

EAST INDIA (COAL FIELDS).

RETURN to an Address of the Honourable The House of Commons,
dated 23 June 1862;—for,

A “COPY of Dr. *McClelland's* REPORT on the COAL FIELDS of *India.*”

India Office,
17 June 1863. }

W. T. THORNTON, Secretary,
Public Works Department.

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 COPY of Dr. *M. Clelland's* REPORT on the COAL FIELDS of *India*.

 INTRODUCTION to the REPORTS of the COMMITTEE for 1841.

It rarely happens that a single Coal basin presents a complete series of all the beds constituting the Coal Formation, much less the transition between that formation and either of those which naturally follow or precede it in the regular order of stratification.

Hence much of the difficulties in conducting geological inquiry: for instead of finding strata collected together in natural groups, we find them dispersed, so as to render the examination of large tracts of country necessary before the structure of any part of it can be well understood.

Although Coal has been formed in basins, we are not to expect it in valleys alone. Physical geography has undergone so many changes since the remote period when the formation of Coal took place, that its beds are now found in every variety of position, dislocated and broken by eruptions of trap-rocks and other causes of general disturbance.

The assemblage of rocks called the Coal formation are sandstone, slate-clay or shale, coal, and often, but not always, mountain limestone, which is also called carboniferous limestone. When we consider the manner in which these beds are transposed, an abstract description of them can be of little value; nevertheless, as we have little or no details regarding the structure and peculiarities of the Coal formations of India, we can do no more in a sketch of this kind than afford an outline derived from general information.

SANDSTONE OF THE COAL FORMATION.

This is a thin-bedded, distinctly stratified rock, very various in its texture, being composed either of large grains of quartz loosely aggregated; and at other times the rock is so persistent as to answer for millstones. The sandstones of the Scotch Coal formations near Glasgow and Edinburgh are used for building purposes, while those of Newcastle are too soft and friable to answer as a building stone. The grains of these sandstones are almost exclusively quartz, intermixed with plates of mica. Sometimes nodules of slate-clay and carbonate of iron occur in it, and in Scotland it contains occasionally fossil wood converted into Coal. It usually alternates with thin seams of coal and shale. At Cherra Ponji, the first stratum of grit which occurs above the Coal is about four feet in thickness and is perfectly friable, composed of large grains of quartz with very little mica. It is separated from that part of the Coal which was exposed in 1835 by a thin bed of shale. The beds of sandstones that occur below the Coal at Cherra are more numerous and important, and are composed of finer particles; but still they are loosely aggregated so as to constitute a soft somewhat friable rock, disposed in strata of various thickness from an inch to three or four feet, the seams or interstices between the strata being formed of thin plates of carbonaceous matter. Although this rock probably occurs in all the Indian Coal fields, the only specimens of it which we can venture to describe as characteristic are those received from Mr. James Pontet, in a Coal district situated on the Burmany river, near the village of Doobradgepore, about 60 miles west of Moorshedabad. In these specimens the sandstone alternates with layers of shale; these rocks pass into each other, and are often combined in the same specimens; and the whole alternate with layers of Coal. In Palamow, we are told that the six-foot Coal found on the banks of the Amanath is overlaid by a sandstone 40 feet in thickness; but we have no description of this rock so as to be enabled to know

whether it be really the sandstone of the Coal measures, or whether it may not belong to the new red, or overlying group; the character of the Coal would suggest the latter as most probable, and consequently that the most valuable Coal beds are below the six-feet bed, the only one exposed.

SLATE CLAY OR SHALE.

This is also a member of the Coal series, which assumes a great variety of form. It is usually a dull, black, soft rock, containing scales of mica, which give it a slaty structure. On the one hand slate-clay passes into Coal, and on the other, into sandstone. It also assumes a great variety of appearances in different Coal fields, according to which it receives peculiar local or provincial names from the miners. Its slaty fracture is not unfrequently produced from the abundance of fossil plants which it contains. Specimens of this rock, which we have seen from Burdwan and the Burmany Coal district already referred to, on the southern side of the Rajmehal hills, were peculiarly rich in fossil plants. The species in both instances were the same. The shale passes occasionally into clay ironstone; at least some specimens of shale, which we have received from Indian Coal districts, show a tendency both in weight and consistence to clay ironstone, which is an abundant rock in the Coal districts of Arracan, Burmany, Assam, and Palamow. All the Indian specimens we have seen of this ore are, however, of low specific gravity, not exceeding 3.3. We have never seen any specimen of clay ironstone from Burdwan, although we should suppose it exists there; but we know red and yellow ironstones to be very abundant in the Burdwan Coal district. In the Cherra Coal measures clay ironstone does not occur, and the iron of that district is manufactured from magnetic iron ore derived from washing the sands of decomposed gneiss rocks in the neighbourhood of Cherra.

COAL.

The beds of Coal in ordinary Coal formations are very numerous. In Northumberland there are 30 beds of Coal, 62 beds of sandstone, 20 beds of mountain limestone, and 128 beds of slate-clay. The lowest bed of sandstone is 228 feet in thickness, and the depth penetrated is 4,035.*

In the Edinburgh Coal field there are 337 beds, consisting of sandstone, limestone, coal, slate-clay, and shale. There are 80 beds of Coal, but most of them too thin for working; the beds of limestone amount to eight.†

The Bristol Coal field is 4,440 feet thick, and contains 36 beds of coal, mostly very thin, but the beds not exceeding three feet in thickness, are in that district worked with profit:‡ and at Radstock, near Bath, where the average thickness of seven beds is but 1 foot 7 inches, the mines are worked with great advantage.§

As none of the Indian Coal fields have yet been cut through, and none of them, with the exception of Burdwan, as yet properly opened, we have no information whatever before us as to the depth and extent of the beds of which they are composed. With the exception of the Cherra Ponji, all the Coal yet raised from Indian mines is crop, or superficial bed. The want of facilities for mining, the remoteness of the Coal districts, the difficulties of travelling, and, above all, the want of intelligence in all things connected with such operations, must long retard all those important interests which are connected with and dependant on the opening of mines in new districts.

LIMESTONE.

This rock is generally regarded as a member of the Coal series, and we believe is usually found to alternate with the other beds. When connected with the presence of Coal, this limestone is of a dark bituminous colour, containing blotches

* Thomson's *Outlines of Mineralogy and Geology*, I. 149.

† *Ibid.* l. c. ‡ *Ibid.* l. c.

§ Letter of Richard Boodle, Esq., 12th September 1840.

blotches of carbonaceous matter. Its fracture is generally conchoidal, and its structure compact. When accompanied with Coal, it is necessarily stratified, and alternates with shale, coal, and sandstone. At Cherra Ponji this limestone is situated beneath the coal, in a thick bed of about 20 feet deep; and from it we extracted, in 1835, 27 species of shells, such as those which are found to characterise the Coal measures in Britain, but none of the species have yet been identified. The whole are figured in the first Reports of the Committee,* plate 2. The specimens themselves have been deposited in the Geological Society's Museum, in London, where they may be compared with the fossils of the English Coal-beds.

A limestone containing similar fossils has been found in Assam, but whether in connection with the Coal formations of that province has not yet been ascertained.

We have no information as to the existence of limestone in the Coal-beds of Burdwan, Palamow, or Tenasserim; but as no description of these deposits has yet been communicated, we cannot say how far the series of beds composing them may be peculiar, or different from those of other coal formations. Although this limestone always enters into the series of Coal strata, yet it frequently extends to districts in which no coal exists, where it receives the name of mountain limestone.

The limestone in some cases is most developed at the lower portion of the Coal measures, where it rests on old red sandstone. Sometimes this position is occupied by millstone grit, and occasionally these rocks, one or both, are much more developed than the shale and coal, and form detached hilly tracts, unassociated with Coal. Thus the limestone, where it is in contact with Coal at Cherra Ponji, is altogether only about 10 or 20 feet in thickness; but a few miles to the west of the Coal, in the direction of Mosmye, it swells out into small rugged hills of from 200 to 400 feet in height, containing caverns. In like manner the limestone of the English Coal formation occurs extensively towards the north of the Penine chain, forming of itself a middle region of hills, under the name of mountain limestone, after it has quitted the great central Coal fields of England.

The limestone of the Coal measures accompanied with millstone grit is accurately described, but apparently mistaken for other rocks, by Captain Dangerfield,† Mr. Hardy,‡ and Major Franklin,§ in various parts of Malwa, Bundelcund, and Nerbudda, where Coal itself has recently been discovered in various situations, none of which have as yet been described.

TRAP DYKES.

These are masses of rocks supposed to be of igneous origin, projected from below upwards, dividing the generality of Coal fields in various directions, and occasioning what miners call troubles. These dykes are not peculiar to the Coal measures, although they are more remarkably developed in this than in any other formation. These dykes not only intersect the various beds of Coal, but displace the horizontal levels, so that on one side the beds are raised, and in the other they are lowered. This displacement may only be slight, or it may be to such a degree as to render it difficult again to discover the continuation of the bed. Beds of greenstone and basalt have been mentioned as occasionally occurring in Coal measures; but this very rarely happens, and when it does such beds are of partial extent, and may be referred to trap-dykes. Although dykes are attended with some inconveniences to miners, yet they have their advantages in rendering many beds of Coal accessible which would otherwise remain unknown. Dykes are also serviceable in cutting off the water, and thus rendering mines comparatively dry.

FOSSILS OF THE COAL MEASURES.

These are so numerous that a mere list of them would swell our sketch to an unreasonable extent. Those which are most common in the millstone grit are stems,

* Calcutta, 1838.

† Malcolm's Central India.

‡ Res. Asiatic Society.

§ Ibid.

stems, the outer surface of which is removed and converted into Coal, or carbonaceous dusty matter. It is in the shale, however, in which the most abundant remains of plants are found, while the shells chiefly occur in the limestone. The following examples of fossils may be said to be characteristic of the Coal formation:—Ferns of various kinds, in which there is merely the impressions of the leaves; these form above half the entire fossil flora of this period. As no fructification is observed, they are divided into groups merely, according to the form of the leaves, &c. Lepidodendrons, or plants having a thick compressed stem, with depressions of various forms on the surface. Some of these forms are supposed to have borne some relation to the present coniferous plants. The other tribes of Coal plants belonged to orders which are altogether extinct, as calamites, stigmara, sigillaria, &c. Of the shells it is only necessary to mention those resembling the muscle, which are often known to indicate the Coal measures, and are so abundant as to form what is called the muscle band in some of the English Coal fields.

It is not so much the number of species, as the number of individuals of some one kind of fossil, that affords the most valuable character of rocks. A due sense of the interest and importance of organic remains cannot therefore be readily conceived from books; for it is impossible in the description of a single species to impress the mind with the same idea of its importance as that which we derive from the inspection of countless numbers of the same object, multiplied so as to constitute a large proportion of the entire mass in which they are found.

We have hitherto considered the Coal formations as deposits in valleys or isolated basins, but from a general review of the different situations in which the mineral has been found in India, it will be seen that, whatever may have been the original level of these tracts at the time of the formation of Coal, nothing can be more diversified than their present aspect in this respect. The great number of dykes with which they are intersected, however, shows that they have, since the period of their original formation, been violently broken up by eruptions from below, as well as denuded by other causes of violence from without.

STRUCTURE OF BURDWAN COAL FIELD.

The Burdwan Coal district is, according to the description of Mr. Jones, situated in an undulating country composed of a slightly calcareous soil, resting on a sandstone seven feet thick, which caps the higher elevations. On the west, beyond Bankora, the district is bounded by hills of syenite. Towards the alluvial plains, the Coal rocks are, however, traced along the skirts of the hills to Beerbhoom and Rajmehal, and in a southerly direction to the Cuttack district. At Burdwan, Mr. Jones considers the breadth of the field about 11 or 12 miles. In a shaft 88 feet deep, Mr. Jones found 37 beds, of which eight were Coal, five sandstone, three soft clay, the remainder hard indurated shale and bituminous sandstone. The largest bed of Coal is nine feet in thickness, and about 40 feet from the surface.

In a northerly direction this Coal crosses the Singbhoom district, and extends along the south-eastern flanks of the Rajmehal hills, where Coal has been discovered at various points described in the reports and proceedings of the Coal Committee. An excavation was made to a depth of 40 feet in the Sultanabad district, on the banks of the Burmany, a small stream which falls into the Baugarutty at Moorshedabad, where the beds corresponded in every way with those of Burdwan. Still further in the same direction from Burdwan, Coal-beds have been discovered at Hurra and Sicrigully, at the north-eastern extremities of the Rajmehal hills. In the valleys on the opposite side of the same chain of hills the Coal fields of Palamow, Sohagepore, and other districts occur, connecting the Gangetic Coal fields with those of the Nerbudda.

SYLHET COAL FIELD.

Under this head may be included several unexplored indications of Coal in workable beds that have been discovered along the base of the Kasyah Mountains as well as the bed generally known as Cherra Ponji Coal. Here the Coal district, instead of being confined to the base of the mountains as in Burdwan, partly occupies

occupies broken summits of adjoining mountains at an elevation of 5,000 feet; while detached masses are found at various altitudes between these summits and the plains, thus showing that the whole has been subject to an eruption or upheavement which must have taken place soon after the close of the secondary or early part of the Tertiary Period; for the acclivities of the mountains, consisting of broken and dislocated beds of sandstone, are covered with the latest secondary and early tertiary marine remains. The only bed of Coal that has as yet been worked in the Sylhet field is one of the broken detached masses, forming the summit of a mountain at Cherra. The peculiarities of this formation have already been noticed. It remains merely to refer to plate 2 (first Reports of the Coal Committee), representing a few of the most characteristic fossils it contains. These are exclusively shells from the limestone situated beneath the only workable bed. The reason of the absence of Coal plants here is, that they are generally most abundant in the upper beds of the Coal formation, and particularly in the shale. The shale, as well as the whole upper portion of the series of Coal-beds, is here removed by denudation, and the lower bed of Coal alone remains, covered merely by a deposit of clay and loose sand.

ASSAM COAL FIELDS.

Regarding the extensive deposits of Coal in Assam, nothing whatever is known in a scientific point of view. All we know on the subject of their economical value will be found in the reports under that head. The most recent discovery of interest that has been made is that of Mr. Bedford, Revenue Surveyor, employed under Captain Jenkins, the Commissioner of the province, of a bed of Coal in the Caribari hills. No good specimen of this Coal has as yet reached Calcutta.

ARRACAN.

Extensive deposits of Coal have been found in Arracan, but, like those of Assam and Sylhet, we have no scientific information regarding them, nor is any more known regarding the Coal of Tenasserim province. For whatever of economical value that has been gleaned regarding these Coal districts, we must refer to the reports and proceedings of the Committee.

NERBUDDA.

With regard to the Coal fields in the Nerbudda, beyond the fact of the existence of Coal near Hoosungabad, as well as Jubbulpore, there is little or nothing known. The limestone alluded to in several communications from that quarter will probably prove to be that of the Coal formation. Descriptions of the fine compact limestone, and the sandstone slates at Jawud, west of Oodeypore, by Captain Dangerfield and Mr. Hardy, apply unquestionably to the limestone and the sandstone of the Coal formation.

Captain Dangerfield himself regarded the limestone as the equivalent of the English mountain limestone, and Mr. Hardy, for no very good reason, considered it to be lias, while the hard bituminous and micaceous sandstone, containing the impressions of ferns, associated with the limestone was considered by both authors as equivalent to the saliferous marls; but at the time of their inquiries, Coal-beds had not been discovered in this quarter, so that the authors may be excused for overlooking the real nature of these rocks.

Whenever the demand for Coal at Bombay may render renewed inquiries for its discovery in Western India desirable, researches should be commenced in the Nerbudda Coal Districts, and extended from thence to the westward, carefully tracing the "saliferous marls" and limestones of Dangerfield and Hardy from Malwa to the westward, having first established their true relative position to the beds of Coal in the Nerbudda.

OLD RED SANDSTONE.

In all parts of the world the Coal formation rests on deposits of great depth, consisting of sandstone and conglomerates, forming the old red system of Murchison; to this there are exceptions, which may always be explained by local peculiarities of certain districts.

The rocks comprised under this head have been hitherto regarded as forming a section of the Coal formation, but Mr. Murchison has pointed out the claims of these beds, both from their extent and organic contents, to rank as a distinct system of rocks, exhibiting the changes peculiar to a long period immediately anterior to the commencement of the Coal formation.

The depth of the sandstones underlying the Coal of the South Welsh Coal Basin is supposed by Mr. Murchison to be little less than 9,000 feet. In India there is an equal development of sandstones immediately below the Coal formation at Cherra Ponji, but in other Coal districts the old red sandstone sometimes consist merely of a few beds of conglomerate. These sandstones in India have not yet been investigated to that extent which the importance of the subject demands. It is only where they are found in contact with Coal formations that their real character can be well established until we are better informed as to the nature of their fossil contents in India. In Europe these consist almost exclusively of the remains of marine animals, chiefly fishes. Plants of any kind are rare, except in the upper strata, where the formation passes into the Coal measures. The great depth of the deposits, and their almost exclusively sedimentary character, afford evidence of these beds having been derived from other pre-existing rocks, and deposited again in the deep basins of seas, by causes similar to those which are now in progress. A formation of this nature will necessarily partake of the characters of the rocks from which it was derived, and differ essentially in its mineral characters in different places. Thus felspar and quartz derived from the gneiss of the great central masses of the Kasyah hills, enter largely into the sandstone forming the basis of the Coal formation at Cherra Ponji. Whether an investigation of the beds at Cherra would be attended with similar results to those deduced from their investigation in Europe by Mr. Murchison, is a question that remains to be proved. The following are the results of Mr. Murchison's observations:—

The old red sandstone consists of various strata of conglomerate, sandstone, marl, limestone, and tilestone, the newest beds of which dip conformably beneath the Coal formation, whilst the oldest repose upon and pass into certain grey coloured rocks, which form the upper part of the Silurian system.

Convinced that the old red sandstone is of greater magnitude than any of the overlying groups, Mr. Murchison applies to it the term of "system," which in geology now implies various groups or formations of strata, indicative of so many distinct periods.

The reason why the old red sandstone has not been regarded as a distinct system, Mr. Murchison thinks, is that in France and Germany its equivalents are ill, if at all developed. It has, however, been recognised in Poland and Silesia; while in Norway there are mountain ranges very similar in structure to the old red sandstone of the North of England, Scotland, and Ireland. There is a sandstone in India corresponding with the old red in England, occupying the same relative position to the Coal measures, and presenting the same lithological characters; but how far its zoological contents will be found to correspond with those of the English rock, is a subject that must be decided by the observations of geologists in India.

We have endeavoured in another place* to put the Indian student in possession of the principal details brought together by Mr. Murchison, in that part of the British Isles of all others best calculated to afford the true distinguishing peculiarities of the old red system as it occurs in the Western World.

Nor is Mr. Murchison's observations confined to this field; they are also extended to Shropshire, where a similar succession of the old red sandstone is displayed, as well as to Herefordshire, where the same rocks compose a great basin,

* Calcutta Journal Natural History.

basin, the lower strata of which are turned up on both flanks against Silurian rocks.

This ample field may be taken as the fairest example presented by the old red system in Europe; and Mr. Murchison's observations afford not only the latest, but the safest standard with which to compare the results of our observations on such rocks in India, as far as they appear to be representatives of the old red sandstone in Europe. Mr. Murchison divides the old red system into three divisions, as follows:—

1. Quartzose, conglomerate, and sandstone.
2. Cornstone and marl.
3. Tilestone.

“In the descriptions which follow, it will be seen,” says Mr. Murchison, “that the distinctions implied by these names are not absolutely peculiar to any one of the three divisions. Thus fossil beds occur, partially, both at the bottom of the first and in the middle of the second division, while conglomerates sometimes take the place of tilestone in the lowest strata.

“The conglomerate forms the uppermost beds of the old red sandstone on the southern face of the Carmarthen and Brecon Mountains, and consist of white quartzose pebbles in a red matrix.

“The stratum dips beneath the carboniferous limestone, where it often assumes a slightly calcareous quality in the cement, with pink and white nodules of quartz, from the size of mustard-seed to two or three inches, sometimes mixed up with grains of a green compact felspar; other and lower beds are, however, pure quartzose conglomerates.

“When fresh quarried, the conglomerate is sometimes of a pink or reddish colour, but after long exposure it frequently becomes nearly white, in which state it might be mistaken for the coarser beds of millstone grit, but it is separated from them by the carboniferous limestone. The conglomerate beds occupy a thickness of about 200 feet, and pass down into chocolate-brown and reddish coarse-grained sandstone, with blotches of red shale, and occasionally a very small pebble of quartz. Below, the conglomerate usually becomes finer, and passes into a pure sandstone of brownish and occasionally gosling green, and deep red colours; other beds are much spotted with green blotches on a dark red ground. Where roads are contiguous, this sandstone is quarried for troughs, cider presses, and building purposes, and some of the lower layers of this division are so fissile and fine-grained, as to allow of their being quarried for flagstones and grindstones. These rocks are distinguished from the next division of the system by the absence of calcareous beds.* In some of the ridges where the lower beds pass into cornstone and marl, thin layers filled with fragments of carbonised vegetable matter have been found, but never in so perfect a form as to resemble fossil plants. These appearances have induced ill-advised speculators to drive galleries into mountains of this rock in search of Coal.”

These sandstones assume a very ancient aspect. “We must not however,” says Mr. Murchison, “judge of the antiquity of rocks by their mineral aspect, nor even by their lithological structure; for, as I shall have occasion to show, there are many portions of the old red sandstone undistinguishable in these respects from the oldest grey wacke, whilst strata of the underlying Silurian system, formerly termed grey wacke, so far from assuming an air of high antiquity, in numberless cases, and over very large areas, resemble closely some of the younger secondary deposits.”

The uncertainty connected with the relative position of rocks in districts not regularly investigated, must expose all casual observations on the identity of structure in remote situations on the earth's surface to serious difficulties.

