengarh hill in Rajputana and extending, at least so far as has been hitherto ascertained, for several miles in the north-easterly direction. It has been found to be a good substance for painting wagons, iron work, iron bridges, &c., and the sides of ships. As it has been found by an analysis in the Geological Survey Department of the Government of India to contain very little iron, and the iron being in the state of peroxide, there is no further room, it is stated, left for oxidization or rusting. Samples have been sent out to various places both in England and India, but no market has been created for it. It has, however, been approved by the Rajputana-Malwa railway, for whom a small paint manufacturing machine has also been erected at their workshops for making paint of the mineral.

IV.—QUARRY STONES.

Brick, fire, and pottery clays are pretty generally distributed. The most valuable pottery clays occur in Jabalpur. Clay of a very fine character is

(1) Clays. found in Raniganj, Bengal, where a European firm has a pottery. The following places in the North-Western Provinces and Oudh are particularly noted for their fine clay suited for pottery:—Aligarh, Muttra, Amroha in Moradabad, Chunar, Azamgarh, Lucknow, and Rampur state. There are several factories in the Madras

Presidency, almost all belonging to Europeans, for manufacturing bricks, tiles, cements, &c. Near Rajahmundry in the Godavari district *kaolin* is reported to exist, of which goglets, some of superior type, are made, but not on a large scale. A small consignment of this clay has, it is said, been exported to England for experimental purposes. Pottery clay also occurs in Mercara in Coorg, where tiles and bricks are manufactured by the Mercara Pottery, which belongs to a European. A pottery has lately been started by European company in the Jhelum district of the Punjab.

Statistics of outturn during 1892 are available for the following provinces only:—

							Tons.
Madras	...	...	...	...	...	...	128,700
Bengal	...	...	...	...	...	...	393,500
Punjab	...	...	...	...	...	...	3,800
Burma	...	...	...	...	...	...	78,000
Coorg	...	...	...	...	...	...	450
Rajputana	...	...	...	...	...	...	3,400
Central India	...	...	...	...	...	...	250
Ajmere	...	...	...	...	...	...	27,900
Mysore	...	...	...	...	...	...	237,100

It is a general term for massive crystalline rocks like granite, gneiss, &c., and occurs chiefly in Western Bengal, in the Madras Presidency, and in the Central Himalaya, but under its general definition it may be set down as of universal occurrence. Granite appears to be used exclusively for local purposes. It is less used than formerly, when it was a favourite stone for monolithic structures. The demand for this stone has increased in the Ganjam and Vizagapatam districts of the Madras Presidency since the East Coast Railway works were opened. The industry is said to be flourishing in Tinnevely and South Arcot.

(ii) Granite.

Statistics of production during 1892 have been supplied by the following provinces only:—

							Tons.
Madras	...	...	...	...	...	...	729,500
Bengal	...	...	...	...	...	...	152,100
North-Western Provinces and Oudh	...	...	...	...	...	...	4,400
Burma	...	...	...	...	...	...	300
Coorg	...	...	...	...	...	...	34,260
Mysore	...	...	...	...	...	...	132,900
Rajputana	...	...	...	...	...	...	28,900
Ajmere	...	...	...	...	...	...	33,800

In some places of Bengal granite is worked by quarrying, while in others rocks are broken with heavy iron bars and other implements. In Madras it is obtained by blasting or by the use of pick axes and crowbars or otherwise excavated.

The present state of the industry in Bengal is fair and flourishing in certain districts of Madras.

Laterite occupies an important position in the superficial geology of India, and is widely distributed throughout the Peninsula. It has been largely used in the canal works in Orissa as well as for metal-ling roads and building purposes in the neighbourhood of its formation. Extensive quarryings are reported to be made in the northern taluks of Ganjam and in Tinnevely, Madras. Laterite also occurs in the Hanthawaddy, Pegu, Tharrawaddy, Mandalay and Minbu districts of Burma where the quarries are worked chiefly for the Public Works Department.

(iii) Laterite.

The estimated production in 1892 is available for the following provinces only:—

							Tons.
Madras	...	...	...	...	...	...	1,523,500
Bengal	...	...	...	...	...	...	398,200
Burma	...	...	...	...	...	...	19,900
Coorg	...	...	...	...	...	...	1,000
Mysore	...	...	...	...	...	...	117,500
Rajputana States	...	...	...	...	...	...	58,900

Marble, kunkur, dolomite, serpentine, &c., can hardly be said to be absent from any of the formations in India, though in some they are either rare or so impure as not to deserve the title. These stones occur in almost all districts of the Madras Presidency and in the Manbhum, Singbhum, Lohardugga, and in several other districts of Bengal. In the Central Provinces, the Sambalpur, Raipur, Jabalpur, Nagpur, and Wardha districts are the chief places of produce. The best limestones from these provinces is probably that occurring in the northern part of the Jabalpur district. It also occurs in the Vindhyan range, in parts of Central India, and in several of the Native States in Rajputana, Makrana being the chief place of produce. There are some hundred quarries within a radius of about 8 miles of this locality. Of these only about fifteen are at present worked. Limestone in the nodular form known as *Kunkur* occurs

(iv) Limestone.

Almost all over the North-Western Provinces and is very largely used for making lime and metalling roads. Pure white marble is found in the Mirzapore district. It is found in parts of the Bombay Presidency, and Sindh. Jhalavad Prant and the south-west coast of Kathiawar abound in limestones admirably suited for building (the Porbunda micolite and the grey sandstone of Dhrangadra being the best known). It also occurs in Assam, Burma, Hyderabad, and Baroda.

