

(1) Number of pages 12(2) Date of repair 6-7-40(3) Initials of the Referencer F

MADRAS RECORD OFFICE.

Government of Madras.

Revenue DEPARTMENT.G.O. No. 39Press
Mis.

Dated

6-8-1873.Not to be folded or roughly handled

Nos. 945—73 S.—R.

GOVERNMENT OF INDIA.
PUBLIC WORKS DEPARTMENT.
STATE RAILWAYS.

SIMLA, JULY 1, 1873.

Mr. Bauerman's Report on iron ores.

READ again:—

Public Works Department Resolution Nos. 348-9 B.—C. of 2nd August 1872.

Public Works Department Resolution Nos. 458-9 B.—C., dated the 2nd November 1872.

Read also:—

A Report dated the 12th April 1873 by Mr. Bauerman, on the result of his inspection of the iron ores found in the localities visited by him.

OBSERVATIONS.—Mr. Bauerman, before leaving India for England, where he will write a detailed report, has laid before the Government of India his general opinion formed upon the evidence which he has obtained in the field during his inspection of the iron ores in the different localities mentioned in the programme which had been prepared before his arrival in India.

2. The places which Mr. Bauerman has examined are—

1st.—Raneegunge coal-field. Clay iron ores.

2nd.—Karunpoora coal-field. Clay iron ores.

3rd.—Nerbudda Valley, north of Gurrawara. Brown iron ores.

4th.—Lohara, north-east of Chanda. Massive hematite.

5th.—Yenak, in Berar. Hematitic sand-stone and conglomerate.

6th.—Dechourie and Kaleedoongee, in Kumaon. Pisolitic hematite.

7th.—Ramgurh and Khyrna, in Kumaon. Specular and massive hematite.

All these places are rich in iron, and of the seven, it appears that Mr. Bauerman reports very favourably of three, viz., Raneegunge, or its vicinity, Lohara in the Central Provinces, and Dechourie in Kumaon.

3. The Governor General in Council, taking into consideration the proposed extension of railway enterprise in India, and the high price which English iron now commands, considers it of great importance that iron manufacture should, by some means, be established on a large scale in India. As it is, however, obviously impossible to settle any definite line of action at present, His Excellency in Council wishes to make enquiry, and to obtain detailed reports on the localities referred to, with full particulars on every point of interest connected with them which will be useful hereafter.

4. The more important points now requiring attention relate to the ownership of the land in which the iron ores are situated, the supply of fuel, and the analytical evidence as to the composition of the ores, fuel, and fluxes. It is hoped that the scientific part of the subject may be fully treated in Mr. Bauerman's complete report; but His Excellency in Council believes that much valuable information on these different coal-fields is at the command of the Geological Survey Department, and of the local Civil authorities.

5. The Government of Bengal will be especially desired, in communication with the Geological Survey Department, to institute enquiries as to what land, containing iron ore and suitable coal, is likely to be available, either as Government property or by purchase.

6. The Government of the North-Western Provinces will be requested to obtain a report from the Conservator of Forests on the supply of fuel available in the neighbourhood of Dechourie, for smelting purposes, as indicated in paragraph 14 of Mr. Bauerman's Report.

7. Information as to the proprietorship of the Lohara ores should be given in the Report for the Central Provinces.

ORDER.—Ordered, that copies of this Resolution and of the Report now

Bengal.
North-Western Provinces. | Punjab.
Hyderabad.
Central Provinces.

read, be forwarded to the Governments and Administrations marginally noted, for information, and with a request that detail-

ed reports on the points indicated in reference to the localities visited by Mr. Bauerman may be submitted for the information of the Government of India.

Madras.
Bombay.
Oudh.
Central India.
Rajpootana,
Mysore,
British Burmah.

Consulting Engineer, Calcutta.
Ditto, Lahore.
Ditto, Lucknow.
Chief Engineer, Punjab North-
ern (State) Railway.
Engineer-in-Chief, Indus Valley
(State) Railway.

Superintending Engineers, Agra and Delhi Districts, Raj-
pootana (State) Railway, Holkar, Neemuch, Northern Bengal,
West Rajpootana, and Agra to Gwalior State Railways.

Foreign Department,
Financial Department.

Home Department,
Military Department.