To compare one district, the peculiarities of which have been thoroughly investigated, with another, but partially known, in a remote part of the world, we have not only to be on our guard against various forms which the same rocks are liable to assume under different circumstances, but we have also to recollect, that

* Very rarely, Mr. Murchison remarks, where this upper division of the old red sandstone is much expanded, it occasionally contains thin courses of mottled, red and green, very impure limestone, not to be distinguished from some of the least calcareous beds of cornstone. In one of these beds Mr. Murchison discovered the scale of a large fish not yet described.

that the laws of geographical distribution of animals should prevent our expecting to find the same organic remains everywhere in the same rock.

In the first reports of the Coal Committee, we stated our reasons for regarding the beds of sandstone which form the basis of the Coal measures at Cherra Poonjee to be equivalent to the old red sandstone. The relative position of the beds in question to the Coal formation, as well as their lithological character as far as we are acquainted with them, are in favour of their belonging to the upper group of the old red sandstone, which formation, according to the observations of Mr. W. Jameson, not yet fully before the public, is largely developed in the north-western parts of India.

There is really nothing in the name that ought to deter us from using it to designate a formation agreeing, at least in all its main characters, with the English rock, and occupying the same relative position between the Coal measures on the one side, and the more ancient rocks on the other.

The second division of the old red sandstone, according to the observations of Mr. Murchison, is the

CENTRAL OR CORNSTONE FORMATION.

The central masses are chiefly composed of alternations of red and green argillaceous spotted marls, affording rich soil. These argillaceous beds sometimes alternate with sandstone, but more frequently with irregular courses of concretionary impure limestone, mottled also red and green. When compact, the calcareous beds are termed limestones by the quarrymen, but when mixed with sand and marl, giving them a brecciated or conglomerate aspect, they constitute the well-known cornstone of Herefordshire and the adjoining counties.

The strata consist of deep red shale, argillaceous sandstone, and hard quartzose, dingy, purple or brown sandstone, slightly micaceous, with intercalated calcareous beds of concretionary structure, varying in colour from red to green, and the concretions (in diameter from half an inch to three or four inches) disseminated through a mottled marl or impure limestone.*

These beds are from 8 to 30 feet deep; the impure concretionary limestone is of very irregular dimensions, contracting and expanding in thickness often in the most capricious manner. Its colour is green, blue, and red; its composition is often sufficiently pure to allow of its being burnt for lime; at other times these beds are only used for road making.

TILESTONE.

These beds constitute the lowest of the three divisions into which, according to Mr. Murchison's investigations, the old red sandstone is separated. Its upper beds pass into cornstone and marls, and the lower change into the Silurian rocks of this author, which it sometimes overlaps.

The distinguishing characters of the tilestone beds are thin, finely laminated, hard, red, purple, or green micaceous sandstones, which split into tiles. These beds are associated with reddish shale; the decomposition of the whole affords a red soil. The organic remains of this division are numerous, and consist of *Arca*, *Avicula*, *Belorophon*, *Cucullæa*, *Lingula*, *Orthoceros*, *Terebratula*, *Turbo*, *Turritella*, *Trachus*, *Tentaculites*, *Scalaris*.

The trap-dykes, which are so common in the Coal formation, are particularly rare in the old sandstone, a circumstance of much importance, and first, we believe, pointed out by Mr. Murchison, and which of itself goes far to establish this author's views regarding the independence of the two formations.

As the Coal formation is overlaid by one red sandstone, and underlaid by another, it is necessary that both these formations should be well understood and characterised in India, so as to know where inquiry for the discovery of Coal may be directed with the best chances of success, and also to appreciate correctly the value of indications of Coal when they have been discovered, and to determine whether such indications belong to the upper or the lower beds of the Coal formation. In the one case, valuable beds of Coal would be found on sinking mines into the subjacent strata; in the other such an operation would be a waste of time and money.

* These sandstones often expose on their surface blotches, prominences, and depressions of circular and partly-coloured forms; some spots being softer than others, on exposure, the rock displays a corroded appearance.

ASSAM.

CAPTAIN VETCH, in a letter to the Commissioner of Assam, dated 25th November 1837, mentions having found detached specimens of various kinds of Coal in the Jellundee, Belseeree, and Booroolee Rivers, that fall into the Bramaputra from the Bootan Mountains, between the 92d and 93d degrees of east longitude, at various distances from 14 to 20 miles from their confluence with the main river, and not far from the foot of the mountains.

The situations in which these specimens were found by Captain Vetch are marked by the letters A, B, C, on the annexed sketch-map of the Coal Districts in Assam.

The great number of more advantageous situations in which Coal has been found in Assam renders the question as to the quality and precise situations of the beds, respectively, from whence Captain Vetch's specimens were obtained a matter of secondary importance; but a proof so unquestionable of the existence of Coal at different points for an extent of at least 40 miles along the foot of the Bootan Mountains, connected with the fact of its having been discovered in a similar way, by the late Mr. Scott, on the banks of the Teesta River, at the foot of the Sikkim Mountains, three degrees less to the eastward, tends to encourage the hope of finding Coal in the lower ranges of the same chain, in some situation in which it may be available for useful purposes.

Regarding Captain Vetch's specimens, Captain Jenkins observes:—"These discoveries of Coal on the north bank of the Bramaputra, and over a tract of country 50 miles in length, appear to me to add greatly to the importance of previous discoveries of Coal on the south banks of the river; for I conceive it may be presumed that we have by no means obtained a knowledge of the full extent of the Coal beds in Assam, and that it is not improbable that they are co-extensive on both sides of the valley, and will be found nearly throughout its whole extent."

To understand the value of the other more useful discoveries of Coal that have been made in Assam, subsequently to the publication of the last Reports of the Committee, it is necessary to examine the value, in a practical point of view, of what has been previously made known on the subject.

Captain Henderson refers to six places at which Coal had been found, indicating the existence of an extended line of Coal districts from Gowhatty to Bramakund. However probable this may be, we have as yet done little to develop the fact, so as to render it practically useful; and in all inquiries of this kind, it is no less important to point out where information is defective than it is to bring forward successful results.

If we suppose an extensive series of Coal districts to exist in Assam, corresponding with the numbers marked on the sketch-map already adverted to, the more western beds, from their vicinity to Bengal, are entitled to our first consideration.

As to No. 6, however, the most western of all, and supposed to be situated on the Kopili River, within 60 miles of Gowhatty, we can find no information; so that the existence of Coal at this very desirable point rests merely on a specimen having been found in the sands of the stream by Mr. Hudson.

Of the next Coal, No. 5, we have a very clear and distinct account, as far as it goes, in a letter from Ensign Brodie to Captain Jenkins, dated 17th May 1837, which we can do no better than give at length. Ensign Brodie observes:—"With reference to your letter of 23d March, I have the honour to forward you a sketch from Mr. Hudson, showing the spots where Coal has been found within this division (Nowgong); they are three in number, but the only bed of Coal the site of which is known, is that on the Jumoona, a little above the falls. I went to this myself during the last cold weather, and raised about eight or ten maunds, specimens of which I sent to you at the time. What I got did not appear to be of a very fine quality, having apparently a good deal of earthy matter mixed with it; but it is more than probable that if the vein were worked further, excellent Coal would be found. The thickness of the strata is about 2½ feet. I laid the surface bare for some 10 or 12 yards, but how far the vein extends beyond this I am unable to say. I believe no difficulty would be found in working the Coal, if it ever should become an object of importance

Assam, 1838.

to do so. The population is certainly scanty, but then it is composed of a class of people (Mikeers and Kacharees) who can be taught, and will willingly put their hands to anything that will afford them a moderate remuneration for their labour.

“The bed is situated at the foot of a small hill on the east side of a little nullah, which runs from the north into the Jumoona, about half a mile or three quarters of a mile above the falls of the latter, the distance of the Coal from the Jumoona itself not being more than 80 or 100 yards. This river is at all times navigable to the falls by canoes, and two or three of these lashed together can take down a considerable cargo. The river is deep again above the falls, so that it is only for about 300 or 400 yards over these that porters would be required: a boat from Gowhatty would, on an average, reach the falls in 20 days, and return in 10; but this would vary with the season.

“Pieces of Coal of good quality have been picked up by myself in the bed of the Nambua, a small stream running into the Dhunseree from the west, but we have no information as to the position of the beds.”

The locality of these last fragments is marked No. 4 in the annexed sketch-map; and beyond the specimens picked up by Ensign Brodie, we have no further evidence of the existence of Coal at the place in question. Here, then, is the sum of all we know regarding Coal in Lower Assam, the particular part of the province in which, if found in sufficient quantity and of good quality, it would most favourably compete with the Coals of Bengal in the Calcutta market. It is desirable, therefore, that the indications of Coal in this quarter should be thoroughly investigated. Captain Jenkins, impressed with the importance of this, has made repeated efforts to have the district examined, and when the Scientific Mission was in Assam, he directed Dr. Wallich to detach one of the members of the mission for this purpose, which was accordingly done, and eight days were allowed for the duty; but this period being too short even to reach Lower Assam from the place at which the order was given, it is needless to say the investigation was not undertaken.

The next Coal noticed in the sketch-map, No. 3, is that which has been longest known, a large quantity of superior Coal having been raised from this bed by Mr. Bruce in 1828.*

† Probably canoes,
6 D.

It is situated on the Suffry, an impracticable tributary of the Disung, but at what distance from the latter does not appear in the account given of the place by Mr. Bruce, who lost several boats† in his attempt to reach the site of the Coal. There is a small range of hills which offers some impediment, but Mr. Bruce states that it might be overcome by widening the pass, and by the formation of a road for hackeries. Inferior Coals were observed by Mr. Bruce, crossing the bed of the stream in different situations, so that if these last beds should be found to afford good Coal, the difficulties would be considerably less in reaching it there than in the higher situation; but in so remote a part of Assam as this, perhaps no Coal would be worth working, unless it occurred under more favourable circumstances for transmission than characterise any of the Suffry beds.

The Namroop Coal, No. 2 in the annexed map, first observed by Lieutenant Bigge and Mr. Griffith, though, like the last, of excellent quality, and the Brumakund Coal, No. 1, found by Captain Wilcox, are probably beyond the reach of being profitably worked and introduced to the navigable part of the Bramaputra; so that of the six localities in which Coal had been found in Assam, at the time the preceding Reports of the Committee were written, one situation only (Suffry) was known from whence Coal might be obtained (and that with some difficulty) for local consumption in the province, at a cheaper rate than it could be supplied from Bengal.

Having thus stated what had been done up to the period at which our last Reports were published, we are the better prepared to show the value of what has since been done in Assam. Coal has been found by Captain Jenkins himself at Boorhath on the banks of the Disung, the main river to which the Suffry Coal had to be carried over so many difficulties. By this discovery, therefore, all these are at once obviated.

Another

* A sample of it was tried at the Mint, and found to be equal to Cherra Poonjee Coal.

Another Coal bed has been found by Captain Hannay near Jypoor, about 12 miles north-east of Boorhath and within three miles of the Boree Dihing, also an excellent river. Full details regarding each of these discoveries having been published in the proceedings of the Asiatic Society for February last,* it is unnecessary to enter into them here, further than concerns the extent of the beds and the quality of the Coal.

Assam, 1838.

* Journ. 1838, pp. 169 to 368.

At Boorhath, beds occur in two situations—first, close to the channel of the Disung, at the commencement of a rising ground about a mile from the village of Boorhath. This bed is described by Captain Jenkins as visible, for about 100 yards in length and eight feet in thickness, above the water and gravel of the stream.

The second bed is about a quarter of a mile distant from the Disung, at an elevation of about 50 or 60 feet, and exposed to the extent of 200 yards in length on the bank of a little watercourse. It was not visible in continuous masses, being concealed here and there by rubbish fallen from above; but it cropped out, says Captain Jenkins, at intervals, and always seemed to bear a thickness of several feet. The Coal in both these beds appeared to Captain Jenkins to be of first-rate quality, and nothing could well be more favourable than the position for working, nor for the transport of the Coal as far as the waters of the Disung admit; but this stream is barely navigable for laden canoes of small size in the dry weather, although in the rains it has a depth sufficient for large boats, and its stream is nowhere impetuous.

The situation of this Coal is about 50 miles from the confluence of the Disung with the Bramaputra, so that laden boats might descend during the rains with ease from the Coal beds to the great river in three days, and return in six. The point at which the Disung joins the Bramaputra is about 180 miles above Gowhatty.

The Jypoor beds are described in a letter from Captain Hannay to the Commissioner of Assam, under date 1st February 1838.† Captain Hannay states in this

† In a subsequent letter to Major White, dated 15th September last, Captain Hannay gives the following particulars regarding the manner in which the Coal occurs, and how he raised it: "The vein which I excavated is situated one-and-a-half mile in a south-easterly direction from Jypoor. It was close to the right bank of a small nullah, which winds its way into the plains and has its rise in the small hills which run along the foot of the Naga Mountains. The bank is not steep, and for a distance of from 300 to 400 yards it is tolerably straight, rising gradually from 80 to 100 feet in height from the spot where the vein is first visible; for a distance of 30 yards the direction is about 205°, when it turns to 190°, and is visible further than it has been excavated by me. Proceeding onwards, however, in a direction of about 160°, and at a distance of two furlongs, you pass over a bed of greyish coloured, soft, shaly sandstone, strongly impregnated with petroleum; and a little further on, there are several springs of this mineral oil issuing out from the description of sandstone above-mentioned, and in the open spaces the surface of the ground is covered with clay-shale and Coal, well trodden down by herds of deer and elephants. A little farther on in the same direction you come upon another rivulet, running west, and intersecting a vein of Coal which is probably a continuation of the one worked by me, and it is here visible in a mass of 11 feet in height and as many in breadth. My observations on this vein did not extend further than this, but on proceeding down the nullah, and also in the southerly direction about six furlongs distant, there are several veins of Coal trending in a direction of 335°, the line of dip being 280°, and at an angle of 45°, thus dipping directly into the centre of the hillocks. I could not work on what (in miner's phrase) is termed the face of the mine, without being at considerable expense in removing such a mass of upper soil, for which I had not a sufficient number of the requisite implements; and I was consequently obliged to work directly down upon the vein, and from this circumstance, added to the tender nature of some portion of the Coal, there was unavoidably a good deal of waste. The annexed sketch will perhaps show more distinctly the situation of the vein and its accompanying strata. The method I adopted in digging was as follows: Having cleared away the surface soil, I ascertained the exact stratification of the sandstone, and having dug in the direction of the partings to the depth of 16 inches or two feet, I cut with axes to the same depth across the vein, and the blocks thus turned out I raised by means of wedges, levers, &c. the best way I could. As might have been expected, I did not find the Coal of an equally good quality throughout, at least with regard to hardness and compactness of texture, that which was uppermost being much impregnated with ochery earth, whilst under this lay the hardest and finest specimens, the blocks breaking off large, and the fracture exhibiting that beautiful iridescence said to be common in Newcastle slaty Coal. Below the last-mentioned description, and as far as I dug down into the vein, which might have been about six feet, the Coal was of a softer nature, intermixed, however, with many lines of hard; thus exhibiting the variety of fracture found in Coal, the trapezoidal and rhomboidal mixed in the harder with cubical fragments, and the whole exhibiting what is called by miners "bright heads," having the white shaly concretions and rusty scale visible in every fracture. The structure of the whole vein is cubical, but the outer layer of Coal to the left is somewhat different from the rest, the texture of it being the same throughout, and its fracture being exactly similar to that of a slice of wood cut from the stem of a tree, and then broken in a contrary direction. It is not so thick as the other layers, and there is no intervening

Assam, 1888.

this letter, that since his arrival at Jypoor, he discovered several beds of workable Coal, and having been directed to forward a few hundred maunds to Calcutta for trial, had already commenced clearing a large vein about two miles distant. "As I wished to collect the Coal at as little expense as possible," Captain Hannay observes, "I selected the vein nearest to Jypoor; and before I came to this determination, I employed myself in exploring the neighbourhood, and have been very successful in finding Coal and iron in great plenty." As the sample, consisting of 224 maunds, has not been found of so good a quality as the Assam Coal that had been previously sent down to Calcutta from the Suffry beds, we have annexed in the preceding note the whole of the details given by Captain Hannay of his operations.

It would perhaps have been better, on such an occasion, if samples of different kinds had been transmitted, rather than a selection of that which, from its hardness, seemed to be the best; indeed, it may be doubted if hardness in Coal denotes a superiority, and if the circumstance noted by Captain Hannay, of the bed becoming somewhat softer the deeper the excavation was carried, be not a very favourable sign.

We are not, however, to expect that a first sample, from the outcrop we may say, of a single bed in a new and extensive Coalfield, should be of a first-rate quality. The only fault of the sample of this Coal selected by Captain Hannay is that it contains a considerable quantity of sulphur, which, from trials made at the Mint, appears to render it unfit for annealing silver, and that 40 maunds are only equivalent to 32 maunds of the variety of Burdwan Coal in use at the Mint at the time, for getting up steam. Captain Forbes is, however, of opinion, that this sample of Assam Coal would be found nearly as good as Burdwan, when burned in the comparatively small furnaces of the boilers of steam-vessels.

As far as the Assam Coals generally have been tried, their qualities have been found to be so good, that we may regard the small cargo transmitted to Calcutta by Captain Hannay, as chiefly valuable in showing the facility with which the article may be raised and transported. Captain Jenkins, in enclosing the bill of expenses incurred in raising and transmitting a boat-load of Jypoor Coal to Calcutta, observes:—"I need not point out to the Committee, that this attempt to work the Coal beds in the neighbourhood of Jypoor has been made under very unfavourable circumstances; the greater part of the last dry season had passed away before Captain Hannay was able to commence operations; indeed, the rains had commenced prior to any Coal being brought from the mine; but notwithstanding this drawback, Captain Hannay succeeded in raising 1,050 maunds of Coal, and conveying to the mouth of the Booree Dihing upwards of 800 maunds, the whole expense of which amounted to Rs. 96. 5. 6., so that the Coal has been brought down to the confluence of the Booree Dihing with the Bramaputra, at something less than two annas a maund."*

Boorhath and Jypoor, the places at which the Coal beds just noticed are situated,

Quality of Jypore
Coal, and opinion
of Captain Forbes.

Relative advantages of Boorhath
and Jypoor Coal
beds.

shale between it and the tough clay which lies upon it. This layer is also much impregnated with mineral tar, which has an aromatic odour, and in several of the masses of Coal belonging to it I found a rich, yellow-coloured, fine clay, having the appearance of orpiment. It will be observed by the accompanying sketch, that I had no hard or rocky substance to encounter, which is a great advantage both with regard to expense and facility in working. I only worked the Coal to the extent of 15 yards in the length of the space, and six feet in depth; and although I found a good deal of ponderous slaty substance, much impregnated with pyrites, on which pickaxes struck fire, still I did not come upon rock; and to all appearance the vein of Coal may extend many yards further down. The breadth of the vein, including the partings, is about nine feet, and the loss in digging must have been about one-third of the whole quantity excavated. On examining the beds of two watercourses which pass over the vein of Coal, and which come from the summit of the hillocks, I found several beds of sandstone of the description called by the miners whitepost; it is soft and easily broken, and was intermixed with large masses of iron ore and soft red sandstone; and there were also two small veins of Coal, which, although several feet higher than the larger vein, evidently appeared to belong to the same bed, having the same dip and bearing. In the beds of these watercourses, and also throughout this low hilly tract, there are found large pieces of petrified wood round pieces of white quartz, and worn fragments of mica slate, having quite the appearance of a salt-mine."

* In concluding this letter Captain Jenkins observes—"It gives me much pleasure to bring to the notice of Government, through the Committee, the zealous manner in which Captain Hannay, at considerable risk and trouble, has co-operated with me, not only in this instance, but in every other where an attempt has been made to develop the resources of the Eastern Districts of Assam."

situated, are laid down in the annexed sketch-map between No. 3 and No. 2; the advantages of the former beds over the latter in regard to situation may also be seen in this map, the Jypoor River joining the Bramaputra 18 miles higher in Assam than the river on which the Boorhath Coal would have to be carried. Besides, this Jypoor Coal is situated from 1½ to 3 miles from water-carriage, while boats may approach at Boorhath to the mines. Nevertheless, these differences are so slight, that a preference to one or other locality must depend on its comparative healthiness, on the quality of the Coal, and on the general capabilities of the place.

Of the healthiness of Assam generally, people now begin to form very favourable notions compared with Bengal. Boorhath and Jypoor are said to be situated in one of the finest quarters of the province. In the present state of things, perhaps, the Boorhath and Jypoor Coals are only to be regarded as the elements of local improvement; the intercourse between Upper Assam and other parts of India must assume a better footing, before its Coals could be supplied to Calcutta at a cheaper rate than Bengal Coals; but whether the former might not compete with the Burdwan Coal in the supply of the depôts on the Ganges, unless the present prices of the latter can be considerably reduced, and whether it would not be advisable, considering the local improvement to which such an arrangement would give rise, to adopt measures for supplying the Gangetic steamers from this quarter, even though no direct saving were at first to be expected—such a question it is not perhaps the business of the Committee to examine into, still it is one of so much importance, and so intimately connected with the practical results of its proceedings, that we may be pardoned for alluding to it in detail.

Advantage of obtaining Coal from the eastward for the supply of the Gangetic steamers.

The rates at which the following stations are supplied under the present contracts, which will expire on the 26th of July next, are as follows:—

	Rs.	a.	
Cutwa- - - - -	55	8	per 100 maunds.*
Berhampoor - - - -	56	-	" "
Kulna - - - - -	54	-	" "
Comercolly - - - -	64	-	" "
Surdah - - - - -	70	-	" "
Golgong - - - - -	70	-	" "
Rajmehal - - - - -	67	-	" "
Monghyr - - - - -	74	-	" "
Dinapoor - - - - -	80	-	" "

(Average, Rs. 67. 7. 6., or Rs. 654. 11. per 1,000 maunds.)

But as the Bhagirutty and Sundurbun courses are only used alternately by the regular steamers, the quantity of Coal consumed annually at the four first depôts, can only be equivalent to the quantity consumed at two of the others; the true average price of the Coal consumed will therefore be Rs. 67. 13. 2. per 100, or Rs. 678. 13. 9. per 1,000 maunds. Considering the proximity of the two first depôts, Cutwa and Berhampoor, to the Adji and Rajmehal Coals,† and the Kulna and

* Note by Captain Johnston.—These charges include the landing, storing, and delivering the Coal from the depôts to the steamers, and all loss by defalcation or other causes. The contractors are not paid for the quantity of Coal they despatch, but only for that which they deliver, free from dust and small Coal, on board the steam-vessels.