Marble is used for subsidiary building purposes, and kunkur very largely for metalling.

The estimated production during 1892 was:—

	Tons.
Madras	87,200
Bengal	157,600
Burma	101,800
Assam	49,500
Mysore	29,500
Rajputana	270,700
Central India	87,100
Ajmere	12,600
Berar	300
Baroda	5,200

Information regarding the method of working is forthcoming only from Madras, Bengal, Assam, and Rajputana. In some places of the Madras Presidency it is collected from the surface, while at others it is dug out of earth. In Bengal some of the quarries are worked with pick-axes and blasting, while in others the stone is excavated by hand labour. In Assam the method is not uniform: some of the quarries are worked under leases issued by Government for various periods, and some under permits issued annually by Government. In some quarries the stone is detached by blasting with dynamite and gunpowder, and the boulders are then split and broken with native crow-bars and hammers; while in others no dynamite is used, the stone being workable without blasting. In Makrana (Rajputana), where the quarries vary in depth from 30 to 75 feet, and follow the lead of the vein, the marble is excavated by blasting, and then cut into the required size by means of steel saws. It is hauled to the surface on wooden rollers by manual labour, the chips and dust being burnt into chunam, and used for the finer kinds of plastering. The quality of the stone is generally better according to the depth it is worked, but, owing to the rude appliances used for hoisting it to the surface, it is impossible to work to any depth. The rates levied by the Marwar durbar are as follows:—

Rs. 1 per maund up to 10 maunds, and annas 4 per additional 2½ maunds.

Rs. 2 per maund on all articles such as cups, plates cut from the stone.

Rs. 2 per cart load on coloured marbles, which are inferior to the white stone.

The revenue derived from the quarries is credited to His Highness's privy purse. From statistics it would appear that the output is declining, which may be accounted for by bad seasons and the demand having lessened owing to the marble quarries opened on the Jaipur State. The railway which has just been opened through Makrana will, however, certainly give an impetus to further excavation, unless the opinion that the quarries are nearly worked out, as expressed by Mr. Foote, the Geological Superintendent of the Baroda State, is correct.

Slate occurs in the Cuddapah, Kistna and Kurnool districts of the Madras Presidency.

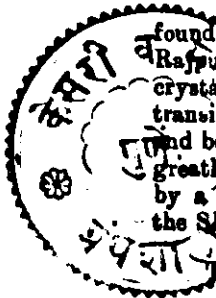
(v) Slate. Samples of slates are found near the villages of Mohari and Belgoa in the Saugor district of the Central Provinces in the vicinity of the Cawnpore road. In the Bagalkote taluka of Bijapur a hard glaz rock occurs which is prized as a building stone. Slate is also found in Jamalpur and Dhararah hills near Monghyr in Bengal, in the Simla and the Kangra districts of the Punjab, in the Jaipur, Ulwar, and Dholpur States of Rajputana, and in the Banda, Jhansi, Dera Dun, Kumaun and Garhwal districts of the North-Western Provinces.

The stone is used for buildings, flagging and other masonry structures, but not extensively, as it cannot be easily split into thin slabs.

The estimated production in 1890 was—

	Tons.
British Provinces	44,000
Native States	12,900

It includes quartzites. Several of the recognised formations in India, viz., the Vindhyan and Gondwana, cretaceous and tertiary, afford sandstones admirably suited for building, and some of them have from very early times been largely drawn upon for the supply of materials for this purpose. The Vindhyan formation stands pre-eminent, and its stones are used in the construction of the unbricked forts, palaces, and sacred edifices of Delhi, Agra, and Northern India. Sandstone is obtainable in the Ganjam, Vizagapatam, Godavari, Anantapur, Kistna, North Arcot, South Arcot, and Tinnevely districts of the Madras Presidency and in the Nimar, Chindwara, Jabalpur, and Saugor districts of the Central Provinces. Chunar in the Mirzapur district of the North-Western Provinces is particularly famous for its fine sandstone. Sandstone is



found in the Shahabad, Monghyr and Cuttuck districts of Bengal and in the several States of Rajputana, of which the Tonda hills in the Kishengarh State produce beautiful quartz crystals, but there is no trade in them. All the hills in Kishengarh belong to the transition series, and supply sandstone for building purpose. Very large and durable slabs and beams are found in certain quarries near the town of Kishengarh. These slabs are greatly valued for roofing purposes and there is a large trade in them. The quarries are worked by a class of Brahmans called Neharaj or mohobrahmans. Sandstone is also found in the Shwebo and Myingyan districts of Upper Burma and in the Hyderabad State.

The estimated production in 1892 was—

	Tons.
Madras	19,300
Bombay	78,900*
Bengal	60,000
North-Western Provinces and Oudh	200,000
Punjab	78,200*
Central Provinces	31,600*
Burma	34,000
Ajmere	30,700
Mysore	35,500*
Rajputana States	143,700
Central India	150
Baroda	2,900

* For 1890, later figures not being available.

It includes basalt and other massive compact crystalline black or dark coloured rocks and occurs chiefly in the Bombay Presidency, Western Bengal, and the Central Provinces, where samples of trap are found (vii) Trap. all over the Saugor and Mandla districts. It is also found in the Godavari, Kistna and Trichinopoly districts of the Madras Presidency and in the north and south-western parts of His Highness the Nizam's dominions.

Trap is used largely for metalling and building purposes.

The estimated production in 1890 was—

	Tons.
British Provinces	1,388,414
Native States	1,703

REVENUE AND AGRICULTURAL DEPARTMENT; }

Simla, the 6th November 1893.

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