To the Governments, Administrations, and Officers marginally noted, for information.

And to the Department of Agriculture, Revenue, and Commerce, for information, and with a request that the necessary communication may be made to the Superintendent of the Geological Survey.

C. H. DICKENS, *Colonel, R. A.,*
Secy. to the Govt. of India.

GOVERNMENT OF INDIA.
PUBLIC WORKS DEPARTMENT.
STATE RAILWAYS.

To

Nos. 945—73 S.—R.

Dated SIMLA, July 1, 1873.

Received

*Forwards a preliminary report by Mr.
Bauerman on the result of his inspection
of the iron ores found in the localities
visited by him.*

Dated Bombay, the 12th April 1873.

From—H. BAUERMAN, Esq.,

To—The Secy. to the Govt. of India, P. W. Dept.

As I have now completed my inspection of the iron ores in the different localities laid down in the programme arranged on my arrival in India, I wish to communicate to you the general opinion that I have formed upon the evidence obtained in the field.

The places that I have seen are as follows :—

- 1.—Raneegunge coal-field.—Clay iron ores.
- 2.—Karunpoora coal-field, south of Hazareebagh.—Clay iron ores.
- 3.—Nerbudda Valley, north of Gurawara.—Brown iron ore.
- 4.—Lohara, north-east of Chandah.—Massive hematite.
- 5.—Yenak, in Berar.—Hematitic sand-stone and conglomerate.
- 6.—Dechourie and Kaleedoongee, in Kumaon.—Pisolithic hematite.
- 7.—Ramgurh and Khyrna, in Kumion.—Specular and massive hematite.

2. As regards richness and quantity of ore alone, the importance of these different deposits may be taken as follows :—

1st.—*Hematite of Chandah.*—There are two localities about five miles apart, known as Lohara. At the eastern one there is a mass of dense red hematite and magnetite more or less silicious, forming an isolated hill, which rises to about 120 feet above the level of the surrounding country. This mass would probably yield from 300,000 to 500,000 tons without going below the surface. The second or Western Lohara is similar in character, but smaller in extent. These ores are about 45 to 50 miles from Chandah, and would become of great value in the event of iron-making becoming general in India, as they would be used for fettling puddling furnaces and for mixing with the poorer ores of other districts. Whether they can be smelted upon the spot depends upon the nature of the coal obtainable from the Chandah-Berar coal-field, and upon this point there is at present no evidence upon which to found an opinion, as neither of the collieries in process of sinking at Piskaon and Wurrora have as yet reached the coal. From what I have heard of the character of the seam as developed by boring, I do not think that it is likely to prove serviceable for blast-furnace purposes, but no opinion of any positive value can be formed upon this point until the coal has been developed to some extent by actual mining.

3. The ore at Yenak consists of pebbles of red hematite in a red sand-stone matrix, forming regularly stratified beds. The most important of these is about 27 feet thick; the ore is scattered irregularly through the rock, and in places forms loose heaps of considerable extent on the ground where the sand-stone has been weathered at the surface. In depth the rock will probably become hard, so that it would require breaking by mechanical means to separate the stone from the ore; but as the series extends for about nine miles, probably a great deal of ore might be got by mere surface gleaning along the outcrop. The ore is similar to that of Lohara, but does not occur in such large masses; there is lime-stone close by, and the Berar coal-field is within a few miles. This may probably become a place of some value when the coal-field is further developed.

4. The iron ores of the Raneegunge coal-field resemble the clay iron-stones of the European coal measures, but are more concentrated, forming a middle series between the upper and lower coal-bearing rocks. Though not so

rich as the hematite of the Central Provinces, they are more accessible for working, and are found in conjunction with fuel that may probably be used for smelting purposes.

Much of this iron ore is used as ballast and road-metal on the Barrakur Branch Railway and the Grand Trunk Road; it can be raised very cheaply, and is by far the most promising material for any scheme of iron-making to be carried out at once, as the district is well supplied with roads and railways, and more coal is produced than can be sold in the present state of the market. The Karunpoora clay iron ores, which form the basis of Mr. Donaldson's scheme for iron-making at Hazarebagh, are much inferior in quality and quantity to those of Raneegunge, and cannot be considered to be of any practical value except for the native iron-workers, especially as the country is without roads, and nothing is known of the quality of the coal, which it was proposed to use for smelting; this part of the country is also very deficient in lime-stone.