† Regarding the Adji Coals, Mr. Erskine observes in a letter, dated 6th November 1838, to the Coal Committee: "It would be impossible to say how much Coal might be got down to Cutwa during an average season, and it would be equally rash to give a tender for the supply of a stated quantity, or to depend on such a contract, till the navigation of the Adji has been put to the test of experiment." In another part of the same letter Mr. Erskine remarks that "Government could not depend on a larger supply than 10,000 maunds in one season, till the navigation of the Adji has been tried, and then states that, "If 40 rupees per 100 maunds could be offered for the Sheergurh" (which is the best Adji) "Coal, a much larger supply might be brought to Cutwa than that above-mentioned, by employing carts to bring down the Coal to the lower Adji ghats during the dry season, making the carriage from thence in boats less precarious." Mr. Erskine adds, that he should be happy himself to undertake the delivery of Coals at Cutwa for a year, by way of trial, should no one else offer to do it on more favourable terms. The Rajmehal Coal discovered by Mr. Pontet will, that gentleman thinks, cost at Berhampore about six annas per maund; but farther particulars require to be known regarding it, before any reliance can be placed on receiving supplies from this bed.

Assam, 1838.

and Comercolly depôts to Sylhet, the most economical arrangements that could be made for their supply would certainly be with persons connected with the mines in each of those districts, who might be requested either to furnish tenders, or to make such other arrangements, by way of experiment, as might seem most efficient for securing so small a supply as that required on the Bhagirutty and Sunderbun lines.*

This would leave the higher stations to be supplied on a separate contract from Burdwan, or any other source from which it might be done cheapest. The average charge for Coal at the five depôts from Surdah to Dinapoor is at present Rs. 72. 3. per 100, or Rs. 721. 14. per 1,000 maunds.

The entire consumption for the past year has been about 91,000 maunds on the whole line from Calcutta to Allahabad; but should the number of steamers be increased, the expenditure of Coal must also increase in the same proportion, and the supply would in such case become, in every sense, an object of more importance.

Boats of any draught would have a favourable current throughout the year from Disung Mookh on the Bramaputra to Surdah, with the exception, during the dry season, of about 80 miles from Jafirgunge to Surdah; they would thus be enabled to reach Surdah, one of the depôts for Coal, in about one month, say even six weeks, from the date of leaving the Disung River. Returning unladen for fresh cargoes, they would be about two months, thus making three trips in the year with the greatest ease, inclusive of the time required for taking in and discharging cargo.

The following are the rates at which boats are hired by the Commissariat for the conveyance of public stores, and though higher, perhaps, than those which merchants pay, may be taken as established charges, at which any extent of tonnage may be had. The boats required for this duty should each carry at least 1,000 maunds:—

Hire of boat, at 3 rupees per 100 maunds burden, per mensem †	Rs.	a.	p.
	30	—	—
1 Majee, at 5 rupees per mensem	5	—	—
15 Boatmen, at 4 rupees each	60	—	—
	95	—	—

Or, 1,140 rupees per annum, to which must be added insurance, which to Gowhatty is 3½ per cent.; and there is nothing in the navigation of the Bramaputra for 200 miles above Gowhatty, to increase the risk beyond that of an equal distance on the Ganges; insurance would therefore be, on three trips, Rs. 52. 8., which, added to the annual cost of the boat and men, gives Rs. 1,192. 8. To this sum must also be added the original cost of raising and conveying the Coal from the pits to the Bramaputra; this, according to Captain Henry's experiment, is two annas per maund, which for 3,000 maunds would be 375 rupees, making in all for 3,000 maunds of coal delivered on any part of the Ganges, from which three trips might be annually made to Assam, Rs. 1,537. 8., or Rs. 512. 8. per 10,000 maunds; being Rs. 209. 6. less than the rate at which the depôts from Surdah to Dinapoor are now supplied‡.

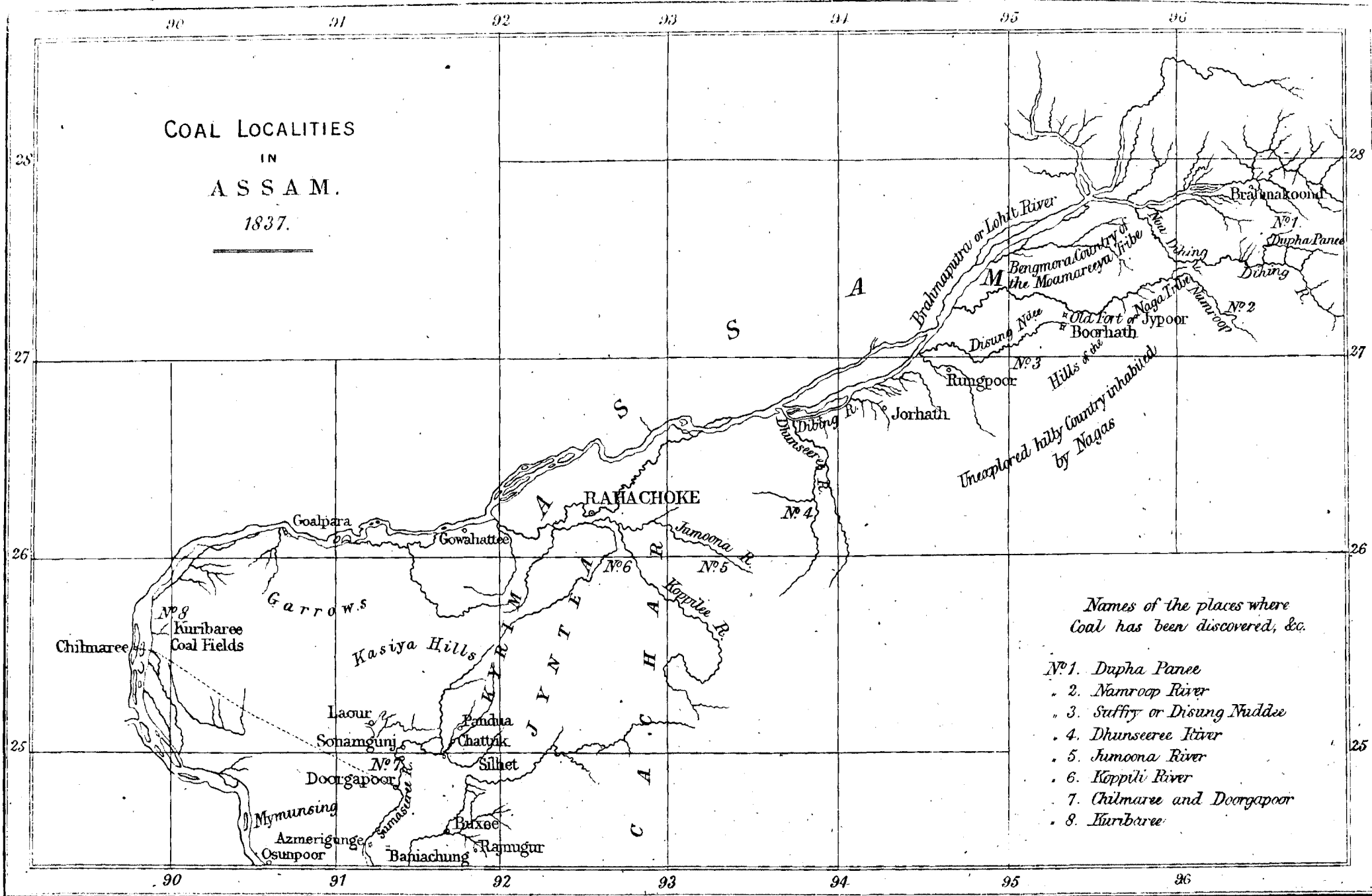
Perhaps

* Mr. George Loch, at the time Deputy Collector of Sylhet, calculated the expense of delivering 100,000 maunds of Cherra into boats at the foot of the hills at 24,800 rupees, or about 25 rupees per 100 maunds. To Cutwa, Berhampore, and Kulna, the boat-hire would be 7 rupees per 100 maunds, which would make the Coal cost about 32 rupees per 100 maunds at each of those depôts. (See Appendix 1.) The correctness of Mr. Loch's calculations has since been proved by the delivery of this Coal in considerable quantity by Major Lister.

† Note by Captain Johnston.—I believe this is for the measurement of the boat; a boat of 1,000 maunds will not carry more than 600 or 700 maunds weight.

‡ Major Henderson remarks, that the calculation here entered into does not provide for incidental expenses, including clashies' establishments, wastage, landing charges, custody, all which would somewhat

COAL LOCALITIES
IN
ASSAM.
1837.



- Names of the places where
Coal has been discovered, &c.*
- No. 1. Dupha Panee
 - " 2. Namroop River
 - " 3. Suffry or Disung Nudde
 - " 4. Dhunseeree River
 - " 5. Jumoona River
 - " 6. Keppili River
 - " 7. Chilmaree and Doorgapoor
 - " 8. Kuribaree

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RETURN - EAST INDIA (COAL FIELDS)

Perhaps the most important results from opening Coal-mines in Assam for the supply of Gangetic steamers, until more convenient sources should become better known than at present, would consist in the assurance of an unlimited and steady supply at all seasons; and the widening of the field for competition, while the attention of natives being directed to a new and promising branch of trade, the measure would contribute largely to the local improvement of the province. Lieutenant Brodie, Principal Assistant to the Commissioner, found Coal of good quality, about a year ago, in a favourable position on the Disung River, a specimen of which was forwarded to the Committee in July last, and found to afford,—

Specific gravity, 1.3.

Inflammable matter	-	-	-	-	-	-	40
Carbon	-	-	-	-	-	-	55
Earthy matter	-	-	-	-	-	-	5
							100

Recently, Mr. James Bedford, Revenue Surveyor, and other officers employed under Captain Jenkins, have discovered several situations in the Carribari Hills, in which Coal exists. For all the particulars as yet known regarding the Coal of this very desirable quarter, see proceedings of Committee, April and May 1841, and the proceedings generally for all that has been recently done for the development of the Coal resources of Assam.

somewhat increase the expense, though not very considerably: Captain Johnston therefore makes it out as follows:

	Rs.	a.	p.
Boat hire for 3,000 maunds of Coal, as per above statement	1,140	-	-
Cost of 3,000 maunds of Coal, at two annas per maund	375	-	-
Insurance at (3) three per cent.	45	-	-
Loss on Coal by two removals and 12 months' storing, 300 maunds;			
landing charge on 3,000 maunds	22	8	-
Re-loading and delivering 2,700 maunds at one rupee per 100 maunds	27	-	-
Sircar and peon's wages for 12 months, seven and five rupees	144	-	-
Ground rent and expense of shed, at six rupees per mensem	72	-	-
Total Cost of 2,700 maunds of Coal delivered to Steam-boat - Rs.	1,825	8	-

or 10 annas 9 pie per maund nearly.

Note by the Secretary.—The weight which boats may carry depends a good deal on rivers and seasons. In March and October it might be necessary to load boats lightly, but at other periods Coal boats from Assam might be laden, if necessary, to within six inches of the water, having such fine rivers to navigate; but if a 10,000-maund boat be too small, a 1,400-maund boat might be employed instead, with the same number of men, which would make a trifling difference in expense, but would give a great advantage in the results. Captain Johnston's calculation, which omits nothing that could be necessary, while other things are probably overrated, still leaves an advantage of 1 anna 3 pie per maund, in favour of the rate at which Assam Coal might be supplied to the stations, between Surdah and Dinapoor, compared with that now paid by the Government for Burdwan Coal for those stations.

The loss on Coal, by moving it from place to place, varies according to the nature of the Coal, and the number of removals; the latter cause would be at its minimum in the Assam Coal, as the same boat that would take it up in Assam could deliver it at the depôt for which it might be intended, and where it is not necessary it should remain a year in store. A sirdar and peon moreover would not be necessary for every 2,700 maunds of Coal, but for all at the depôt, which might be 20,000 maunds; the boatmen would be responsible for the Coal on board their own boat, and being measured out and into the boat, there would be no room for cheating. It is also too much to charge the entire expense of a shed to 2,700 maunds, when the same shed would answer for all the Coal required at the depôt. Both statements, however, show that the Jypoor and Boorhath Coals might be introduced to the higher stations on the Ganges with considerable advantage; and if free passage to emigrants were offered in the return boats, with the prospect of employment, the present paucity of labourers in Assam would, by the intercourse which would thus be formed between Assam and the more popular parts of India, be soon remedied.

ARRACAN.

Arracan, 1840.
Kyuk Phyu Coal.

COAL has been discovered at Kyuk Phyu, in the northern extremity of the island of Ramree, near Oogadong, close to the anchorage of ships. It was first observed by Lieutenant Foley in 1833, and afterwards described by that gentleman and Captain Margrave (vol. 11, "Asiatic Journal," p. 595); the quality of this Coal is good, but the quantity, as far as it has yet been discovered, is deficient. In consequence of the impenetrable nature of the vegetation, inquiries have been conducted in the neighbourhood to a very limited extent; but as the character of the Coal itself, and that of the adjoining rocks agree with the ordinary appearance of the best Coal-fields, favourable hopes may be entertained as to the extent and value of the indications in question; what has been supposed to be the same vein has been found in two distinct situations four miles apart.

Kingtelle or Sandoway Coal.

At Sandoway, in the same district, Lieutenant Mackintosh found Coal in the Kingtelle neighbourhood; one specimen of this Coal mixed up with siliceous matter is said by Mr. Walters to form the substance of the entire hill (*vide* "Journal Asiatic Society," vol. 11, p. 264); iron ores are also said to occur here in considerable quantity. This great number of indications of Coal at various points along this coast, and the little we knew regarding them once suggested to a member of our Committee, they were all referable to a cargo of Coal once shipwrecked at Arracan.

The more we know of Coal, the more we are impressed with the fact, that it never presents false indications of its presence. There is hardly an instance, either in India or elsewhere, of its appearing at all, that it does not do so under circumstances to render it in the highest degree important to society; and although at first the quality and extent of the beds in any new district may be for a time doubtful, yet experience teaches us, that where these indications do not improve in proportion to the intelligence and enterprise directed to their complete development, the mineral is not true Coal, but a substance, the peculiarity of which is easily detected, as the brown Coal of English geologists. The samples of Coal we received from different parts of the Arracan coast, were such as to leave no question whatever as to the beds from which they were taken belonging to the true Coal formation.

Ramree iron ore.

Coal has been found composing a part of Oogadong, a small island opposite to the harbour of Kyuk Phyu, in two situations, not very far from each other. The sample supplied was much impregnated with pyrites; it was, however, a caking Coal, belonging to the true Coal measures. It would be a desirable object to try how far the Oogadong Coal might answer for the reduction of Ramree iron ore, which is very abundant. Red Hill being said to be composed entirely of an ore which was formerly worked to some extent by the Burmese, a small quantity of ore and Coal might be sent to Calcutta for trial, and if the result proved satisfactory, trials on a larger scale might be repeated on the spot, where experiments of the kind must always be cheaper and more satisfactory than when made at a distance. Coal has also been found on Paget, or Adam's Island, south of the Great Island, of Ramree. It has also been found in small seams in one of the Bolonga Islands, as well as near the beach at Sandoway; but the necessary information is wanting to enable us to conclude anything from these indications, beyond the fact of the existence of Coal, to a great extent, in the Arracan Provinces.

Hoong Coal.

The most promising bed yet found is one that was brought to the notice of the Commissioner, Captain Bogle, by Lieutenant Lumsden, who states that it was found about two years ago by persons employed in Coal finding by Captain Williams. This Coal occurs at a place called Hoong, near the head of a river, which descends from a range of hills on the southern extremity of the island, falling into the Sandoway channel. Mr. Lumsden states that large boats may approach to the very spot where the Coal is found. On visiting the spot, Mr. Lumsden found "an irregular vein of Coal, of about a foot in thickness, mixed with broken red sandstone, and on working below it, he came to a kind of *clay slate*, and eventually to water." Mr. Lumsden, however, states, that he was obliged from fatigue to leave the work to a native, who in a few days brought to him 120 maunds of Coal—a larger quantity than we should have supposed a native could procure in so short a time, under circumstances described by Mr. Lumsden. A sample of this Coal, consisting of four or five maunds, was brought to Calcutta by Captain Bogle, and tried in the Laboratory of the Honourable Company's

pany's Dispensary, and found to burn with a clear bright flame and very little smoke. The following are the results of its analysis:— Arracan, 1840.

Specific gravity, 1·28	
Inflammable matter	40
Carbon	54
Ferruginous ash	6
	100

It is a free-burning Coal, giving out a strong heat, and would no doubt be found suitable to steam purposes, as it is quite free from the sulphureous impregnation which rendered the former samples of Arracan Coal objectionable. The want of more satisfactory information than we yet possess regarding Arracan Coal is much to be regretted, as there is no part of India in which good Coal mines could be attended with more advantage, whether we regard the situation on the coast, or the peculiar circumstances of the province itself. This district is chiefly known to Europeans by the mortality that took place there during the late war. Few are aware that within 20 miles of the town of Arracan, there is a fine elevated chain of mountains extending parallel to the coast, and affording no doubt as fine a climate as any part of the world, although the coast itself is low, and like many similar tracts in the North of Italy, and South of Europe, unhealthy. Let good Coal be once discovered in abundance in this fertile province, and the deadly effect of climate to persons exposed in miserable boats, or damp huts surrounded by swamps, will disappear, and the indolent streams become the track of steamers, perhaps to the very foot of the hills, which might thus become available as places of residence. Since the foregoing observations were written, Coal of an excellent quality has been found on Cap Island, opposite to the harbour of Kyuk Phyu, on the western coast; also on a small point of land Ramree Island, opposite to Cap Island. For both these discoveries the Committee is indebted to Colonel Hervey and to the kindness of Assistant Surgeon Hinton for communicating the particulars.

Cap Island Coal.

At Keang Dyeng, more to the southward on the western coast of Ramree Island, Coal has been discovered and a few bags forwarded to the Committee for trial, and proved to be the best Coal for steam purposes ever yet found in India. Keang Dyeng is only about four miles from the coast, and is situated near a creek navigable for boats of small size. The very excellent quality of this Coal renders it desirable that the extent of the beds and facilities for working them should be inquired into. This will now, perhaps be accomplished, since a miner, furnished with all the necessary implements, has been placed at the disposal of Captain Bogle, the commissioner.

Keang Dyeng Coal.

The Hoong Coal situated south of Ramree town, the capital of the island, has also been found to be of very excellent quality, and Captain Williams, the civil officer of this portion of the district, has found the Coal beds to appear in various situations, north and south of Hoong.

TENASSERIM PROVINCES.

THE annexed map will show at how many points Coal has been found in the Tenasserim Provinces, and at what points it is likely to prove of most utility. Coal has been found by Dr. Helfer at A and B, two situations above the falls of the Great Tenasserim, at a distance of eight and nine days' journey, respectively, from the town of that name; but the quality is inferior, and the situation quite beyond the reach of any mode of conveyance to the coast.

Tenasserim Provinces, 1840.

Although the quality is excellent in a third situation in which the mineral has been found by Dr. Helfer at C, yet its distance from the coast is such as to render it of very doubtful utility on the Bengal side of the peninsula. A still more recent discovery, by a native, places us in possession of what would seem to be a more promising Coal, close to the banks of the Great Tenasserim river, and within 29 miles of the town of Tenasserim.

Coal found on the Great Tenasserim.

Two reports have been addressed to the Commissioner of the Tenasserim Pro-

Tenasserim
Provinces, 1840.

vinces on the above-mentioned Coal, one by Lieutenant Hutchinson, dated 6th May 1839, and the other, of a somewhat later date, by Dr. Helfer. From Lieutenant Hutchinson's Report, we learn that the position of this Coal is $12^{\circ} 21' 30''$ N. lat., and about $99^{\circ} 5'$ E. long.; or, by the course of the river, 29 miles from the town of Tenasserim, and 65 from Mergui, although its direct distance from the coast is only 28 miles.

The Coal is said by Lieutenant Hutchinson to form a thick bed, covered by three feet of "clay slate," and from 20 to 40 feet of sand, which is so tenacious as to require no propping where springs do not exist. In a subsequent correspondence on this subject, the Coal is described as within 10 feet of the surface, and from all we can learn, we have no doubt it might be worked like crop-coal and clay ironstone, as described by Mr. Farey, *i.e.*, merely by sinking pits down to the Coal and raising it at once; and after undermining on all sides as much as can be done safely by the use of props, the latter may be withdrawn, and the roof allowed to fall in.

This Coal burns with a bright flame, and answers admirably for steam purposes; 50 pounds tried in the still furnace laboratory of the Honourable Company's Dispensary, afforded four gallons of distilled water, and left a residue of four pounds weight of ashes, cinders, and small coal that fell through the bars of the furnace during combustion. Its specific gravity is 1.27.

Composition.

Volatile matter and water -	-	-	-	-	-	-	-	55
Carbon -	-	-	-	-	-	-	-	40
Ash -	-	-	-	-	-	-	-	5
								100

It is to be regretted, however, that the bed seems to contain seams of shale, or that various thin beds of Coal, separated merely by thin beds of shale have been mistaken for one thick bed of Coal, and the mixture of Coal and shale both supplied together. It is necessary on such occasion to recollect that a Coal-field consists not of one, but a series of beds placed one above another; of these, some may consist of good, others of bad Coal, and that it is the best only that should be worked.

The distance of this Coal in a direct line from the coast being only 29 miles, Lieutenant Hutchinson proposed to construct a road, which he supposed would reduce the expense of delivery on the coast considerably. Boats of large draught, it is said, may ascend the Tenasserim river at all seasons to Tenasserim town, within 29 miles of the Coal, and during the rainy season to the Coal itself, so that nothing could be more favourable than the position of this Coal for all purposes of local improvement, as well as for steam navigation to eastward. Forty tons of this Coal cost $5\frac{1}{2}$ annas per maund at Mergui, and 8 annas per maund in Calcutta.

Coal on the Lenhea river. We have been informed by Captain Lloyd, *i.n.*, that about one degree lower down the coast, Coal has been found of very good quality, on the Lenhea river; but the Committee have no information on this head, although some progress had been made in raising a quantity when the work was discontinued, in consequence, probably, of the more favourable position of the Coal near Tenasserim. The Lenhea Coal is situated, Captain Lloyd thinks, about $11^{\circ} 22'$ N. lat. and $99^{\circ} 8'$ E. long., about 40 miles up the river, the navigation of which is doubtful. It is, however, the most southern point at which Coal has been hitherto found on the Malay coast.

Coal at Maulmain. A detached fragment of an inferior Coal, called anthracite by some, has been found near Maulmain, latitude $16^{\circ} 30'$ N., thus indicating the presence of Coal formations between the Tenasserim Coal-fields, 12° N. latitude, and Arracan 19° N. latitude, and holding out strong inducements to further search being instituted in that quarter.

And Tavoy. More recently, excellent specimens of Coal have been presented to the Committee by Mr. Blundell, the Commissioner of these provinces, as found somewhere on the Tavoy river. On this subject further information may shortly be expected.

BURDWAN AND ADJI COAL DISTRICT.

THE Burdwan Coal District is certainly next in importance to that of Sylhet, that part of it in which the collieries are situated is 140 miles N.W. of Calcutta, and is traversed by two rivers, the Damuda and the Adji; the first enters the Hoogley about 25 miles below Calcutta, and the second enters that branch of the Hoogley called Bhagirutty, about 70 miles above that city. The point at which the Damuda forms a junction with the Hoogley is 160 miles from the site of the Coal mines; whereas Cutwa, the town at which the Adji joins this river, is only 110 miles from the mines, while it is 70 miles nearer the great line of navigation on the Ganges, making a difference of 120 miles in favour of the Adji compared with the Damuda, as a line of conveyance to that part of the Ganges for the navigation of which the provision of Coal is now chiefly required to be made. As a drawback, however, from this very marked advantage, there would be a land carriage of ten miles across the country, from the present mines on the Damuda to the Adji; but as these rivers extend parallel to each other for the distance of 40 miles (according to Arrowsmith's map), the most favourable portion of this space might be selected for the construction of a railroad from the present mines on the Damuda to boats on the Adji.

Burdwan and Adji
Coal District,
1837.

The advantage of the Adji compared with the Damuda as a line of conveyance, has here only been considered with reference to Coal already worked; but the assistance which the Committee is receiving from the communications of Captain Forbes with Mr. Erskine, a gentleman residing on the spot, leaves scarcely a doubt as to the existence of good workable Coal close to the Adji itself; and in a letter received from Mr. E., dated 6th July 1837, four situations are pointed out in which good Coal may be raised, and delivered into boats at an expense of from $\frac{3}{4}$ to $\frac{1}{2}$ an anna per maund. He moreover announces the dispatch of 2,000 maunds which will be delivered at Cutwa, at the rate of 3 annas per maund, including all contingent charges.*

The first situation in which Mr. Erskine points out Coal, is Mammudpore, two coss south of the Adji Ghat, at Seedpore, land carriage per maund $\frac{3}{8}$ ths of an anna, but this Coal, as it appears on the surface of a ravine in which there is a stream of water, is somewhat heavy and hard. The quality may probably improve by pursuing the vein to a distance from the surface, or by sinking a shaft, better beds may be reached.

Mammudpore
Coal.

The second locality pointed out by Mr. Erskine, is a little to the west of the first, and $2\frac{1}{2}$ coss from the same ghat, carriage per maund $\frac{3}{4}$ of an anna, quality better than that of the first.

The third place, and that from which Mr. Erskine himself has been in the habit of taking Coal, is Pariharpore, a good deal west of the other situations, and only two coss, Mr. Erskine thinks, from the Damuda, and four coss in a south-westerly direction from Durbadanga, the nearest ghat on the Adji, which is one coss above Seedpore,—carriage $1\frac{1}{8}$ per maund. This is a lighter and more brittle Coal than either of the others, presenting a glistening and resinous lustre, and on exposure is inclined to crumble. Mr. Erskine is also kind enough to say, that he will take an early opportunity of visiting the several situations in which the above-mentioned Coals occur, and will afford the Committee farther information as to the nature and extent of the several beds.

Pariharpore Coal.

Mr. E. says that to the eastward of Mammudpore, all traces of Coal, or indeed any rocks, disappear, while on the contrary the quality of the mineral improves on advancing towards the west. Mr. Erskine adds, that the last time the late Mr. Jones visited Elambazar, he said that in his borings about Beerkoolthee, near the Seedpore and Durbadanga Ghats on the Adji, he had met with Coal even superior to that on the Damuda, and wished much to open a mine in that situation, in conjunction with the late Mr. D. Erskine.

Upon

* In a subsequent letter Mr. Erskine states that he had raised 4,000 maunds, and that the additional 2,000 maunds were also dispatched, but that he feared the expense would be four annas per maund, which is, however, only half the present contract price. For this important result the public are entirely indebted to Captain Forbes and Mr. Erskine.

The Coal thus delivered was at the time thought unfit for use on board steam vessels. Nevertheless, three years afterwards, when it became necessary to inquire what had become of the 4,000 maunds of Coal, it was found to have been all delivered to the steamers and used by *mistake* as Burdwan Coal. See Proc. Com. April 1841, para. 3.

Burdwan and Adji
Coal District,
1837.

Upon the whole, the Burdwan Coal-fields appear to be as yet very imperfectly known; from 1817, the date of Mr. Jones's last communication (published in the "Asiatic Researches," in 1829) until the present time, no communication has been made from this quarter except the interesting remarks of Mr. Erskine just quoted. Mr. Jones, about the same period, reported the discovery of the south-east basset of this Coal, about six miles from the place then established as a Colliery, so that he was induced to believe from this circumstance, that a basin of great extent, containing many beds of Coal, exists; Colonel Shelton has recently found a rich vein of Coal crossing the Benares road at Angballee, close to the 187th milestone, which rather tends to support Mr. Jones's conjecture. It is, however, the eastern and the northern limits of the Burdwan Coal district that ought to be traced with the utmost care, these being the directions in which Coal would be most desirable for purposes of navigation.

As this is a question of much importance, it is necessary to examine the opinions of Mr. Jones regarding it; we cannot attach much weight to an assertion contained in one of his earlier reports, viz., that he did not think it necessary to prosecute his inquiries beyond the point at which the Damuda becomes unnavigable, knowing that the whole country from Jenal to within five miles of Serampore, affords Coal. In proof of which he gave the following section as the result of repeated borings, but does not mention any one of the particular localities in which they were conducted. Common clay, six feet; loose sand, one foot; slate, seven feet, with four inch layers of sandstone, 12 inches apart, containing impressions of plants; Coal and slate, nine feet; black slate; two feet, bad Coal not cut, three feet, = 23 feet.

Still less can we coincide with the soundness of his reason for supposing the great line of navigation to be intersected by Coal beds somewhere about the situation of Cutwa, where he consequently thought Coal might be found merely because he supposed that direction to be indicated as the course of the strata in the mines of Ranygunge. The importance of the subject, however, and the extent of Mr. Jones's local knowledge, would justify a few borings being resorted to, at certain points between Hoogley and Rajmal.

It is to be regretted that the official authorities in Burdwan, and Mr. Jones's successors in the management of the mines in particular, should have profited so little as they appear to have done by his example, and that even occasional notices of the progress of the works he established, should since his time have been discontinued. The depth of the shafts, the direction of the galleries, and the nature of the beds through which they are excavated, would be information of the highest interest, and well calculated to bring into notice whoever might furnish such details. The practical reports of miners have at all times been received as the most valuable contributions to science, and are justly looked upon as the most estimable records of a class of facts which are second to none in importance.

The face of the country composing the Burdwan Coal Districts is described by Mr. Jones as undulating, presenting a difference of level between the heights and vallies of about 60 feet. The surface is composed of a yellow clay supporting a good soil, both slightly calcareous. The clay rests on a grey sandstone that effervesces in acids, and which is seven feet in thickness; in many places where its surface is exposed, a slight efflorescence of soda is found on it.

Beneath this rock an inferior quality of Coal, accompanied with shale, containing the impressions of plants, occurs bending over the low hills and descending deep beneath the surface of the vallies. Below these beds good Coals are found. Though wheeling in a slight degree, the bed of Coal carry their line of bearing to an amazing extent (says Mr. Jones) with little variation; their breadth in a south-west direction may be supposed to extend 11 or 12 miles towards Bancoora, where hornblende, sienite, and quartz, begin to appear. In a north-west direction the attendants on coal are traced for seven miles from the present works along the right bank of the Baracan river to a place called Rajkol, and in this course the Coal Measures are intersected by a large whindyke running in the direction of Bishenpur.*

The first bed of Coal is reached in the Ranygunge Colliery at a depth of 45 feet 3 inches, and is 1 foot 3 inches in thickness, and of inferior quality, succeeded by alternate layers of Coal and shale for a further depth of 3 feet 9 inches, including two thin layers of Coal. Two important beds then occur, the first 8 feet and

* Asiatic Res., 1829, p. 164.

and the other nine, separated from each other by a thin stratum of shale. The lowest of these, which is very good Coal, is separated by a thin layer of sandstone containing vegetable impressions,—from the sixth bed of which is only nine inches, a similar alternation introduces the seventh and lowest bed of good Coal, only three feet below which, 13 beds of sandstone and shale occur, containing vegetable impressions and including a thin bed of inferior Coal. At the depth of 88 feet 2 inches the excavation was terminated in a bed of grey-coloured hard sandstone.*

Burdwan and Adji
Coal District,
1837.

This description refers to the mines in 1815, scarcely more than a year after they were first opened, since which time nothing has been communicated on the subject, but it is probable the workings have been since carried on in the nine feet bed, 57 feet from the surface, and that no greater depth than 88 feet has been attained.

The whole district affords rich and valuable iron ores of various kinds, and Mr. Jones, after erecting temporary furnaces and forges at Sheargur, found by many experiments that immense quantities of iron can be made at little expense, but he recommends works of this kind to be conducted on a large scale by means of mills. Clay ironstone, red and brown ironstones of a poor description, as far as they have yet been tried, are common throughout this great Coal district.

Since our last report little has been elicited regarding the northern boundary of the Burdwan Coal-field, where the beds advance towards the Adji river. Mr. Erskine in reply to a circular from the Committee, dated October 1838, recapitulates the different places at which Coal has been found. Mammudpore is the most eastern situation. The pits are here four or five miles from Seedporeghat. The mineral is better to the westward at Pariharpore, about 10 or 12 miles above Seedpore. Seedpore is 18 miles from Cutwa or Culna on the Hoogley, and the river is pretty open during the rains for boats of 400 maunds burden from Mauly Ghat to Cutwa, a distance of 40 miles. The upper portion of the river rises and falls suddenly, so as to render it difficult to manage a larger boat than 200 maunds. Mr. Erskine observes, that considering the difficulty of the Adji navigation, and the scarcity of boats at present, and also the high price that it would be necessary to offer to boatmen to induce them at first to undertake the carriage of Coals; he does not think the Coal could be delivered at Cutwa under four annas per maund. Should the regularity of the employment induce people to build more boats (as has been the case on the Damuda) prices might fall to about three annas per maund. Adji Coals are now used for the Dhoba sugar works, to the extent of 10 or 15,000 maunds per annum.

1840.

Mr. Adji Coal.

Mr. Erskine has recently renewed his offers to supply Coal at Cutwa, but the price at which he would undertake the delivery of a limited quantity, not exceeding 10,000 maunds, is six annas per maund. (*Vide* Proceedings March 1841, para. 11.) The quality of the Coal Mr. E. proposes to supply at this rate appears to be good. In a memorandum dated 10th May 1841, Captain Johnston reports of Mr. Erskine's Coal that small sample sent for trial consisted of large blocks from 50 to 60 lbs. each kept up steam well.

1841. Adji Coal.

SYLHET COAL DISTRICT.

THE existence of Coal at Burdwan has been known as early as 1804, when it was observed by the officers of a regiment marching across the district. This discovery was communicated to the late Major General Hardwicke, and although the country was at the time depending for supplies of Coal on England and New Holland, no farther attention appears to have been directed to the subject until 1809, when the military board, having been called upon for information, appears to have reported unfavourably of the quality of the coal in question.

Sylhet Coal
District, 1837.

In 1813, when the inconvenience of depending on distant sources for an article of such increasing consumption began to be felt, Mr. Colebrooke directed the attention of Government to a discovery of Coal that has been made near Sylhet by Mr. Stark, but which coal was shortly afterwards also condemned by the officers

* See Asiatic Res., 1829, p. 167.

Sylhet Coal
District, 1837.

officers who were directed by the military board to report as to its quality. Mr. Jones was then dispatched by Government to examine the Burdwan Coal on the spot, and to report the best way of rendering it available to the public works in Calcutta, but the difficulties attending the navigation of the Damuda river near the source of which the Coal-field is situated, induced him to look with more confidence of success to the Sylhet Coal district which he was accordingly permitted to visit.

Mr. Jones reported from this quarter that Coal-tar, beads, and amulets, had been manufactured for centuries about the neighbourhood of Laour, from Coal found in the Kasya Mountains, but the impracticable nature of the country and the rude condition of the Kasya tribes, prevented his making any considerable progress in discovery; and it was not until after these mountains became subject to the protection of the British Government that an extensive bed of Coal, forming a large portion of a precipice, scarcely more than a mile from Cherra Pouji, was brought to public notice*

This Coal may at any time be delivered into boats at the foot of the mountains at four annas per maund, this being the regular rate of porter hire, and from the way in which the Coal occurs at Cherra, no expense is incurred in extracting it.†

If the demand for this Coal were sufficient, the expense of conveyance might be much lessened by carting it from the pit to the brow of the mountain, and for the remainder of the distance by employing either mules or bullocks, except at the more difficult passes, where men might be stationed to receive the loads; such improvements in the mode of conveyance would imply a certain outlay in forming better roads, but even without this, Mr. G. Loch has afforded a practical proof of its value by the delivery of 1,000 maunds of this Coal at Dinapoor, including all charge, and under every existing disadvantage, for 425 rupees, being 350 rupees less than the contract price for Burdwan Coal, an inferior article. It is possible, however, that contractors may not be found ready under the present limited demand, to supply this Coal at so great a reduction, and perhaps Mr. Loch's experiment will require to be repeated before the result can be considered as the scale at which the Cherra Coal may be made generally available on the Ganges. It is, however, to be observed that two-thirds of the expense incurred by Mr. Loch was for mere conveyance from Cherra to the foot of the mountains.

Indications of Coal
at the foot of the
Kasya Hills.

No attempts have been recently made to find workable beds of Coal nearer the foot of these mountains, although several highly favourable indications have been observed in various situations between the Patli river and Sylhet, both by Mr. Stark and Mr. Jones. Even the bed from which the first boat load of Coal sent from this quarter to Calcutta for trial, although situated near the foot of the mountains, and four feet in thickness, is now little known.

About two miles from the mouth of a small river which descends from the lower Tippera Hills, petroleum issues from a sandstone near the bed of the stream. Mr. Jones sank to the depth of four feet into the rock, when he found it become slaty, thus indicating he says, the presence of Coal, though it does not appear why he did not persevere in his excavation. He observes, however, that as the place is well known, others can, if necessary, prosecute the search.‡

In the Patli river Coal is plentifully found in rolled pieces, supposed to be derived from several sources—some of the streams which enter the Patli, from the Garrow Mountains, introduce abundant fragments; some of these are also supplied from sources much nearer.

The plains near Susung, and beyond Scripore or Cheripore, is a small rivulet, in which there is a nine-inch vein of Coal. On the top of what Mr. Jones called the second range of mountains in Laour, but which may rather be supposed to be little more than one of the higher ranges of hills at the base of the Kasya Mountains, the people who accompanied Messrs. Jones and Stark found a two-foot bed of

* "Journal of Asiatic Society," 1832, p. 252.

† From May to September small boats can approach the base of the mountains by the Pandua river, at other seasons the ghats are sometimes two, and at others four, miles distant, but no difference of charge is made by the porters on this account. See "Journal Asiatic Society," vol. III., p. 26.

‡ The quality of this Coal is considered by Mr. J. Prinsep as ten per cent. better than that of Burdwan.

§ There is a small cluster of hills adjoining the place, composed of sandstone, the most remarkable of which is named Arpun, and is well known from a Mussulman Doorga being placed on the top. Opposite to Solagur, in Laour, there is another petroleum spring, the product of which is named Otr, and is used externally in cutaneous affections.

of Coal of good quality, but Mr. Jones was of opinion that no smaller vein than four feet would pay, and the descent, he observes, was difficult.

Sylhet Coal
District, 1837.

In the Disyung river and its tributaries, Mr. Jones states fragments of common Coal are found, but in less quantity than in the rivers about Laour, so much so, that 15 persons were seven days in collecting one maund without finding the source from whence any of the pieces were introduced. It is worthy of remark, that all these indications of Coal are quite independent of the Cherra bed, as no fragments were found in the Pandua river, or in any of the streams which fall from the mountains, on which the Cherra Coal is placed.

In a letter, addressed to W. B. Bayley, Esq., Secretary to Government, dated 24th April, 1815, it is stated by Mr. Jones, with reference to Sylhet Coal, that Mr. Stark had found a vein seven feet six inches in thickness, which dips one inch and a quarter to a foot, thus rendering it easy to work, adding,—“the water will discharge itself, and the road to it will be good.” Mr. Jones tried a basket of this Coal, sent to him for the purpose, and found it of good quality; the locality, however, is not mentioned. In a subsequent letter, dated 15th May, 1815, Mr. Stark himself addressed Government direct on the subject. It would seem from his statement, that the discovery was made in the mountains between Pannatick and Bunsikora, and that 250 maunds taken from two distinct veins has been sent to Calcutta with a proposal to supply the public works to any extent with the same kind at 12 annas per maund. In a more recent letter, dated 10th January, 1816,* Mr. Stark addresses W. H. Trant, Esq., Secretary to Government, and explicitly points out the situation of the two beds of Coal above referred to. One of these was discovered by himself at Charago in March, 1814, and was examined by Mr. Jones the following February, but was abandoned, in consequence of not having water-carriage, it was alleged sufficiently near; Mr. Stark then renewed his inquiry, and found a bed of Coal at Barachara, which would seem to be the one described as seven feet six inches in thickness. Mr. Stark stated that he was happy to find the quality of this Coal improved the deeper the excavations were carried, although what had been taken from the surface had been tried and approved of in Calcutta, so that he was led to expect that this Coal would equal that brought from Europe. Having failed, however, to create a monopoly in his own favour (and by the attempt excited the opposition of Mr. Jones and Messrs. Raitt, Inglis and Co.†), the Barachara and Charagow beds were given up, and finally lost sight of by the success of Mr. Jones's Mines at Burdwan.

Charagow and
Barachara Coal.

There can be little question as to these beds being placed much more favourably with regard to the plains than the Cherra Poonji Coal, for, independent of the remark that “the road to it will be good,” Mr. Jones, as well as Mr. Stark, had too little confidence in the disposition of the Kasya tribes to venture further into their country than the skirts of the hills.

Although the pyrites contained in Charagow and Barachara Coals may render them unfit for fuel, still they may be employed profitably in the manufacture of the sulphate of iron and coal tar. To obtain the first of these articles in large quantity, the brassy or pyritous Coal, as it is called, might be exposed during the rains in a pit calculated to collect a certain portion of water; the sulphur will decompose the water thus accumulated, and form sulphuric acid, which, by acting on the iron of the decomposed pyrites, will form the salt in question, which may be purified by subsequent lixivation and crystallization, which, like the first part of the process, may be performed by the natural changes of season in India. In this way an important article in the arts and commerce of the country

Sulphate of iron,
how it may be made
from refuse Coal.

* This letter is not in possession of the Coal Committee, but may be seen in the reports of the Select Committee of the House of Commons. It casts a complete light on what is stated in paragraph 57, regarding the situation of the beds from which Mr. Stark sent down the first boat load of Coal for trial.

† Mr. Cracroft states, “that Mr. Inglis embarked 5,000 rupees in working this Coal, which was dug close to the water and loaded on the boats at once; but it was not approved of on trial in Calcutta; the money was consequently lost, and the speculation abandoned. The Coal is highly impregnated with pyrites, which renders it unfit for use in steamers.”

But supposing the Coal discovered by Mr. Stark to be that which was afterwards worked by Mr. Inglis and disapproved of, yet still when we recollect that the Burdwan and Pulamow Coals were also at first condemned, it would be desirable to know something more regarding the Charagow and Barachara beds and their topography before we again cast them aside.

Sylhet Coal
District, 1837.

country might be obtained almost without labour.* One of the specimens of Coal recently discovered by Lieutenant Vetch on the north side of Assam contains a considerable proportion of pyrites, and would, as well as the Sylhet Coal referred to by Mr. Cracroft in the preceding note, answer admirably for this manufacture.

Iron ore.

The hills in the neighbourhood of Sylhet, Mr. Jones says, afford an iron ore in their concretions resembling cast-iron plates,—what he alludes to is an oxide derived from the loose sandy materials of these hills; but, being spread over a great surface, and occurring in but small quantities in any particular place, it may be considered as of no great importance, but its value will depend in a great measure on the degree of success that may attend inquiries for Coal at the foot of the mountains.

Perhaps it was the presence of this ore that led Mr. Jones to look upon Pandua as the best situation he had seen for the establishment of iron works for the manufacture of bar, bolt, and hoop-iron. The late Colonel Watson also expressed himself favourable to similar views, but seems to have formed them chiefly on the supplies of iron procurable in the interior of the mountains, but this source would also, it is to be feared, be insufficient for the supply of extensive works. The vicinity of Coal, and the convenience of the situation with reference to navigable rivers, certainly render it desirable that such resources in this quarter should be fully investigated.

Iron ore.

The ore now in use in the interior of the Kasya Mountains is procurable with considerable difficulty by washing the sands in low and inconvenient valleys in very remote situations. The method of smelting it, has been briefly noticed by Mr. Cracroft, but a few additional particulars regarding a process so simple as to enable one person with ease to conduct the several occupations of working. The bellows, and supplying ore and fuel at the same time, may here be interesting, particularly as the same operations, as they are performed in Kemaon, require two persons for the bellows alone, and so laborious is this part of the labour, and so much exposed to heat and smoke are those engaged in it, that they are obliged to be relieved every ten or fifteen minutes.