5. The brown hematite of the Nerbudda Valley, which is found in lime-stone about 25 miles north of Gurravara, is, as regards quality, about the best of the Indian iron ores that I have seen. If good coal were to be discovered by the boring at Gurravara, that station would form a good site for an iron-work, producing small bar and sheet-iron, and similar high-classed products. The coal got at Mohpani is apart from its quality far too high-priced at present to be thought of for use in iron-making, the Nerbudda Coal and Iron Company asking Rs. 11 per ton taken at the pit's mouth, and at this rate I believe that the Great Indian Peninsula Railway Company can take the whole produce of the mine. The best native iron is made from the Nerbudda ore, and it is probable that the manufacture will continue to flourish in this district as the demand for native-made iron seems to continue, even in districts that can be supplied with English or Swedish bars. I think it would be advisable to avoid touching such localities in laying out large works, which should as much as possible be confined to ores not in use by the native iron-workers.

6. The Kumaon iron ores are brown and red hematites, which occur in irregular deposits in sands and clays at the foot of the hills at Dechourie and Kaleedoongee. They are very variable in quality, the best yielding from 40 to 50 per cent., while the worst are not much better than red-brick earth. As the color is about the same both in the good and bad samples, they are very deceptive in yield, as is proved to be the case by the working of the blast-furnaces at these places.

7. The other localities visited by me in Kumaon are Ramghur, where a slaty, specular, and micaceous ore occurs in mica schist, and Khyrna, where a dense red hematite is found in small veins in quartzite. The latter is of very little value as regards the possibility of obtaining a large supply of ore, and the former, though more abundant, is not likely to prove sufficiently large in quantity to justify the expenditure of the large sum of money that would be required in order to construct roads or tramways for conveying the ore to the works at the foot of the hills.

8. The Kumaon iron-works appear to have been planned originally under the belief that good rich and easily workable ore and flux, together with cheap fuel, were to be obtained in the immediate vicinity of the furnaces. The results of working have proved that only the last of these advantages really existed, and that was in great part neutralized by the enormous consumption of fuel, which could probably not be paralleled at any other furnace in the world.

9. Too much money has been spent upon secondary objects, such as machine shops and workmen's and managers' houses, in preference to limiting the expenditure to that necessary for the erection of good furnaces and iron-making plant. The works at Korpatal and Ramghur are quite worthless, and appear to be a pure waste of money. The furnaces at the lower works of

Dechourie and Kaleedoongee are of too small and antiquated a pattern ever to be worked economically. At the former place two new furnaces of a larger size and better model than the old ones were commenced during the last stage of the Company's active existence, but unfortunately they were never finished.

10. About 300 or 400 tons of pig-iron are still on hand at the lower works; the bulk of it appears to be of a fine grey verging upon mottled fracture, such as would be considered good forge pig-iron; as a foundry iron, it does not appear to have been very successful, judging from the castings about the yard. By the use of hot blast and larger furnaces, probably a better kind of foundry iron could be produced. Strangely enough, out of the enormous mass of printed papers relating to these works, I have been unable to find any information relating to the composition of the ores used, or the iron produced, except some extraordinary analyses* that seem to show the presence of arsenic in the ore in considerable quantity. If this be true, it is not likely to yield good bar-iron; but I should not be inclined to accept these analyses unless they had been verified by some competent chemist. It would be well, however, to test this point practically in England before going into large expenditure upon puddling furnaces and rolling mills. This could readily be done, as I am informed by the Agent of the Company that about a ton of the pig-iron has been sent home for the purpose of experiment.

11. The great deficiency of India in regard to iron-making is in furnace-building materials and lime-stone for fluxing. At Raneegunge fire-bricks that appear to be of a very good quality are made from mixtures of various clays brought from a distance, and consequently they are comparatively high in price. As to their fire-resisting qualities, I have heard very different opinions from the colliery engineers who have used them in their boiler flues, so that it will be necessary to have direct experimental evidence before pronouncing an opinion upon this point.