Manufacture of
iron.

Over the fire (in the Kasya method) is placed a hollow cone made of clay, and open at both ends, the object of which is to prevent the radiation and consequent loss of heat so inconvenient and disadvantageous in the Kemaon method. The mixture of ore and wet charcoal in the proportion of two parts by weight of the former to one of the latter, is held in a trough at the top of the cone. The bellows are placed vertically at some distance from the fire, with which they communicate by means of a horizontal pipe. The individual by whom the several occupations already mentioned are conducted places himself on the end of the bellows, with a foot on each valve (*see* Mr. Cracroft's Figure, plate 6, Vol. I. "Prinsep's Journal"), and, by changing the weight of his body from side to side by an alternate rocking motion, and at the same time balancing himself as well as the bellows by means of a rope fixed below to the latter, and above to the roof, and held in one hand, while with the other, by means of a long shovel, he supplies the mixture of fuel and ore from the trough, but in small quantities at a time, not unlike the way in which grain is supplied from the hopper of a mill. The large quantity which is thus kept in fusion compared with the small proportion in which the ore is supplied, may be supposed to facilitate reduction, and to constitute one of the chief peculiarities of the principles.

Every two hours, or 10 times during the 24, the iron is extracted from the fire in the form of a ball about five pounds weight, which, while hot, is beaten, as described by Mr. Cracroft, with a wooden club into a flat, compact form; it is then split almost in two with a heavy iron cleaver, which renders it more easily converted into bars.

There may be five forges of this kind in the village of Serrarcem, each yielding 20lbs. of iron daily, and 100 villages in which the tradé is carried on to the same

* Sulphate of iron, or green vitriol is used as a cheap substitute for sulphuric acid in chemical manufactures. There would be a considerable demand for it in the Calcutta market if the price at which it is offered for sale were at all reasonable; but at present the contract price for the little that is indispensable in the laboratory of the Hon. Company's Dispensary is purchased at 10 rupees per maund for the impure sulphate, which we have no hesitation in saying might be produced at a tenth of that sum. The demand for green vitriol at a reasonable price, would be very considerable, and its production at a cheap rate a great boon to the manufacturing chemist.

same extent. Suppose the smelting to be continued only during the cold season, 1,650 tons of iron would be annually produced. Mr. Jones states that the iron from the mountains sold in his time (1815) at the foot of the hills for *R.* 1. 5. per maund; but, according to inquiries in Serrareem, as well as at one of the weekly markets at Myrung, where several tons of iron were exposed for sale, the price on the spot was from 14 annas to a rupee for 20 seers, or, at the lowest, *R.* 1. 12. per maund; which, compared with the price stated by Mr. Jones, would make a material difference, not merely in the aggregate value of the trade, but also in the profits that would result to those who might embark in such works as those recommended by Mr. Jones. Still, however, the price above stated is from 14 to 26 annas per cwt. less than the average price of English pig-iron in Calcutta during 1835, so that if it could be delivered in sufficient quantity at such rate, the manufacture might be successful; the reduction of the ores found in the plains along the foot of the mountains, might, however, make up for any deficiencies from above, and thus in the vicinity of Coal, sufficient supplies of iron for works of any extent might be obtained.

Sylhet Coal
District, 1837.

The mountain ore produces about 50 per cent. of iron, and unlike that of the Ponar valley in Kenaon, it is only necessary to submit it once to the fire. A great bed of Coal forms the surface on which the village of Serrareem is erected, but unless some more profitable and convenient repositories of the ore can be found than those already employed, the use of this Coal as a fuel would be of little advantage; the smelting as it is at present managed, is far from being the most expensive part of the manufacture.

From the indications afforded by the north-east frontier, if we include under this head the Coal Districts of Sylhet, Cherra, Arracan, and various parts of Assam in which Coals have been noticed, we may safely calculate on their affording supplies not merely for the navigation of the Bramaputra to its source, but also for that of the lower parts of the Ganges as well as the adjacent parts of the Bay of Bengal.

We learn from Captain Jenkins that the late Mr. Scott was aware of the existence of Coal somewhere in the vicinity of the Caribari hills, and the committee have recently been put in possession of the fact referred to, by the existence of two beds of good Coal being detected at Doorgapore in the Garrow Hills; but particulars as to the extent of the beds and the circumstances under which they occur are yet insufficiently known, so that we cannot at present venture to offer any further observations on the subject, than merely to say, that we are in daily expectation of more information from this quarter.

Doorgapore Coal.

Although the attention of the Coal Committee has been constantly directed to this quarter, the only result accomplished since the last Report, that can be said to be new, is the delivery of 10,000 maunds of Cherra Coal at Goalparah, in Assam, at the rate of eight annas per maund, after the attempt to supply that station from Burdwan had failed.

Sylhet, 1840.

Three beds of Coal, situated near the foot of the hills, have been brought to notice, but we have no information on the subject to enable us to decide whether these are new discoveries, or merely the bed alluded to in our last Reports as having been brought to notice some 25 years ago by Messrs. Jones and Stark. Without going into that question, we shall merely state all we know of the three beds now alluded to:—

The first and most promising is that of Byrung Peonji, situated near a village of that name, within about two miles of water carriage, and the ground such as to allow of the construction of a hackery road.

Byrung Peonji
Coal.

We know nothing of the circumstances of the bed further than is stated by Mr. Landers, a practical gentleman, who has been appointed to the superintendence of Coal Mines in Sylhet and Assam, and who observes:—

“Byrung Coal is of a soft quality, intermixed with stones, three feet and a half high and varying in its thickness. The vein runs from east to west, and descends with the hill towards the south: to what extent this field may exist, it is impossible at present to say, the want of proper implements” (these have been since provided) “prevented me from ascertaining; a trial ought to be made by running galleries into the strata six or eight fathoms, at once to determine both height and quality, and also if it would admit of any outlay.” This Coal has been tried, and appears to be likely to answer very well

Sylhet Coal
District, 1840.

Chiela Coal.

Mustuck Coal.

for steam, while it has the additional advantage of yielding excellent Coke.*

Not far distant from the Byrung bed, there is another at a place called Chiela or Chaila, which varies from one to three feet in thickness. This, however, is said to be an inferior Coal.

Major Lister, to whom we are indebted for the first and almost the only information we had regarding the two foregoing Coals, states, that Mr. Inglis of Chuttack, has found a Coal bed above Chaila, at a village called Mustuck, about 1,500 or 2,000 feet above the plains, and within such distance of water-carriage, as to enable a porter to deliver five burdens daily from the pit into boats. Mr. Inglis is of opinion, that this Coal is quite as good as that of Cherra, and Major Lister observes, that it looks so, though the quality is different, being blacker, with an exceedingly high polish; it burns considerably longer than Cherra Coal, and cokes less, but is heavier, and yields more ashes.

The value of these, as well as similar indications alluded to in our Report for 1838 is still doubtful, and must remain so until the whole tract along the base of the Kasya hills be submitted to a geological survey. For the present season, if the Government require Coal from this quarter, we agree with Major Lister in thinking it will be necessary to confine our exertions exclusively to the Cherra bed. This, as is well-known, is situated on the summit of a mountain, nearly 5,000 feet above the sea, and at such a distance from navigable rivers as to render it a day's work for each cooly to deliver a maund, or about 80 lbs., of Coal from the pit into a boat.

The only way of lessening this inconvenience would be by improving the conveyance, by an improvement of the road. Above and below the steepest portion of the descent would admit of bullocks being used, as stated in p. 48, in our former Report. Instead of porters for the steeper or middle portion of the journey, it has been proposed to construct a slide, as suggested by the late Colonel Watson. The improvement of the road between Cherra and the plains would be a work of some public utility, as it would be the means of facilitating ingress and egress to and from the mountain plateau, it would, therefore, be a very desirable object, independent of the Coal. The value of a slide, however, would depend entirely on our success in finding as good a Coal below, as that which is above, an uncertainty which can only be removed by a perfect geological survey, as already suggested.

Some difference of opinion prevails as to the best way of transmitting Sylhet Coal to the great lines of inland navigation on the Ganges: some contending that it would be necessary in the first instance to send them a distance of 300 miles to Calcutta, and from thence back to Surda, and other depôts on the Ganges; experience is the only way of settling questions of this nature, and measures are now in progress for the delivery of the largest possible quantity 10 or 15,000 maunds of Cherra Poonji Coal in Calcutta, with the least possible delay, compatible with the fair trial of the experiment.† The Kasyas, on whom the burden of the experiment will literally fall, though a fine athletic race, are little accustomed to labour; Major Lister may, therefore, have some difficulty at first, in reconciling a sufficient number of them to a continued effort, the object and importance of which they can be so little expected to understand.

Quality of Cherra
Coal.

It is necessary to take the quality of Coal into account before any particular price per maund can be regarded as dear or cheap; it is quite incredible to what degree a slight difference in quality affects the value of Coal for steam-vessels. It has been found by means of the only trial instituted between Cherra and other Coals now in use, that nine maunds are equal to 14 of Burdwan Coal. Let us suppose (without laying too much stress on a single trial of a few maunds) the proportionate value of the two Coals to be ascertained as above; 100 maunds of Cherra would not only as a fuel be equal to 155.5 of Burdwan, but we should also have to debit to the latter the value of 55.5 maunds stowage or tonnage, which might amount to more than the entire value of the Coal consumed.

The Cherra Poonji Coal forms the cap of a hill from which each cooly may help himself to his load, almost without the aid of mining, so that the carriage,

four

* Communication has been received from Major Lister since the above remarks were written stating that Mr. Landers has traced the Byrung Poonji bed for two miles to the westward, without finding more on an average than a foot of good coal.

† This was accomplished during the rainy season of 1840 by Major Lister, who delivered 21,000 maunds of this Coal in Calcutta at nine annas per maund.

four annas per maund from the pit to the nearest navigable river, though high, may be said to include the expense of winning, or bringing Coal to the surface. Could any of the following indications of Coal lower down towards the foot of the mountain, be found to yield good supplies, a portion, or nearly the whole of this large item of expense might be saved, viz.: 1. Tipperah Hills, in a small river which descends from a hill with a Mussulman Doorga called Orpeen, on its summit. 2. Opposite to Jalalpur, in Laur. 3. Palli river and several streams descending from the Garrow Mountains. 4. Near Susung. 5. On the top of one of the lower ranges at Laour, and in the rivers of Laour. 6. In the Dysung and its tributaries. 7. Between Pannalik and Bansekora. 8. Barachara, to which we have now added Byrung, Poonji, Chaila, and Mustuck. (*Vide* proceedings.)

Sylhet Coal District, 1840.

The rate of boat-hire from the Sylhet District, along the verge of which the Coal formation lies, to Surdah on the Ganges, one of the principal depôts for the supply of steamers, is stated by Mr. H. Inglis to be 21 rupees per 100 maunds. In regard to water conveyance, Sylhet has the advantage of any of the Coal districts to the westward, while its proximity to the great rivers of Bengal gives it an advantage over the Assam Coal Districts; and thus while any mines that might be established in Sylhet would hardly be affected in value by similar establishments in any other part of India, there is hardly a district from Arracan to Palamow the value of whose mines would not seriously be affected by any subsequent discovery of Coal in Sylhet. In like manner any Collieries that might be established in Assam, or other remote provinces, would be entirely superseded in the Bengal market by any new discoveries of good beds of Coal that might be made in the Sylhet District. It is for this reason that we have suggested the importance of a scientific investigation of the Coal measures along the base of the Kasya and Garrow Hills, since upon this, and the manner in which it is conducted, must depend in some measure the prudence of investing capital in more distant Coal districts.

Advantageous position of the Kasya and Garrow Hills, for Coal Mines near their foot.

Surdah is within a few miles, of Bogwangola, a principal mart for grain of every kind, goor, oil, ghee, and the chief articles of Native consumption. Being situated in the centre of Bengal, near the junction of all the principal rivers, as the Bhaugarutty, the Ganges, and Bramaputra, it is naturally the centre of internal commerce, and consequently the greatest mart for boats in Bengal. Surdah, or some situation in that neighbourhood, appears therefore to be a desirable situation for a general depôt, and as this point is of importance, we have consulted J. W. Grant, Esq., of the Civil Service, who had been long Commercial Resident at Maldah, and Major Carter, who has been for a large portion of his life in the Bengal Commissariat, and the experience of both these gentlemen goes to prove that at Bogwangola and Jellinghee, boats for the transmission of Coal from Surdah to any part of Bengal, or the Upper Provinces, may be had to any amount of tonnage likely to be required.*

The distance from Cherra Poonji to Calcutta by water, is about the same as to Surdah; while the latter is 150 miles nearer to Rajmehal, and other depôts to the eastward.

Major Carter states that the voyage from Calcutta to Cherra in an empty boat should not take above 24 days, and returning laden, about the same period, as the stream would be favourable to Dacca, and from thence in the tideway. "Assuming, however, two months as the time necessary to complete a voyage, including loading and unloading, it strikes me," says Major Carter, "2½ annas per maund should nearly cover the carriage, and below I give the grounds of my opinion.

	Rs.	
A 1,000-maund boat can be hired at per mensem	-	30
10 Dandies at 3 rupees each	- - -	30
1 Manjic at 4 rupees	- - -	4
		64
		2
		Rs. 128

Rate of boat hire from Sylhet.

This

* We have been the more particular in our information on this point, since it has been suggested that Cherra Coal should first be brought to Calcutta, and from thence transmitted to the depôts on the Ganges.

Sylhet Coal
District, 1840.

This boat should carry 800 maunds, which just gives 2 annas 6½ pice per maund, so that at this rate Cherra Coal ought to be delivered in Calcutta at 7 annas per maund; Major Carter therefore expresses his surprise that an offer recently made by the Marine Board, of 9 annas for Cherra Coal, had not been taken up, and suggests that if boats of 2 or 3,000 maunds, such as are used for bringing wood from the Sunderbunds, were employed as far as the rivers would admit, the carriage would be still lower.

The readiness with which boats may be had for any regular trade, may be imagined by the following observation of Major Carter:—"Hundreds of large boats frequent the Sunderbunds, nearly as far as Dacca, in search of cargoes of rice and dhan, the worth of the former of which is very little more in ordinary years than Coal, and the latter scarcely one-half as valuable; they do not find their cargoes at one place, or belonging to one person, but attend the banks and purchase in whatever quantities the people bring to the market, often only a few seers, and seldom exceeding a few maunds."

The Commissariat regulations and general custom of paying boat-hire on a computed distance, instead of the time actually employed, might in the first instance militate against the economy of any arrangement for hiring boats, says Major Carter; but if a few boats were purchased or built at Dacca, or in the Sunderbunds, and manned by a private individual, the result would prove the correctness of these calculations. A good boat could be built for 500 rupees; and in six trips, at the above rate, would yield 300 rupees, leaving 60 rupees for casual repairs, this would repay itself in less than two years; but a boat is expected to last seven or eight.

CUTTACK.

Cuttack, 1840.

ABOUT ten years ago a specimen of Coal found in the Cuttack District was sent to the Asiatic Society, probably with some particulars, which do not appear to have been noted in the proceedings; the circumstance was, however, suggested to the Committee by Captain Jenkins, in 1837, about which time Lieutenant Kittoe, then with his regiment at Cuttack, obtained a specimen, together with some particulars, which he communicated to the Committee, on which he was requested to visit the spot, where he collected the following particulars. Half a mile from the Fort of Talcheer,* Coal seams are exposed along the banks of a small nullah called Belajoore (at a spot where workmen employed by Mr. G. Becher, had, a few years before, extracted some specimens of Coal). Mr. Kittoe found, in an excavation formed for the purpose, at a depth of 13 feet, a bed of "good glistening Coal," 1 foot to 1½ foot thick, reposing beneath 10 feet of "shingle," and two beds of shale and blue clay, each 1½ foot thick. The latter, as well as a grey rock beneath the Coal, both containing fossil plants.

Mr. Kittoe states, that a native contractor offered, in the event of Coal being raised at Talcheer, to convey it down the Bramenee river to Hunsua, on the coast, where large sloops may anchor, at 4 annas per maund; but Mr. Beetson, the contractor for the transport of salt from thence to Calcutta, was of opinion that 2 annas per maund, at the utmost, would be sufficient. From the coast to Calcutta the transport of Coal would be the same as that of salt.†

The next Coal, to which Mr. Kittoe was conducted by his guide, is a few miles higher up the Bramenee, and at a distance of 16 or 18 miles from that stream, so that its conveyance would be considerably more expensive. The Coal here presents an average height of 15 feet above the sand for a mile on either side of a nullah called Sungurra, a tributary of the Bramenee. The country is said to be level from the Coal to the bank of the Bramenee, so as to afford every facility for the construction of either a road or a canal. Iron ore is found in great abundance throughout both of these Coal districts, and the ore is smelted to

* Talcheer is a town on the Bramenee River, 140 miles from the coast.

† At present there are three contracts of the conveyance of salt from Hunsua to Calcutta; the rates are 18 rupees, Rs. 17. 8. and 17 rupees per 100 maund.

to some extent, and by the same process as that which prevails in other parts of India. Cuttack, 1840.

Such is the substance of Mr. Kittoe's report.* The specimens of Coal furnished were not of good quality. Three specimens of Talcheer Coal examined at the Mint afforded the following average results:—

	Specific gravity, 1.3610.
Volatile matter - - - -	39.
Carbon - - - -	44.1
Earthy matter - - - -	15.10
	100

Talcheer and Hingolee may be regarded, we think, without much doubt, as an extensive and valuable Coal-field. The workable beds will probably be found to be some distance from the surface at the spots visited by Mr. Kittoe, but the district appears to have been subject to so much local disturbance, that more favourable positions for Coal mines may be expected, when the country has been properly examined.

Since the above remarks were written, the Committee have received a communication from Mr. Mills, the Commissioner of Cuttack, enclosing a report from Mr. Beetson, whom he deputed on 22d February last, at the instigation of Mr. Smith, the President of the Coal Committee, in order to procure further information on the subject. Mr. Beetson reports, that "the samples laid before the Committee, by Lieutenant Kittoe, were far inferior to those I have now brought with me. The latter are equal to the best Burdwan; but to satisfy the Committee as to its description and quality, if Government will pay the expenses, which will amount to a mere trifle, I shall be happy to undertake the delivery of 100 or 200 maunds in Calcutta by next December." Mr. Mills observes that the specimens, as far as he and other gentlemen at the station are able to judge, are so very good, that he authorised Mr. Beetson to procure 100 maunds for trial in Calcutta; 150 maunds were accordingly transmitted to the Committee, in February 1841, and proved to be most inferior description of crop Coal intermixed with Coal shale (*see* proceedings of the Committee, May 1841). There can be no doubt, however, that with a moderate degree of intelligence, as good Coal may be found at Cuttack as anywhere else. The locality in which the Coal occurs is, according to Mr. Beetson, called Gopal Pushad, and the nullah by which it is laid bare, Sangra, which corresponds with Mr. Kittoe's name Sangurra. Mr. Beetson states, that the distance from Gopal Pushad to Talcheergur is from 14 to 16 miles, and recommends that the Coal be carted by buffaloes (the common draught cattle of the country) to Talcheergur. From Talcheer, the Coal could then be conveyed in 10 or 12-maunds boats to Kumalung, six miles below Talcheergur, where it should remain till the setting in of the rains, and from thence it may be conveyed for six months of the year in from 100 to 300-maunds boats to Hunsua on the coast, where it would be available for sea-going steamers at from 3 to 4 annas per maund. From Hunsua, Mr. Beetson would undertake to convey the Coal to Calcutta at 18 rupees per 100 maunds; and, indeed, he thinks he could supply it to the Calcutta market at 6 annas per maund, including every expense. Cuttack Coal, 1841.

RAJMEHAL.

At Rajmehal Coal has been found by Captain Tanner in two situations, viz. at Sicrigully, on the banks of the Ganges, and at Hurrah, twenty-five miles distant. With regard to Sicrigully this place has been recently visited by Lieut. Don, who reports to the Committee, that as far as he and Lieutenant Egerton, who accompanied him, could determine, no Coal exists at the foot of the Mootee Jarma waterfall, where it was supposed to have been observed by Captain Tanner.† Rajmehal, 1836.

Sicrigully Coal.

At

* *Vide* "Asiatic Journal" of 1839, p. 137, 144.

† I am informed by Mr. C. Glas that there is a Coal Mine at Sicrigully, but not at the foot of the waterfall; the spot visited by Lieutenant Don, but near the village of Moharajpore, in the vicinity of the waterfall Moo tee Jarma.

Rajmehal, 1838. At Hurrah large quantities of Coal have been extracted, but although we have every information relative to the working and expense of conveying this Coal to the river, yet our knowledge regarding the natural circumstances under which it occurs is very defective. This Coal is inferior, and without a more comprehensive knowledge of the district than we are possessed of at present, it is impossible to come to any conclusion as to whether or not better beds of Coal might be expected, and what measures would be most likely to be adopted with success.* Captain Forbes found by various experiments conducted at the Calcutta Mint on 500 maunds of the Hurrah Coal, that nearly double the quantity compared with the Burdwan Coal, was required to produce the same quantity of steam, and that it is generally unfit for smithery purposes; affording an inadequate heat for welding, or even for hammering with facility, and on analysis Mr. Prinsep found it yield upwards of a fourth part in ashes.

Hurrah Coal.

Iron ore.

Mr. C. Glas, an old and intelligent resident at Boglepore, says that two and a half miles south of Sercunda and 14 miles from Rajmehal, iron ore is found in the greatest abundance scattered over the surface in masses each several yards square, which might be manufactured to any extent at a trifling expense, but the quality of the iron afforded is inferior to that of English cold short iron; but he says that an ore affording a remarkably superior iron, from which he himself manufactured steel, is to be had plentifully at Misadhe and Joypore, about 70 miles south and south-west of Boglepore. The roads to the part of the district in which this ore occurs are such as to admit of the employment of wheeled carriages for its conveyance to the river side.

Galena and copper.