12. The locality that seems to me to offer the best prospects for the establishment of large iron-works in India is somewhere in the neighbourhood of the Barrakur Branch Railway, within reach of the Sanktoria coking coals, and the clay iron-stone banks which are exposed on the railway cutting and on the Grand Trunk Road. The coke made in this coal-field is moderately dense, but will probably be found to be very ashy and to contain a good deal of sulphur, both very prejudicial qualities for iron-making purposes, but still it is the best fuel that can be got in the country, and I believe that similar fuel is successfully used in some parts of Europe. I will institute enquiries upon this point as soon as I return to England.

13. With the exception of kunkur, there is no lime-stone to be got in the Raneegunge or Barrakur district nearer than the Soane Valley. This might, however, be brought down at a not unreasonable cost, upon the completion of the Soane Canal, supposing that the East Indian Railway would carry it at a moderate rate from Arrah. If kunkur were to be used, it could be obtained near the works, but whether the quantity required, from 10,000 to 15,000 tons a year, would be forthcoming seems doubtful. The only person from whom I have been able to obtain any information upon this point, Mr. Dejoux of the Public Works Department, tells me that he thinks there would be no difficulty in obtaining such a supply.

14. In conclusion I wish to impress upon the Indian Government the necessity of getting complete analytical evidence as to the composition of the ores, fuel, and fluxes proposed to be used before going into any projects for the erection of new works. The problem to be solved is not a simple one, as there appears to be no single locality in which all the requisites for the production of iron can be obtained to advantage on the spot. The Kumaon works seem to be the most favorably situated in this respect, but Mr. Ramsay, the late manager, has left on record his opinion that richer ores are necessary to make iron profitably, and that information is required as to the capacity of

the forests for yielding wood and charcoal for carrying on the works on a large scale without being destroyed. I think it is doubtful whether any process of clearing a given area per annum could be safely adopted, but rather that it would be necessary to select the timber over a large spread of ground, leaving a sufficiency of growing trees to protect the ground from being dried up. This, however, is matter for the Forest Department, which should be able to give the necessary information; but until such information is forthcoming I agree with Mr. Ramsay that it would be unsafe to start large forges and rolling mills in Kumaon. I should rather be inclined to reserve the forest for the production of high class pig-iron, leaving the conversion into malleable iron to be done with coal in the lower country.

15. Another point to which I wish to direct attention is that of railway rates. It is becoming a common practice in most iron-making countries in Europe, and especially in the United States of America, to carry iron ores and other materials for iron-making from very great distances to the smelting furnaces, and it would facilitate the production of iron in India if good ores could be carried to the coal in the same way. For this purpose, however, very much lower rates would be necessary than those now charged by the Railway Companies for the carriage of minerals.

16. I hope to be able to communicate a detailed report soon after my arrival in England. I have collected samples for examination by Dr. Percy, or such other chemist as may be selected for the purpose by the India Office, if it should be considered necessary to do so.

No. 468. Read the following Proceedings of the Government of India, Public Works Department, (State Railways,) dated Simla, 1st July 1873, Nos. 945-73 S.—R.:—

Mr. Bauerman's Report on Iron Ores.

Read again:—

Public Works Department Resolution, Nos. 348-9 B.—C., of 2nd August 1872

Public Works Department Resolution, Nos. 458-9 B.—C., dated the 2nd November 1872.

Read also:—

A Report, dated the 12th April 1873, by Mr. Bauerman, on the result of his inspection of the iron ores found in the localities visited by him.

OBSERVATIONS.—Mr Bauerman, before leaving India for England, where he will write a detailed report, has laid before the Government of India his general opinion formed upon the evidence which he has obtained in the field during his inspection of the iron ores in the different localities mentioned in the programme which had been prepared before his arrival in India.

2. The places which Mr. Bauerman has examined are—

1st.—Raneegunge coal-field. Clay iron ores.

2nd.—Karunpoora coal-field. Clay iron ores.

3rd.—Nerbudda Valley, north of Gurrawara. Brown iron ores.

4th.—Lohara, north-east of Charda. Massive hematite.

5th.—Yenak, in Berar. Hematitic sand-stone and conglomerate.

6th.—Dechourie and Kaleedoongee, in Kumaon. Pisolitic hematite.

7th.—Ramgurh and Khyrna, in Kumaon. Specular and massive hematite.