The late Mr Jones, in one of his letters, observes that, in the neighbourhood of Luchmepore, in the Boglepore Zillah, lead is afforded. In another letter he states that the Hills of Curruckpore, distant 40 miles from Boglepore, are composed of quartz, and contain a rich vein of Galena discovered by Buchanan. Perhaps the same vein is in both cases referred to. "Very probably," he adds "copper will be found in Dholboom near Ragduha,† on a nullah, called Guree, that empties itself into the Subbon Reeka river."

Alum.

Near Sahibgunge Mr. Glas states, alum is found in such abundance as to supply the local consumption of the neighbourhood, but no trouble has been taken to procure it in a better state than that in which it appears on the surface.

Doobradgepore Coal.

When our last reports were written, Coal was known to exist in two situations only in the Rajmehal Hills, namely, Sicrigully and Hurrah. In April 1838 Major Forbes was informed by Mr. James Pontet that he had found a bed of Coal in the Rajmehal Hills on the banks of a nulla called the Burmany, 16 miles distant from water carriage during the rains, and about 30 miles west of Moorshedabad, and nearly in the line of the canal proposed by Major Forbes. A specimen of this Coal afforded the following results on analysis:

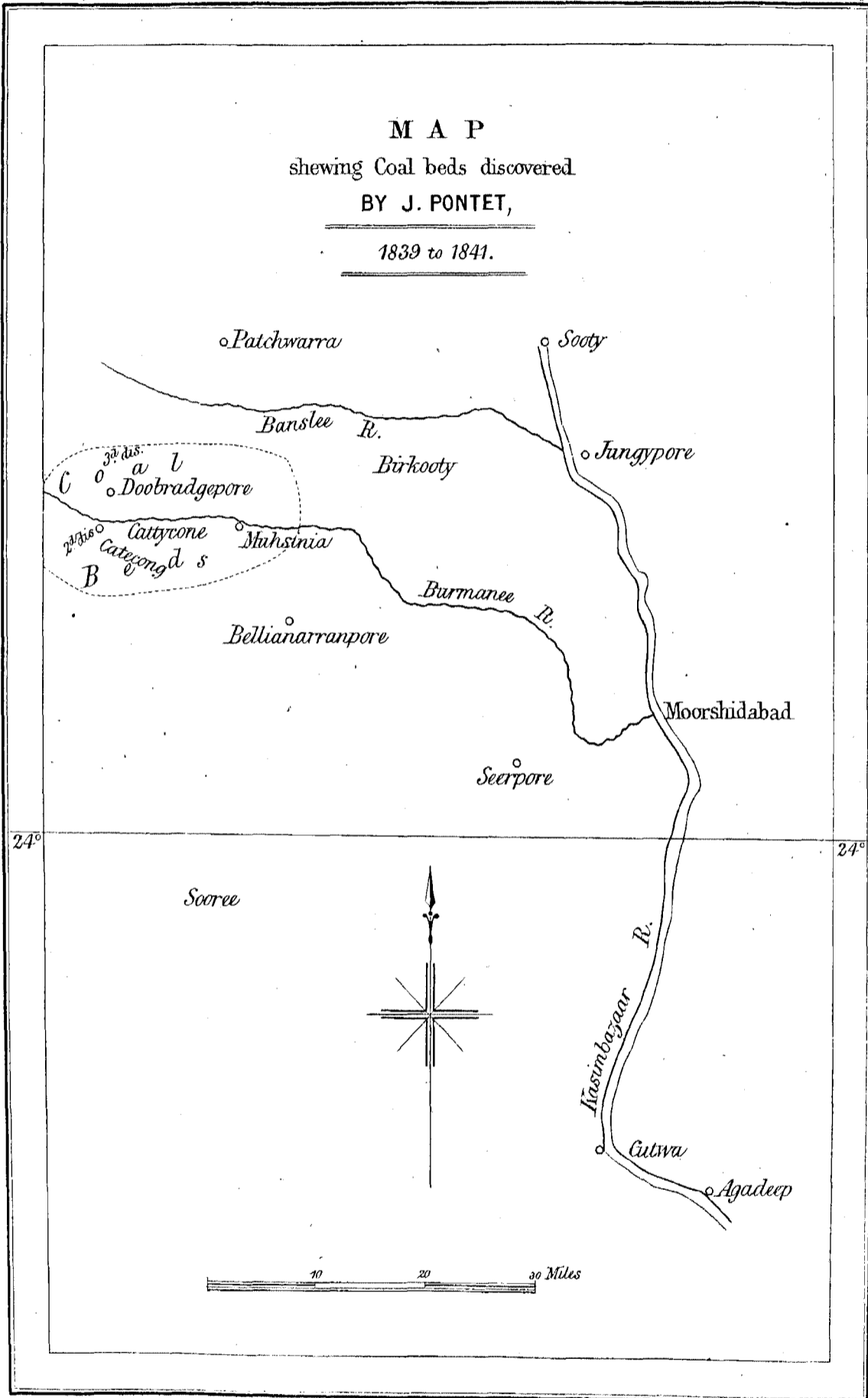
Specific Gravity, 1.370	
Volatile matter	42.0
Carbon	44.8
Earthy matter	13.2
	100

A sample consisting of a few maunds furnished by Mr. Pontet some time before to Mr. Scott the Commander of the Jumna steam-vessel, also proved of favourable quality. Mr. Pontet having been desirous of procuring the means of extending his observation, these were provided, and on the 20th June, he despatched 10 bags of Coal to Calcutta, this also proved favourable; but a subsequent dispatch of 400 maunds consisted of shale and inferior Coal. In explanation of this last unfortunate circumstance, Mr. Pontet stated that the necessary aid did not reach him till the rains set in, when the place being unhealthy, he was obliged to leave the raising and dispatch of the Coal to inexperienced natives.

The following is an extract from Mr. Pontet's letter, in which he describes the operations in which he was engaged. "After the first vein of Coal, we came upon

* Mr. Glas states that Coal is found throughout a large tract of country in Bareoup.—it is probably the same as that discovered by Captain Turner—a portion of this Coal is said by Mr. Glas to have been recently on fire.

† See *Asiat. Res.* 1828, p. 170.



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upon a hard black stone; and finding the operation of boring through it so very tedious, I took upon myself to select a spot for a shaft, and procured well-diggers and stone-cutters, who have been for the last two months at work, at present to all appearance with satisfactory prospects. As one of the stone-cutters who opened a shaft at Burdwan, says this mine bears some resemblance to it, I am induced to persevere a few feet more, in hopes of coming to a useful vein. The first 23 feet of soil is red and black earth mixed with kunkur, and under that, to a depth of 40 feet, are 13 different strata, three of Coal, and the rest various kinds of stone." Mr. Pontet transmitted to the Committee specimens of all the different beds passed through, which are remarkably characteristic of the true Coal measures; and of 11 different beds passed through in the last 17 feet of the excavation, there were several beds of Coal of good quality, but too thin for working, and in the shale we observed excellent specimens of *Vertabraria Indica*, one of the few abundant fossils of the Burdwan beds that happens to have received a name.

Rajmehal, 1840.

See Proceedings for April 1841.

The excavation was formed on the N. W. side of the Burmany Nullah; but Mr. Pontet states that he traced the Coal a mile S. W. of the Burmany river, from which he concludes that the Burdwan and Rajmehal beds are connected. Mr. Pontet subsequently found the indications of Coal more extensive than he at first supposed, and that Coal formations extend for 10 miles round the village of Doobradgepore, the Burmany river passing through the centre of the Coal district. While these pages are passing through the press, a sample consisting of 10 bags of this Coal has been received. It presents the appearance of ordinary surface Coal; 40lb. used in one of the furnaces of the Hon. Company's Dispensary, burnt as well as inferior Burdwan Coal, and left 8 lb. of ashes.

The following is the results of analysis of an average specimen of the sample in question:

	Specific Gravity, 1.4.	
Volatile matter	- - - - -	42
Carbon	- - - - -	38
Ash	- - - - -	20
		100

In a report on the Rajmehal Canal submitted to the Government in 1832, by Colonel M'Leod and Major Forbes, it is stated that Mr. Ward, the Commissioner of Boglepore, was aware of the existence of Coal in a bed of sandstone near the pass of Patchwary. The situation appears to be 10 or 15 miles to the north of Doobradgepore, and together with the Hurra and Sierigully indications proves the extension of Coal formations along the entire base of the Rajmehal hills.

PALAMOW COAL FIELD.

THE Coal-field of Burdwan is connected by means of what would seem to be the shattered remnants of Coal measures with another principal Coal-field in the valley of Palamow, on the opposite side of the Mongir Mountains.

Palamow Coal-field, 1837.

Coal has been known to exist in Palamow still earlier than the period at which it is brought to notice at Burdwan, since several spots are marked as Coal mines on Arrowsmith's map, but it was not till after the introduction of steam navigation that the fact excited any interest, when the late Mr. A. Prinsep, then collector of the district, directed attention to its importance; since that period Palamow has been frequently visited by persons sent to inspect the Coal, from whose reports the following particulars are gleaned:—

The Coal-fields of Burdwan and Palamow are separated from each other by the prolongation to the eastward of the Vindhya Chain, to which they bear a similar relative position, both reposing in low hills of sandstone, the one at the southern and the other at the northern foot of the chain.

The valley of Palamow situated at the source of one of the great branches of the Soane, is scarcely raised at its outlet above the general level of the plains of India, but is inclined with a slight ascent to the granitic mountains by which it is sur-

Palamow Coal-field, 1840.

rounded, except towards the north, at which side the Caile or Palamow river joins the Soane. The length of the valley from north to south may be about 70 miles, but its breadth is much contracted by the approximation of steep granitic hills on opposite sides, between which small diversified vallies are extended laterally.

The climate would seem to be better than that of most parts of India, and if we consider the proximity of the elevated granitic platform on the east and south, a very favourable climate might here be available for the residence of those who would engage in the enterprise of turning the mineral resources of the district to account. The lands being little adapted to the ordinary agricultural pursuits of the country, are in a great measure deserted, but the inhabitants who are peaceable and sufficiently numerous to afford the requisite number of labourers for such works as might here be established, are at the same time ready to enter upon any new branch of industry calculated to improve their present condition.

Singra or lower Coal-field.

The Caile* or Palamow river, joins the Soane at the outlet of the valley, about 80 miles from the confluence of the latter river with the Ganges, and is perfectly navigable for ordinary boats during the rains to a place called Manjean, 18 miles within the valley; above this the navigation becomes more difficult in consequence of the occasional projection of rocks into the stream, but boats of 150 maunds burden can with ordinary caution ascend during the rains 22 miles higher to the village of Singra where the first Coal-field occurs, accompanied, according to Mr. Homfray, with a rich and inexhaustible iron ore. This Coal-field is, however, only two and a-half miles long and one mile broad; the main Coal,† which is not far from the surface, is 3 feet 8 inches thick, and though not reckoned of a quality exactly fitted for getting up steam, yet would answer admirably for the reduction of the ore with which it is associated.

Upper Coal-field.

In order, therefore, to obtain inexhaustible supplies of Coal suitable for steam navigation, it is necessary to ascend 20 miles still higher up the Caile, where a great Coal-field, indicated by Rennell in his map of Bengal, occurs, and which is supposed by Mr. Homfray to be 14 miles in length by 6 in breadth, with a workable main of good Coal 3 feet 9 inches; but, unfortunately, the navigation of the Caile is quite obstructed by boulders from Chandoo to the Coal-field, a distance of 13 miles,‡ and the country on either side so rugged as to prohibit the possibility of forming a road at any moderate expense, and the only practicable mode of conveyance would, consequently, be bullocks, which, on such difficult passes, could, according to Mr. Homfray, only carry half the ordinary loads,§ and for the rest of the way, *i.e.*, from Chandoo downwards, small boats of 150 maunds, with caution, could traverse the river to Manjean, as already stated, where large boats during the rains might receive their cargoes.

In order to overcome the difficulties opposed to the navigation of the Caile, several expedients have been proposed. That of Captain Sage, of forming a bund at Ganeah Ghat, where, for three miles, the river is obstructed, would, if successful, only have the effect of obviating a portion of the difficulty to be encountered; for the rest, he suggests the formation of a cut from the bund across the table-land, for the distance of 30 miles, to the nearest branch of the Great Ponpon river, the bed of which should be levelled and locked the whole way to Futwa on the Ganges; or instead of the last part of the proposition, to remove, by means of gunpowder, the impediments to the navigation of the Caile at Manjean, below the situation of the proposed bund.

This last is certainly the more feasible plan, but before either of the modes proposed for bringing the Palamow Coal into use for the navigation of the Ganges, be carried into effect, it would be necessary first to know whether or not the mineral

* It is sometimes called Caile, and in Arrowsmith's map, Coyle, a name which in the same map is also bestowed on another neighbouring river.

† We use Mr. Homfray's term although we have no details sufficiently satisfactory to prove that the bed alluded to is the *main* Coal. On the contrary, it appears to be merely the *crop* Coal as well from its superficial position as from its quality and appearance.

‡ A considerable proportion of this distance, comprising a tract of two or three miles at least adjoining the Coal-field, appears from a map, constructed by Mr. Homfray, to offer no difficulties to the formation of a road.

§ From Chandoo in a direct line to the Coal-field, the distance would seem from Mr. Homfray's map to be considerably less than 13 miles, and if the plain adjoining the Coal-field be deducted, the really difficult part of the distance would probably be much diminished; and when we recollect, that good roads are made in Kemaon, for instance, with less important objects over mountains 7,000 feet in height, it is easy to see, that a ridge of hills a few hundred feet high, however rugged, will not form an insuperable obstacle to the useful application of the Palamow Coals.

mineral can be had in situations more accessible; if not, some ingenious plan will, no doubt, sooner or later, be devised for bringing this Coal into use.

The lower Coal-field appears to have been originally a slightly inclined plane, composed of sandstone, shale, and Coal, disposed in horizontal beds, in which streams have worn ravines to a depth of from 20 to 60 feet, giving to the present surface a broken and uneven aspect. On the sides of the undulations, and in the ravines Coal bassets are everywhere seen.* There would seem to be above the Coal, a sandstone 38 feet in thickness, intersected in the middle of its depth by a minor bed of Coal and shale, beneath which a 2 feet 6 inch bed of Coal occurs; an alternation of sandstone and shale divides this from the main Coal, beneath which there is 60 feet of sandstone. The rocks associated with Coal, in the upper field, do not appear to be very different from those which compose the lower one, except that the sandstones would seem to be finer and harder in the former. Only two beds of Coal, the one 3 feet 9 inches, and the other 1 foot 6 inches are given in its section by Mr. Homfray.

Mr. Tytler, an engineer, employed under the Controller of Steamers, having been deputed, under the authority of the Marine Board, to Palamow, describes a bed of Coal six feet thick, exposed, to a great extent, on the banks of the Amanath river, where Mr. Homfray, a short time before, could only find a 3½ feet bed, "so interrupted by ravines as to render the field very limited." There is, however, evidence enough in the Reports of Major Sage and Mr. Tytler, as well as in the information furnished to Mr. Ravenshaw, the Commissioner of Patna, to show that Coal is here abundant enough; the only doubt is, as to its quality. Major Sage, Executive Engineer, Dinapore, states that he had formerly been in the habit of receiving supplies of Coal from Palamow, which he considered a good and useful fuel. We have no doubt that a good Coal may be procurable in Palamow, but such samples as have been hitherto sent to Calcutta for trial have been inferior; partly, no doubt, from their having been ill chosen from the numerous beds that seem to occur in the district. Major Sage found the following results, from comparative experiments instituted between Palamow and Burdwan Coal, from which it would appear that the former has the advantage in quality:

	<i>Palamow.</i>	<i>Burdwan.</i>
Coke - - -	46 2 - -	46 2
Volatile matter - - -	47 - - -	40 -
Earthy matter - - -	6 8 - - -	13 8
	<hr style="width: 50px; margin: 0 auto;"/>	<hr style="width: 50px; margin: 0 auto;"/>
	100 -	100 -

Palamow Coal-field, 1840.

Nature of the Palamow Coal-field.

Quality of the Coal.

Palamow compared with Burdwan Coal.

In experiments of this kind on a small scale, everything depends on the specimens selected for comparison. The Burdwan Coal varies in quality in different mines, just as Palamow Coal would vary if mines were once fairly established in that district.

The best Burdwan Coal we can induce the Contractor who supplies the Laboratory of the Honourable Company's Dispensary to furnish, affords 25 per cent. of ashes, but the kind used on board steamers is said to be very superior to this, and the Ranyunge variety with which other Coals are compared, is the best in Burdwan.

* The following computation of the Section has been made by Mr. Homfray, from the appearances on the surface of the ravines:—

SURFACE.		<i>Ft. In.</i>			<i>Ft. In.</i>
Sandstone - - -	20	-	Ironstone } Shale -	5	-
Coal - - -	1	4	Measures. } Ironstone 1	-	-
Shale - - -	-	10	Shale -	4	-
Sandstone - - -	18	-	Ironstone -	6	-
	<hr style="width: 50px; margin: 0 auto;"/>		Shale -	3	6
	<hr style="width: 50px; margin: 0 auto;"/>		Sandstone } -	-	-
Coal - - -	10	}	very white } -	-	-
Stone - - -	8	}	Aluminous -	-	-
Coal - - -	1	8	Sandstone -	-	-
Shale - - -	-	3	Quartz and beneath it granite.	-	-
Sandstone - - -	-	8			
Coal - - -	-	3			
Shale - - -	-	8			
Sandstone - - -	-	3			
Shale - - -	-	3			
Sandstone - - -	-	-			
Assumed Measurement - - -	-	60			

Palamow Coal-
field, 1840.
Disadvantage of all
new Coals at first.

Burdwan. Much judgment is therefore necessary in selecting samples for trial from new Coal Districts, when the object is to compare them with Burdwan Coal. Whatever Coal it has been customary to use, will always have the advantage of a new Coal in such trials, inasmuch as the form of the furnace, and the manner of keeping up the supply will be such as are suited to the old Coal, while the necessary experience is wanting with regard to the most favourable circumstances for burning the new.

If the draught of the furnace be too great for the Coal, the fire will burn down too rapidly, and the Coal will be wasted in an unnecessary quantity; and if not sufficient, the fire will burn too slowly, and the stoker, perhaps accustomed to throw in fresh fuel at certain intervals, will keep the fire choked, so as to require more frequent stoking than necessary, and (as Colonel Presgrave remarked on the late trial of Palamow Coal) every time the door is opened for this purpose, a volume of cold air enters, the effect of which is to lower the steam.

On board the Jumna steamer, 13th March 1840, three samples of Palamow Coal were tried, one furnished to Mr. Ravenshaw by Cazeer Mohumdee, mixed however with Chupree Coal, and the other two from Mr. Tytler; the first seemed to answer best, though evidently raised without judgment, and mixed with shale. The faults of this compared with the best Burdwan Coal were, that it required a much larger quantity to keep up steam, and that it ran into slags or clinkers, which choked the bars of the furnace. This last defect may have been owing to the Coal being mixed,* and perhaps would not have taken place had the bars of the furnace been wider apart. Mr. Tytler's sample from lower Miral appeared to burn very freely, but compared with the best Burdwan Coal, twice the quantity was required to keep up steam. On a third sample from Upper Miral being tried, it was found that even with an excessive consumption of the fuel, it could not keep the engine at full work. The value of these experiments will, however, depend on two circumstances, namely, whether the samples tried were the best that could be chosen, and whether the furnaces of the Jumna are as well suited to the nature of the Coal as any that could be constructed.

Miral Coal.

Mr. Ravenshaw thinks he could procure a contract for the supply of Palamow Coal at Dinapore for six annas per maund, it would therefore be of some importance to have the question of its quality fairly set at rest.

SOANE RIVER.

Soane River,
1841.
Dearee, or Chupree
Coal.

In a letter from Mr. Ravenshaw, Officiating Commissioner of Patna, to the Government of Bengal, dated 6th January last, that gentleman states that a Cazeer had found a bed of Coal at a place called Chupree, four miles from Dearee on the Soane, near its junction with the Cail, and estimated the expense of delivering Coal from this bed to Dinapore to be five and a half annas per maund. On this information 300 rupees were advanced to the Cazeer to enable him to commence operations; but after extracting 100 maunds, precisely similar to Palamow Coal, the bed is said to have assumed a slaty character, and the Cazeer abandoned his operations. If the Cazeer's statement regarding the existence of Coal so near the Soane be correct, the circumstances under which it occurs ought to be fully investigated. On some old maps a Coal Mine is marked in this vicinity, and judging merely from the samples produced by Mr. Ravenshaw, there can be little doubt of the existence of good Coal wherever those samples were raised.

* A small quantity of carbonate of lime or soda would have the effect of rendering the earthy parts of Coal fusible. We think in another trial of Mr. Ravenshaw's mixed Coal, we could easily select the pieces which formed slags from the general mass, as they are covered on the surface with an efflorescence of soda. We think they belong to Singra, one of the Palamow beds, and the peculiarity is probably very local.

ABSTRACT of the PROCEEDINGS of the COAL COMMITTEE, from May 1839 to May 1841.

At a Meeting of the Committee, held 23d May 1839.

Present:—C. W. Smith, Esq., President; Major Henderson, Major Forbes, Captain Johnston, and the Secretary. Proceedings.
May 1839.

1. CAPTAIN JOHNSTON informed the committee that the Marine Board, under the orders of Government, had authorised the despatch of 50,000 maunds of Cherra Ponjie Coal to Calcutta, and that funds for that purpose had been placed at the disposal of Mr. Loch. This is an object the committee had long been anxious to accomplish, with a view to give the coal a full trial.

2. The following announcements of discoveries of Coal were then made.

3. A discovery of a new bed on the island of Rambree, communicated by Captain Bogle, Commissioner of Arracan, together with several maunds of the Coal which is found on the bank of a navigable creek about six miles south of Rambree town. The Coal proved of excellent quality, but information is wanting as to the extent of the bed and facilities for working it. Hoong Coal,
Arracan.

4. A discovery of a new bed of Coal near the village of Mamloo, communicated by Mr. G. Loch. This bed is situated more conveniently with regard to carriage than the Cherra Ponjie Coal. Sylhet.