All these places are rich in iron, and of the seven, it appears that Mr. Bauerman reports very favourably of three, namely, Raneegunge, or its vicinity, Lohara in the Central Provinces, and Dechourie in Kumaon.

3. The Governor-General in Council, taking into consideration the proposed extension of railway enterprise in India, and the high price which English iron now commands, considers it of great importance that iron manufacture should, by some means, be established on a large scale in India. As it is, however, obviously impossible to settle any definite line of action at present, His Excellency in Council wishes to make inquiry, and to obtain detailed reports on the localities referred to, with full particulars on every point of interest connected with them which will be useful hereafter.

4. The more important points now requiring attention relate to the ownership of the land in which the iron ores are situated, the supply of fuel, and the analytical evidence as to the composition of the ores, fuel, and fluxes. It is hoped that the scientific part of the subject may be fully treated in Mr. Bauerman's complete report; but His Excellency in Council believes that much valuable information on these different coal-fields is at the command of the Geological Survey Department, and of the local civil authorities.

5. The Government of Bengal will be especially desired, in communication with the Geological Survey Department, to institute inquiries as to what land, containing iron ore and suitable coal, is likely to be available, either as Government property or by purchase.

22. 4. 1873
P 2348/73

Mr 39

Preliminary Report by MR. BAUERMAN
on the result of his inspection of the
iron ores found in the localities visited
by him,—dated 12th April 1873.

Exam in Mr 40.
6 Aug 1/73 Mr 39

*Proceedings of the Madras Government, Public Works Department,
29th July 1873.*

6. The Government of the North-Western Provinces will be requested to obtain a report from the Conservator of Forests on the supply of fuel available in the neighbourhood of Dechourie, for melting purposes, as indicated in paragraph 14 of Mr. Bauerman's Report.

7. Information as to the proprietorship of the Lohara ores should be given in the report for the Central Provinces.

ORDER.—Ordered, that copies of this Resolution, and of the Report now read, be forwarded to the Governments and Administrations, marginally noted, for information, and with a request that detailed reports on the points indicated in reference to the localities visited by Mr. Bauerman may be submitted for the information of the Government of India.

Bengal.
North-Western Provinces.
Central Provinces.

Punjab.
Hyderabad.

Madras.
Bombay.
Oudh.
Central India.
Rajpootana.
Mysore.
British Burmah.

Consulting Engineer Calcutta.
Do. Lahore.
Do. Lucknow.
Chief Engineer, Punjab North-
ern (State) Railway.
Engineer in Chief, Indus Valley
(State) Railway.

Superintending Engineers, Agra and Delhi Districts, Raj-
pootana (State) Railway, Holkar, Neemuch, Northern
Bengal, West Rajpootana, and Agra to Gwalior State
Railway.

Foreign Department.
Financial Department.

Home Department.
Military Department.

To the Governments, Administra-
tions, and Officers, marginally noted,
for information.

And to the Department of Agricul-
ture, Revenue, and Commerce, for
information, and with a request that
the necessary communication may be
made to the Superintendent of the
Geological Survey.

(Signed) C. H. DICKENS, Colonel, R.A.,
Secretary to the Government of India.

No. 469.

ORDER THEREON, 29th July 1873, No. 1,910.

RAILWAY, No. 55.

COMMUNICATED to the Consulting
Engineer for Railways and to the
Revenue Department, for information.

(True Extract.)

Walker Colonel, R.E.,
Secretary to Government.

To the Consulting Engineer for Railways.

„ Revenue Department. *with Report*

no 39
Copy to the Board
of Revenue

Exd. W. H. French.
20 Spare Copies.

will be supplied from the office
To B. M. M.
Copy 12/8
6 Aug 73

20 1000

Recd 1873 Sept
2348
Govt. of 1873 Madras.

PUBLIC WORKS.

To

THE CONSULTING ENGINEER FOR

RAILWAYS.

&c. &c. &c.

Dated July 29th.

Recd.

5 August 1873

Encl.

G. O., 29th July 1873, No. 1,910.

JULY.

Nos. 468-469

Iron ores.—Proceedings of the Government of India forwarding a preliminary report by Mr. Bauerman on the result of his inspections of the iron ores found in the localities visited by him, communicated to the Consulting Engineer for Railways and to the Revenue Department.

With Order
6 Aug 73 12 39