5. A specimen of Salt and Coal from Salt springs and Coal beds on the Dhunsiri river, in Assam, presented by Captain Jenkins. These specimens were found by Mr. Grange in his late expedition to the Naga mountains. The Coal now presented confirms previous indications of the existence of extensive beds on the banks of the Dhunsiri, which is a larger and more manageable river than either the Dihing or Dysung, on which valuable Coal beds were previously found. Assam.

6. In expressing the thanks of the committee to Captain Jenkins, for his long and constant endeavours in promoting its objects, the secretary was requested to consult him as to the measures he would propose for establishing depôts of Coal on the banks of the Bramaputra, supplied each with 20,000 maunds, for such public exigencies as might occur.

7. Mr. Pontet presented to the committee a series of specimens exhibiting a section of his excavation in search of Coal on the Burmany Nulla, about 30 miles west of Moorshedabad, at the southern foot of the Rajmehal hills. The specimens consist of Coal shale with impressions of Coal plants, and sandstone of the Coal measures, as well as clay ironstone. The excavation was carried to a depth of 40 feet, the first 23 feet being yellow clay with dark bituminous layers. Doo Bradgapore Coal.

The remaining portion of the excavation as follows:—

Thin seam of Coal	-	-	-	-	-	-	-	-	-	-	-	} So many layers alternating from the depth of 23 ft. to 40 ft. from the surface.
Shale containing plant impressions	-	-	-	-	-	-	-	-	-	-	-	
Hard shale without fossils	-	-	-	-	-	-	-	-	-	-	-	
Hard coarse sandstone	-	-	-	-	-	-	-	-	-	-	-	
Good Coal in thin seam	-	-	-	-	-	-	-	-	-	-	-	
Bituminous shale containing impressions of plants, particularly <i>Vertabraria indica</i>	-	-	-	-	-	-	-	-	-	-	-	
Hard bituminous shale with layers of sandstone	-	-	-	-	-	-	-	-	-	-	-	
Clay ironstone	-	-	-	-	-	-	-	-	-	-	-	
Hard sandstone	-	-	-	-	-	-	-	-	-	-	-	
Good Coal in thin seams	-	-	-	-	-	-	-	-	-	-	-	
Sandstone alternating with layers of shale	-	-	-	-	-	-	-	-	-	-	-	

8. Iron ore was announced as received from the Tenasserim provinces for trial, and a memorandum regarding it presented by Captain Johnston from Mr. Blundell.

June 1839.

A Meeting of the Committee took place at the President's Quarters, 3 June 1839, when the Members already enumerated attended.

Iron ores.

1. WITH a view of making experiments on the yield of the Tenasserim iron ore, alluded to in the 8th paragraph, proceedings of the last meeting, Major Forbes proposed that an application should be made for the sanction of Government to the erection of a smelting furnace in the vicinity of the Mint. Major Forbes conceived that by means of such a furnace, experiments on the comparative value of the different iron ores of the country could be made, and results of a practical nature obtained. The following are Major Forbes' remarks on this subject :—

2. "With a view to making experiments on the yield of the iron ores sent to the Mint, I have to request the approval of the committee for an application to Government requesting the requisite sanction for my constructing in the vicinity of the iron foundry attached to the Mint, a small iron smelting furnace, which can conveniently be worked, as regards blast, by the powerful blowing machines there erected, and driven, as circumstances require, either by a 14 or 40-horse power steam engine, at present used for the iron melting cupolas employed in making various descriptions of castings from pig-iron sent out from England.

3. "By means of such a smelting furnace, the comparative value of the pig-iron obtainable from the different ores of the country would be readily ascertained, and the pigs derived from them could immediately be rendered available; and such an examination of the country iron ores would obviously be advisable as the means of beneficially directing capital to the sites in which, with most certainty, profitable iron works could be established.

"Without so heightening the largest of the present Mint cupolas as to render it unfit for the purposes to which it has hitherto been applied, and for which it is required, the class of experiments alluded to could not be made, but for the purpose of large castings from pig-iron of any description, the kind of smelting furnace proposed (besides the making of pig-iron direct from the ores) would be serviceable. The cost of such a furnace, as shown by the plans and estimates subjoined, would be Co.'s Rs. 1,945. 10."

Meeting of the Coal Committee, held 5th August 1839,

August 1839.

Present :—C. W. Smith, Esq., President; Major Henderson, Major Forbes, Captain Johnston; and Mr. McClelland, Secretary.

Colonel Presgrave was prevented by indisposition from attending.

Tyroo Ghat Coal,
Assam.

1. THE secretary brought to the notice of the committee a letter from Captain Jenkins, dated 12th July 1839, which accompanied specimens of Coal found by Lieut. Brodie near Rungpore, at a place called on Pemberton's map, Teroogong, of which a description and analysis is annexed. Particulars of this discovery are to be forwarded hereafter by Captain Jenkins. The locality seems to be a little west of that from which the first Coal sent to Calcutta from Assam had been taken, which was a small branch of the Dysung river, called the Suffy. This seems to be the fifth locality in which Coal has been found under workable circumstances in Assam; and Captain Jenkins expresses a hope that a practical person, capable of opening mines and conducting all the necessary operations for the delivery of the Coal, may be sent into Assam, in order that a good stock of Coal may be provided on the banks of the Bramaputra for emergencies.

Hoong Coal, Arra-
can.

2. Captain Bogle, in forwarding to the committee a report from Lieut. Lumsden, in which the several localities where Coal has been observed at Arracan are enumerated, also observes that it is impossible to extract Coal from any beds in that quarter, unless the Government will send practical persons to conduct the necessary operations. Lieut. Lumsden's report makes us acquainted with the circumstances of the discovery of Coal south of the town of Rambree, which has been already adverted to; he himself only found the vein of Coal a foot in thickness, and commenced sinking a pit, but found the place so hot that he was obliged to trust the rest to a native, who, a few days after, brought to him 120 maunds of the Coal which Captain Bogle last submitted to the committee. Mr. Lumsden has seen this Coal used in a smith's forge, and finds it nearly free from pyrites (the general fault of former samples of Arracan Coal), although the blacksmith complains that it works badly, but Mr. Lumsden thinks it would answer for steamers, and also expresses a hope that the interest now excited in favour of Arracan Coal, will lead to some arrangements for its thorough investigation. Mr. Lumsden says two superintendents from Burdwan mines, with a couple dozen of miners, would set the matter at rest in one season.

3. Although it would be desirable that the committee should have more specific information regarding the precise localities of Coal, the thickness of the beds and their probable extent, together with the quality of the mineral in each particular locality, before recommending the adoption of any practical measures that might be attended with a weightier outlay

outlay than has hitherto attended the operations of the committee, yet it certainly appears necessary to develop the practical utility of the various indications of Coal that have been observed in different provinces, and that some steps should be taken by deputing practical persons for the above objects.

4. The difficulty of the committee consists in finding persons every way suited to the peculiar duties required. The members of the committee undertook to make inquiries and to communicate the result, so that after ascertaining the salary and qualifications of different individuals, their names might be submitted to Government, with proper recommendations. In the meantime, the secretary was desired to communicate to Captains Bogle and Jenkins, the intention of the committee to meet their wishes as much as possible.

5. Letters were read by Captain Johnston from Mr. H. Inglis, in reply to the Marine Board, stating that the want of practical superintendence of the mines at Cherra must cause a temporary suspension of operations, and prevent the possibility of providing by the end of the rains above half the quantity of Coal required, that is, 10,000 maunds; in consequence of the Coal having been excavated from the lower part of the precipice in which it occurs, all the superincumbent beds of clay and rubbish slipped down so as to bury it. It was suggested at the committee that a practical person should be sent up to Cherra to superintend the works, and Captain Forbes mentioned a Mr. ———, with whom he was requested to communicate.

6. With reference to the bed of Coal which Mr. Loch alludes to (June 1839, paragraph 4) as having been discovered below the village of Mamloo, about 10 miles west of Cherra, nothing has been heard since Mr. Loch left the Sylhet District; the secretary is therefore requested to communicate with Major Lister on the subject. Byrung Ponji.

7. Received from Captain Johnson, for perusal, an elaborate report of Mr. Tytler, announcing the discovery of a bed of Coal on the Amanath, near the village of Mirall, and close to Singra, the place visited in 1836 by Mr. Homfray. The bed is said to be of good quality and inexhaustible, six feet two inches in thickness. The specimen forwarded to the committee appeared to be a dull, slaty Coal. Captain Johnston was requested to convey the thanks of the committee to Mr. Tytler, who is employed under the orders of the Marine Board, as well as to communicate to the committee the result of Mr. Tytler's present inquiries into the facility with which the river Soane can be navigated; and the secretary was requested also to communicate with him on the subject of the Palamow Coal. Mira or Singra Coal,
Palamow.

8. Specimens of iron ore from Tyroo Ghat, in Assam, occurring along with the Coal, together with a sample of the iron manufactured from it, were submitted to the committee.

9. Also iron ores from Palamow, sent by Mr. Tytler, for which the Secretary is directed to return the thanks of the committee.

10. A report from Lieutenant Hutchinson, addressed to Mr. Blundell, and forwarded through Captain Johnston to the Coal Committee, was read. It relates to the specimens of anthracite received some time since from the Tenasserim Coast, which is proved by Lieutenant Hutchinson to be a detached nest of anthracite imbedded in clay, and of little value, further than as an indicator of larger beds, perhaps, in some part of the surrounding country.

11. Major Forbes presented an interesting specimen of the anthracite of Poltsville Mines, about 100 miles north-east of Philadelphia, to the committee.

12. Specimens of serpentine from the Punjab, forwarded by Mr. C. Masson, were then submitted, together with a specimen of flexible asbestos from Kanigoram, said to be a Coal locality, west of the Tokht Saliman range.

13. The secretary announced the sanction of Government to the erection of an experimental furnace for smelting native iron ores at the Mint, together with a disbursement of 250 rupees for the purchase of 500 maunds of Cherra limestone, as flux for the same.

14. Mr. Blundell, the Commissioner of Tenasserim, informed the committee that he has shipped on board the "Ganges" 40 tons of a coal recently discovered near Mergue, the expense of which to Calcutta will not exceed eight annas a maund, or 5½ annas at Mergue. The particulars regarding the discovery of the Coal in question have not yet reached the committee; but Mr. Hutchinson's report on the subject is said to be before the Government.

At a Meeting of the Committee, held on Monday, 9th September 1839,

Present:—C. W. Smith, Esq., President; Colonel Presgrave, Major Henderson,
Major Forbes, Captain Johnston, and Mr. McClelland, Secretary.

September 1840.

THE question, as to how far it is the duty of the committee to recommend the employment of practical men in opening Coal Mines in Assam and Arracan, was discussed, as well as the possibility of obtaining persons every way fit for such a duty, and who the com-

mittee could undertake to recommend. It was agreed that Mr. A. Landers should be recommended for Assam, where practical assistance appeared to be most required. Memoranda were then submitted to the committee on the trial of the following Coals by Captain Johnston:—

1. Samples of two Coals from Palamow, on the Amanath River, called Upper and Lower Miral Coal.

Both kinds burnt so slowly that it was impossible to keep the steam up from either, but mixed with Burdwan Coal, they answered very well. In a furnace with a better draught, Captain Johnston thinks either of the above Coals would answer. Captain Johnston next tried a sample from the same vicinity, also sent to Calcutta by Mr. Tytler as anthracite. This Captain Johnston found to burn when mixed with Burdwan Coal, but to ignite very slowly of itself. If the draught of the furnace in the river steamboats were improved, these Coals, Captain Johnston thinks, would become valuable fuel.

2. Captain Johnston then submitted a memorandum regarding Tenasserim Coal, to the effect that the Coal worked by Lieutenant Hutchinson is equal to the best Burdwan.

3. A third memorandum from Captain Johnston, stating that only one tender had been made to the Marine Board for the supply of Cherra Ponjie Coal at 12 annas per maund, and that with certain stipulations which could not be complied with; also that 8,000 maunds of that Coal is in course of being supplied to Assam, in consequence of the loss of the boats despatched with Burdwan Coal to that province.

4. A specimen of iron ore, found by Mr. Blundell two days' journey from the town of Tarsey, with every facility for water-carriage, was presented; also a specimen of lead ore from the banks of the River Salmeen.

Meeting of the Coal Committee, 7th October 1839,

October 1840.

Present:—C. W. Smith, Esq., President; Colonel Presgrave Major Henderson, Major Forbes, Captain Johnston, and Mr. McClelland, Secretary.

1. READ an extract of a letter from Mr. Jameson, assistant surgeon, announcing the existence of Coal formations along the foot of the hills, south-east of Umbala, and Mr. Jameson expresses his confidence of finding good workable Coal beds in that direction, which will, he considers, prove of the highest importance to the navigation of the Indus. Mr. Jameson is preparing a report on the subject for the Government.

2. A letter was read from the Government, in reply to the committee's recommendation of Mr. Landers; that gentleman is to be employed under the Commissioner of Assam in opening the Coal mines in that province.

3. Read a letter from Captain Jenkins, accompanying specimens of Coal found near the banks of the Dunsiri River, in a line nearly between Dezova and Chumakotee, in large quantities. The specimens are slaty and indifferent looking Coal.

4. Read a letter from Mr. Turner, in reply to queries on the manufacture of steel, and offering his service at 400 rupees a month. Mr. T. announces his having despatched specimens of iron used in the manufacture of steel, illustrative of the process.

At a Meeting of the Coal Committee, held at the President's Quarters, 4 November 1839,

November 1839.

Present:—C. W. Smith, Esq., President; Colonel Presgrave, Major Henderson, Major Forbes, Mr. McClelland, Secretary.

Coal west of Tyroo,
in Assam.

1. READ a letter from Mr. Brodie to Captain Jenkins, announcing the discovery of a new bed of Coal, a good deal west of Tyroo, and much nearer Deko. It has the advantage of being a Naga village; and Mr. Brodie thinks it is more than probable that we should be able to make contracts with the Nagas to convey it down to the river. He seems to think there are some places nearer to Diko still; but whether this be the case or not, says Mr. Brodie, "I look upon this Coal as the most valuable yet discovered in Assam, from its vicinity to populous villages, and the ease with which the Coal may be transported to the great river."

2. Read a letter from Mr. Goldie, executive engineer of Moorshedahad, to whom the committee referred on a former occasion, stating his inability to afford any information regarding the Coal discovered by Mr. Pontet, in the Rajmehal hills, as his duties do not admit of his leaving Moorshedahad.

3. Major

3. Major Lister's communications of 17th having been circulated in the Committee, it was agreed that the secretary should write to thank him for the information he had given, and point out that as Mr. Landers is now appointed for the special purpose of working the Cherra and Assam Coals, it may be in his power to instruct the Kassiahs in the art of mining, so as to render it unnecessary to send native miners to Cherra, as Major Lister suggests. No miners being available, the Committee were desirous of ascertaining whether military sappers and miners could be had if applied for; but found, on reference to Colonel MacLeod, the chief engineer, that there are none to be had; we must, therefore, trust to the success of Mr. Landers in instructing Kassiahs and natives of Assam in the art of mining.

4. With reference to the box of specimens stated to have been forwarded without address by Mr. Turner, as per custom master's receipt, 21st September 1839, the secretary was ordered to apply to the custom master of Quilon to know by what ship the package in question has been forwarded.

5. It was suggested by Major Forbes, that the remarks in Mr. Turner's letters regarding the manufacture of iron be collected and published. See Appendix.

At a Meeting of the Committee, held 9th December 1839,

December 1839.

Present:—C. W. Smith, Esq., President; Colonel Presgrave, Major Henderson, Major Forbes, Captain Johnston, and Mr. M'Clelland, Secretary,

PAPERS were read on the preparation of an artificial fuel which had been tried by Lieutenant Lynch, I. N. The fuel is composed of the charcoal of tamarisk wood, pounded and mixed with hot petroleum. The materials being both very common on the banks of the Euphrates, this fuel might be used probably with advantage in the navigation of that river.

2. The secretary was requested to ascertain the expense of making such fuel in Calcutta.

3. The following experiments on the Coal of Byrung Ponjie, and remarks by the secretary, were read, when it was ordered to send a copy to Major Lister and to enjoin careful examination of these beds by Mr. Landers.

4. Two specimens of Byrung Ponjie Coal alluded to by Major Lister in his letter of 17th October last, as forwarded to the Coal Committee by Dak Banghy.

This Coal, as stated by Major Lister, is within two miles of water carriage, with facilities for the construction of a road for hackeries to the pits. The beds are said to be from two to four feet in thickness. Byrung Ponjie Coal.

No. 1. Specific gravity, 1.3.						
Inflammable matter	-	-	-	-	-	- 34
Carbon	-	-	-	-	-	- 64.5
White ash	-	-	-	-	-	- 1.5
						100

Note.—One pound of this Coal was ignited in a table furnace and burned with a clear bright flame, caking very freely until the whole was consumed to cinders.

No. 2. Specific gravity, 1.28.						
Inflammable matter	-	-	-	-	-	- 25
Carbon	-	-	-	-	-	- 29
Earthy matter	-	-	-	-	-	- 46
						100

A. No. 2. Inflammable matter						
-	-	-	-	-	-	- 30
Carbon	-	-	-	-	-	- 50
Earthy matter	-	-	-	-	-	- 20
						100

Two pounds weight of this last specimen was found to burn slowly without caking, and left one pound nearly of cinders and white slaty ashes, &c.

5. The two last specimens were the same Coal; the first unadulterated with earthy matter, should be considered a distinct Coal, from a different bed, but Major Lister does not state whether there are two beds or only one.

6. These three specimens, taken as a whole, are not to be regarded as useless Coal, even for steamers; and from their locality, they might be had for a very low price indeed. Under these circumstances Major Lister ought to be written, and asked to employ Mr. Landers in a diligent examination of the place, and also in raising a few hundred maunds, or a few thousand, according as he might find the quality improve on working, and have it ready for transmission according to orders that might be hereafter sent to Major Lister, and in the mean time to keep us acquainted with his progress. Major Lister, it will be recollected, states in his letter above alluded to, that other beds of coal are spoken of in still more favourable spots; Mr. Landers should be enjoined to visit them, and endeavour to satisfy himself as to their value.

7. Major Lister, it will also be recollected, stated that until an improved method of working the Cherra Coal could be effected, he could not recommend any outlay for the improvement of the road. Now that he has Mr. Landers, he thinks he will be able to learn from him what improvements the working of Cherra Coal will admit of, and what chance of a better Coal being found below; and it is of importance that these points should be decided at once, so as to get something done between this and April with regard to Sylhet Coal.

8. A proposal, under certain stipulations, by Mr. C. B. Taylor, to supply Palamow Coal of good quality at Dinapore, was read and ordered to be submitted to the Government.

9. Read by Captain Johnston a paper on anthracite, by the owner of an anthracite mine in England; also an extract from the letter of Mr. Young to Captain Johnston on the same subject.

At a Meeting of the Coal Committee held at the President's Quarters, 10.30 A.M.,
Monday, 6 January 1840,

Present:—C. W. Smith, Esq., President; Colonel Presgrave, Major Henderson, and Captain Johnston, and Mr. McClelland, Secretary.

1. TEN maunds of coal received from Major Lister as a further sample of the produce of the new mine at Byrung Ponjie, at the foot of the Cossia Hills, alluded to in the proceedings of the last meeting, was received, and a portion of it tried* It appears to be an excellent light Coal, of the same quality as that of Cherra Ponjie, but somewhat more ferruginous in its appearance. It was agreed to offer the thanks of the Committee to Major Lister for this very encouraging sample of coal, and to inform him that in the opinion of the Committee, the sample appears to be well adapted for steam purposes.

January 1840.

2. The secretary, according to the two first paragraphs of the proceedings of the last meeting, reported that the charcoal of mangoe wood, the cheapest sort to be had in Calcutta, requires, when powdered, one-third more than its own weight of petroleum to convert it into the solid form of brick fuel, such as that proposed by Lieutenant Lynch.† The mixture, however, burns with a bright, clear, and durable flame. Petroleum in the Calcutta market is brought from Ava, and sells at 15 rupees per maund, which would make the artificial fuel too expensive, except in places where petroleum is plentiful, as on the Euphrates.

Artificial fuel.

3. Petroleum is, however, a production of Coal districts, and wherever it is found Coal may be also expected; and it is highly probable that extensive springs of petroleum on the Euphrates may be connected with equally extensive Coal measures in that quarter.

At

* The following are the results of analysis of this sample :

Specific gravity, 1.30.	
Inflammable matter - - - - -	51
Carbon - - - - -	42
Earthy and ferruginous ash - - - - -	7
	100 parts.

This, though from the surface, is a capital Coal, and being situated at the foot of the Cherra Hills, will be nearly 4 annas per maund less than Cherra, and consequently the cheapest Coal in India for use in the Bengal Provinces, if the bed proves sufficiently extensive to admit of being worked on a large scale. This there is every hope, will prove to be the case.

† Vide Proc. 9th December 1839, para. 1.

At a Meeting of the Coal Committee, held on Monday, 3 February 1840,

February 1840.

Present:—C. W. Smith, Esq., President; Colonel Presgrave, Major Henderson, Major Forbes; Captain Johnston, and Mr. M'Clelland, Secretary,

THE following Reports from Colonel Presgrave and Major Forbes were received regarding the quality of Major Lister's coal from Byrung Ponjie.

1. *Colonel Presgrave's Report, Cossipore Foundry, 29th January, 1840.*—Specimen of Major Lister's Coal received for trial from Mr. Secretary M'Clelland, 2 cwt. 2 qrs. 10 lbs., chiefly small and dust, kept up the steam of the 14-horse engine for 1 hour and 40 minutes; the Coal seems to be of good quality, but from its broken, dusty state, the sample afforded a less favourable result than it would otherwise have done. The same weight of picked Burdwan Coal kept up the steam in the same engine for 1 hour and 52 minutes. Byrung Coal.

2. One hundred parts by weight of Major Lister's Coal produced 68.75 of good coke, or in other words 2 lbs. of the Coal yielded 1 lb. 6 oz. of coke as per muster laid before the Committee; this is the only muster of country Coal that I have heard of as affording coke.*

3. *Major Forbes' Report.*—“The Coal sent by Dr. M'Clelland from Major Lister on the 14th January last for the Mint Master's opinion has been tried for a smith's fire, and a very good heat was taken by it; the Coal is very much like the steam Coal in use for steam vessels, and is the best country Coal I have seen, 1st February 1840.†

4. The secretary was requested to send to Major Lister an extract of this part of the proceedings, and to inform him that we are anxiously waiting for information regarding the extent of the mine, and the chance of getting large supplies of Coal from this very desirable locality.

5. The secretary was directed to write to Mr. Ravenshaw for further information regarding the Chuppre or Dearee Coal, and to Captain Jenkins and Major Lister regarding Lieutenant Lynch's method of making artificial fuel, and soliciting information from them as to the expense of making it on the spot where petroleum is found.

6. Captain Johnston exhibited a specimen of artificial fuel, regarding which he is to furnish information at the next meeting.

At a Meeting of the Coal Committee, held 9 March 1840,

March 1840.

Present:—C. W. Smith, Esq., President; Colonel Presgrave, Major Henderson, Major Forbes, Captain Johnston, and Mr. M'Clelland, Secretary.

1. It was stated by Mr. Smith, that Mr. Mills, the Commissioner of Cuttack, had undertaken to procure samples of the Coal recently brought to notice in that quarter, but that it would be attended with an expense of 200 or 300 rupees as travelling charges to the individual deputed, which the Committee would recommend for the sanction of the Government.

2. Captain Johnston read an extract of a letter from a friend in England on improved furnaces for burning anthracite, and promised an extract for the use of the Committee.

3. Read a letter to Major Lister from Mr. Landers, his assistant, stating, that the want of proper implements prevented him from ascertaining the extent of the bed of Coal at Byrung, and that there is also an inferior Coal found at Cbeela, another situation at the foot of the Cherra Hills. Mr. Landers states that he intends to submit a plan which will simplify the carriage of the Cherra Coal from the mine to the foot of the hills; and Major Lister observes, that if Coal be required this season, it will be necessary to obtain it from Cherra, and that Mr. Landers is only waiting the arrival of the necessary implements in order to commence operations. Major Lister is of opinion that no great difficulty would be encountered in constructing a bullock road from the Coal to the brow of the precipice, and again from below the precipice to water carriage, and converting the intervening space, about 1,000 or 1,500 feet, into a slide.

4. Major Lister also states, that Mr. Inglis, of Chatack, has found a new bed of Coal, at an elevation of from 1,500 to 2,000 feet, so convenient to water carriage, that a coolie can make five trips in a day; locality of the mine is above Choila, at a village called Mustuk. Mr. Inglis is of opinion that the Coal is quite as good as that of Cherra, and has already despatched a boat laden with it to Messrs. Fergusson and Co., Calcutta, to ascertain its market price. Discovery of Mustuk Coal.

5. Before

* Signed by Colonel Presgrave, Superintendent Cossipore Foundry.

† Signed by Major Forbes, Mint Master.

5. Before any expense is incurred in improving the road, the Committee think it ought to be clearly ascertained whether an equally good Coal cannot be obtained from either the Mustuk or the Byrung beds, which have the advantage of being nearer to water carriage, and consequently promise to yield cheaper supplies.

With regard to the 2d paragraph of the January proceeding, Colonel Presgrave suggested the advantage of making coke from these Coals on the spot, for the use of the Cossipore Foundry and the Mint.

6. Read a letter from Government enclosing extract of proceedings of His Excellency the Honourable the President in Council in the Political Department, under date 5th February 1840, by which the Committee learn that Lieutenant Hutchinson, Artillery, has been appointed to superintend the opening of Coal mines on the Great Tenasserim river in Mergue, and that he requires boring rods and pumps, which have already been granted, Major Forbes suggested that two small steam engines of 20 and 10 horse-power respectively, were available, and if necessary he proposed to fit either of them up at the Mint with pumps, &c., for lifting water. Mr. Blundell, however, says, that in the first instance he is desirous of avoiding expensive machinery, and the Committee are of opinion that as the Coal is within 10 feet of the surface, engines cannot be requisite, and that the bed may be worked like Crop Coal, i.e., sinking pits down to the Coal and raising it at once, then undermining on all sides as far as it is safe to do so merely with props; when the Coal is thus taken out the props are withdrawn, and the roof allowed to fall in. A new pit is then formed, and the same process continued.

7. Reports were received from Major Sage and Mr. Ravenshaw on the subject of Palanow Coal, and a new bed recently found within two coss of the Soane river, of which a sample had been sent to Calcutta for trial. These Reports to be further considered, and brought up again at the next meeting.

8. It was arranged with Captain Johnston that several new Coals should be tried on board the Jumna steamer on Thursday next.

April 1840.

At a Meeting of the Coal Committee, held at the Audit Office, Monday, 6 April 1840,

Present:—Major Henderson, Major Forbes, and Mr. McClelland.

Mr. Smith had left Calcutta for Chittagong, and Colonel Presgrave and Captain Johnston prevented by indisposition from attending.

1. THE secretary submitted a summary of what had been done in the Committee on the subject of Coal since the last general reports were drawn up.

2. Major Forbes stated that the cargo of new Coal from Mustuk despatched by Messrs. Inglis and Co. for trial, had arrived, and that the quality appeared to be excellent for smithery purposes, and that trials were now in progress as to its fitness for getting up steam.

Patchwary Coal.

3. Major Forbes pointed out in a Report on the Rajmehal Canal by himself and Colonel McLeod, dated 1st July 1832, some information regarding Coal in a most favourable quarter of the Rajmehal Hills, situated to the north west of Moorshedabad. The following is an extract from the Report alluded to:—"At the pass of Patchwary, 14 miles to the westward of Maishpoor, on the Bansli Nulla (which enters the Bhaugarutty above Moorshedabad, we are informed by Mr. Ward, the Commissioner of Boglepore, that there is a bed of sandstone with here and there specimens of a very excellent kind of Coal, which must abound in that part of the country, &c."

Cuttack Coal.

4. A letter from Mr. Mills, Commissioner of Cuttack, to C. W. Smith, Esq., announcing that Mr. Beetson whom he deputed at the request of the Committee to the Coal in the Gopalpashad district, near Talachergurb, on the Bhamini river, had found Coal of an excellent quality, which may be delivered at Hansoob, on the Coast, at 3 or 4 annas per maund, and from thence the conveyance to Calcutta would be 17 or 18 rupees per 100 maunds. Mr. Mills has authorised Mr. Beetson to send a trustworthy person to dig 100 maunds for transmission to Calcutta for trial in December next, which arrangement he hopes the Committee will approve of.

5. A letter from Mr. Landers to Major Lister was laid before the Committee, stating that he examined the Coal at Byrung Ponjie in various situations, within a circumference of four miles, and found in all the places an average of one foot of pure Coal and three feet of stiff black clay, with pieces of Coal intermixed. At one place the Coal appeared very good, but on being penetrated the inner parts turned out bad.*

* There can be no difference in the nature of the Coal composing the outer and inner portions of the same bed except such as arise from local causes not usually such as to destroy the value of the whole bed.

SUMMARY of the PROCEEDINGS of the Coal Committee from March till December, 1840. December 1840.

1. THE last meeting of the Committee took place on 6th April, when the secretary submitted the third Report of the Committee on the subject of Coal, which was approved, and ordered to be submitted to the Government.

2. Mr. Landers, a special assistant (to the Commissioner of Assam and the Political Agent of the Cossia Hills) for working Coal and iron mines, reports in a letter to Major Lister, that not one of the beds alluded to as Byrung Ponjie Coal, are workable, but sufficient details are not given by Mr. Landers to enable the Committee to satisfy itself on the subject.

3. Messrs. Fergusson Brothers, and Co., delivered, at the request of the Committee, 302 maunds of Mustuk Coal, on the part of Messrs. Inglis & Co., from a new mine near the foot of the Cherra Hills, to the following departments for trial:—The Mint, Cossipore Foundry, the River Steam Department. The Reports of Major Forbes, Mint Master, and Captain Wilson, Officiating Superintendent of Cossipore Foundry, on the quality of this Coal, are favourable, but that of Captain Johnston has not yet been received.

4. Major Lister writes, 28th April, he had then 10,000 maunds of Cherra Coal ready for dispatch, and at the same time transmits a memorandum exhibiting the heights and distances from the Cherra Coal bed to the plains, for the information of the Military Board. On the 3d of June, Major Lister commenced dispatching the Cherra Coal from the foot of the hills to Calcutta, and by the end of October had delivered upwards of 21,000 maunds. As this experiment was conducted by the advice of the Committee, it would be desirable that it should be made acquainted with the result both as to the out-turn of the Coal and the details of its expense.

5. Mr. Mills announced the dispatch of 150 maunds of Talcher or Cuttack Coal to the Committee for trial on the 21st of October last, the receipt of which may be daily expected.

6. In June last, the Committee received from Government Captain Wroughton's announcement of the discovery of several beds of Coal near the Village of Kotah, in Singrowly, which he hopes to be able to trace towards Burdee on the Soane river. The samples furnished of this Coal, consisting of five maunds, was reported by Major Forbes as inferior, not being burnable on a smith's forge,* but in the laboratory of the Honourable Company's Dispensary it was found to burn freely in a furnace with open bars below. Captain Wroughton has also forwarded specimens of the iron ores found in the vicinity of the Coal mines.

7. Dr. Spilsbury reports the existence of a fine Coal bed within nine miles of Jubulpore, from which the inhabitants of that station have been deriving fuel for some years past.

8. Captain Bogle reports the existence of several springs of petroleum and naphtha in Arracan, the latter particularly pure. Captain Bogle also furnished specimens of clay iron-stone, from which the Muggs manufacture their wrought iron, with samples of the metal in different stages of manufacture.

9. Captain Jenkins has announced the arrival of Mr. Landers in Assam, for the purpose of examining the Coal mines in that province, with a view to commencing to work them.

10. Reports on the above subjects, as well as on the information regarding the iron and other ores, communicated to the Committee, are now in course of preparation.

At a Meeting of the Coal Committee, held at the President's Quarters,
13 December 1840,

December 1840.

Present: C. W. Smith, Esq., President; Major Henderson, Captain Johnston, Captain Wilson, and the secretary.

1. In the proceedings of the Committee dated 9th March 1840, paragraph 5, it is stated that Major Lister in a letter dated 14th February, announces the discovery at Mustuk of a new bed of Coal, at an elevation of 1,500 or 2,000 feet, so convenient to water carriage as to allow of a cooly making five trips in a day, that Mr. G. Inglis is of opinion that the quality of the Coal is equal to that of Cherra, that he had already dispatched a boat load of this Coal to Calcutta with a view to ascertain its market price. The cargo was chiefly purchased by the Coal Committee from Messrs. Fergusson Brothers & Co., to whom it was consigned with the view to having it tried and reported on by the Controller of Steam Vessels,

Mustuk Coal.

* On further trial Major Forbes reports very favourably of the quality of this Coal. *Vide* paragraph 11, Proceedings for December 1840.

Vessels, the Mint Master, and the Superintendent of Cossipore Foundry. The Reports of the two latter have been received some time since, but have been kept back in expectation of receiving that of the Contoller of Steam Vessels, which has not as yet reached the Committee.

2. Major Forbes reports, after a trial of four days in a 20-horse power engine, that 27 maunds of Mustuk Coal is equal to 28 of Burdwan.

3. Captain Wilson, Superintendent of Cossipore Foundry, reports the result of his trials to be in the Cossipore engines that nine maunds of the Mustuk Coal is equal to 12 of Burdwan, and that the Mustuk Coal yields 50 per cent. of coke. English Newcastle Coal yielding 65 per cent. The Burdwan Coal yields none. The quality of the coke from the Mustuk Coal Captain Wilson considers to be superior to that of Cherra.

4. Captain Johnston informed the meeting that his Report would, when received, be equally favourable; and that the trial of this Coal had made such a favourable impression on his mind that he on the strength of it invited Messrs. Inglis and Co. to send in tenders for its supply to any extent.

5. In reply Captain Johnston was informed through Messrs. Fergusson Brothers, & Co., that Mr. Inglis would not enter into a contract, but would send his Coal down to market. Since this reply has been received Captain Johnston has heard from Messrs. Fergusson Brothers & Co., that the conveyance of the Coal from the mines to water carriage* is too expensive to admit of Mr. Inglis prosecuting his intention.

6. Under these circumstances it was agreed in consequence of the superior quality of the Coal, to consult Major Lister as to the course which it would be most advisable to adopt with the view of ascertaining the extent to which this Coal occurs, and the difficulties to be overcome in bringing it into use with as little delay and uncertainty as possible.

7. Reports were then presented regarding the quality of Mergue Coals.

The sample of this Coal sent for trial was damaged, having been exposed to inundations long enough to encrust each fragment with a deposit of mud. The sample was consigned to Captain Johnston, by whom it was distributed for trial.

8. Major Forbes reports—"This Coal had a very dirty appearance, as if it had lain in dirty or muddy water; when broken it had a pitchy appearance. As this coal was chiefly very small, in using it I had to add a quantity of water, to prevent as much as possible its falling through the fire bars. When the water was applied a snapping noise was given out, not unlike slacking stone lime, but rather louder."

Mergue Coal.

"On trial at the 14-horse engine it was found to burn free; the ash pit was particularly bright, and the flame of a white colour. The consumption, as compared with the best Burdwan, was 14 per cent. worse. The Coal appeared in burning to require the fire bars much nearer the boiler than the fireplaces of the Mint admit of, and which are particularly adapted for Burdwan Coal or for wood."

9. Captain Wilson briefly reports—"That the Mergue Coal is of a dirty appearance, and that, being small, a good deal of it fell through the grate of the furnace and was lost, and much of it mere slate. Compared to Burdwan it is inferior, 12 maunds of the latter being equal to 13½ maunds of Mergue Coal. On board a steamer 10 maunds of this Coal lasted three minutes less than one hour. Ranny Gunge, the best Burdwan Coal, lasting one hour and eight minutes.

10. Reports were then submitted from Major Forbes and the secretary on the quality of the Coal recently found by Captain Wroughton near the village of Kotah, in the district of Singrowly, about 50 miles from Chunar.

11. Major Forbes reports of this Coal as follows:

Coal, large rubble (muster only weighing 7.27½ maunds), and in good condition; form, rather slaty, and of a brown colour. When broken the fracture had the appearance of dull looking Kennell Coal.

Kotah Coal.

On trial, at the twenty (20) horse engine it was found to burn freely with a strong flame. The steam was kept up well during the time it was used, and judging from this and from the circumstance that the engine was worked two hours and a quarter with it, at an expenditure of about three maunds per hour, the average consumption of the best Burdwan Coal, I think it may be inferred that this Coal is equal to the best Burdwan Coal.

12. The secretary reports as follows—A maund of the same Coal was tried in the laboratory of the Honourable Company's Dispensary, 22d September 1840, and was found to

* The chief recommendation of the Mustuk bed is its proximity to water carriage. See Proc. 9th March, paragraph 4.

to burn very freely with a strong heat, leaving about 12½ seers of ashes. On analysis it affords the following results:

	Specific gravity, 1.29.	
Inflammable matter	- - - - -	54
Carbon	- - - - -	32.2
Ash	- - - - -	13.8
		100.0

13. The following reports on trials of a Palamow Coal from mines at Deeree, were next submitted. It must be remarked, that the sample of this Coal from having been sent down in bags, and subjected to rough usage on the way probably, was reduced in a great measure to dust, as any Coal would be under the same circumstances. Deeree Coal.

14. Major Forbes reports that this Coal was not in good condition, a great portion being dust. The following is the result of trial at the Mint for the 20-horse engine, "it was found not to keep the steam up, and after repeated stopping, from the steam being exhausted, other Coal had to be substituted. The Coal is much inferior to the worst Burdwan Coal."

15. Major Forbes' second report on the same is as follows:
 "The dust mentioned in the former report being rejected, on trial at the 20-horse engine, it was found to keep the steam well up, during the time it was used, namely, 2¾ hours, at a trifling excess of expenditure over the best Burdwan Coal."

16. The following is the result of analysis of a specimen of this Coal.

	Specific gravity, 1.62.	
Inflammable matter	- - - - -	37.6
Carbon	- - - - -	58.1
Ash	- - - - -	4.3
		100.0

17. Captain Wilson having tried a sufficient sample of the above Coal, reports that it is equal to Burdwan Coal for steam purposes and burns freely. On board a steamer 10 maunds of this Coal was found to last one hour, Rannygunge or best Burdwan lasting an hour and eight minutes.

18. Mr. C. B. Taylor informed the Committee that persons employed by him have found a bed of Coal at Rajhara, in the Palamow district. The bed is said to be seven feet thick under a sandstone of 40 feet, both circumstances coinciding with what has been stated before regarding the Mirall Coals on the Amanath. Mr. Taylor presented a specimen of the Rajhara Coal as well as a few specimens from another bed, two miles distant, which the secretary has not yet had time to analyse.

19. Mr. Taylor states, on the authority of his native miners, now in Palamow, that he could supply good Coal to any extent from that quarter, and all that prevents him from at once commencing operations is the fear of the Coal being left on his hands. The Committee agree to authorise Mr. Taylor to deliver at the public expense 200 maunds of Rajhara Coal at Dinapore, and if good to recommend its use on the part of Government to a certain extent, and on such terms as might appear fair and reasonable.

At a special Meeting of the Coal Committee which took place at Government House, in the presence of the Governor General, 6th January 1841,

Special meeting, January 1841.

Present:—C. W. Smith, Esq., President; Major Forbes, Captain Johnston, Captain Wilson, Members; Mr. McClelland, junior Member, and Secretary.

H. Inglis, Esq., Assistant to the Political Agent, Kasyah Hills, Visitor.

1. Mr. INGLIS described the road from the Cherra Coal Mine to the brow of the hill at Mahadeo, a distance of three or four miles, as capable of being rendered fit for carts. At Mahadeo there is a steep precipice (800 feet deep, and 2,400 feet in its inclined length) on which a slide might probably be constructed.

2. From the base of this precipice on the new line of road proposed by Major Lister, the descent is moderate and uniform down to the river. A zigzag road, Mr. Inglis states, might be made down the precipice to allow cattle and even elephants to be used.

3. His Lordship informed the Committee that an engineer officer had been ordered to Cherra, Lieutenant Yule, with instructions to examine the means of improving the old and constructing a new road where necessary, as well as to ascertain the value and relative position of the various beds of Coal in the neighbourhood, to water carriage.

4. With regard to water carriage, Mr. H. Inglis stated, that the commissariat rates of 24 rupees per 100 maunds were now being paid by the Government for the delivery of Cherra Coal in Calcutta (not inclusive of demurrage) but he submitted a memorandum to show that, by constructing their own boats, 20 or 500 maunds each, the Government could deliver their Coal in Calcutta at 18 rupees per 100 maunds, being a saving of 6 rupees per 100 maunds.

5. Mr. Inglis stated that the boats would cost 500 rupees each, and with slight repairs would last 10 years, making three trips each year with 500 maunds of Coal, and although the boats would generally have to return empty, yet occasionally ordnance stores, &c. could be carried by them when, necessary as far to the eastward as Gowahatti, or to the northward as Bauleah, the limits on the great rivers to which it is safe to entrust Sylhet boatmen.

His Lordship saw no objection to this arrangement, particularly as it was stated that the Government had at one time a lime agency in the same quarter, with 50 boats of their own, to bring down the lime to the Presidency.

6. In reply to a question by his Lordship, Mr. Inglis considered Bauleah on the Ganges as equal in distance to Calcutta with regard to the delivery of Cherra Coal, and that its cost (from 8 to 9 annas per maund) would be the same at both.

7. His Lordship inquired of Captain Johnston the present rate at which Burdwan Coal is delivered at Bauleah or Surda, and finding that Cherra Coal could there be delivered at two or three annas per maund less, suggests that future supplies of Cherra Coal should be carried partly to Bauleah, with a view of supplying the river steamers at a cheaper rate than at present.

8. In consequence of the want of ground to land the Coal on its arrival at Calcutta complaints have hitherto been frequent on the part of the Sylhet boatmen, arising partly out of their detention until ships were procured to receive their cargoes, and partly out of the mode of weighing, by which deficiencies were made to appear, and charged to the boatmen.

9. To remove such causes of complaint in future, Captain Johnston explained that a piece of ground has now been procured to receive the Coal immediately on its arrival, and that every facility will be afforded in future for the prompt discharge of the boats. It was also stated that Major Lister, or his assistant Mr. Inglis, might have a sircar in attendance on the part of the boatmen to see the Coal weighed, and that the boat people be not exposed to any unnecessary delay at the ghat.

10. It was decided, under these arrangements, that Major Lister should send down to Pandua, as much Cherra Coal as he can, and continue to dispatch it to Calcutta and Bauleah to the extent of tonnage he may be able to procure, provided the expense of delivery at either place does not exceed the rate at which the 20,000 maunds were delivered in Calcutta during the last season, including every expense.

11. Mr. Inglis having stated that the timber for the new boats could not be had before the next rains, it was ordered that boats should this year be hired and his Lordship hoped that in 1842 the Coal would be brought down in Government boats, as proposed by Mr. Inglis, which would lessen the price materially.

12. With regard to Mergue Coal, his Lordship remarked that its freight to Singapore and Penang is as high as from Calcutta to either of these places, viz., about 20 rupees per 100 maunds, and is desirous of knowing how this can be remedied, and what the nature of the coast trade may be on the southern parts of the Malay Peninsula. Vessels passing up the bay for cargoes in Calcutta calling at Mergue, would cause a detention of about four days, without including the delay of taking in the Coal, as for instance, 200 tons which might be shipped in from one to two days, according to the facilities afforded.

13. Letters were directed to be written to Arrakan and Cuttack, regarding the Coals of those districts. It was stated that the sample of Cuttack Coal, which Mr. Mills promised to forward to the Committee in November, had not arrived.

A letter was directed to be written by Major Forbes to Mr. J. Erskine, to know the rates at which he would undertake to supply the depôts at Cutwa and Berhanpore with Adji Coal.

14. It was stated that a letter had been written to Mr. J. Pontet, regarding the Rajmehal Coal, of which he supplied about two years since some very interesting information.

15. It was directed that Captain Smyth, executive superintendent of the Nuddyah rivers, should also be requested to repair to the sites of the Coal beds in that quarter, and if possible to make such inquiries on the spot as should determine the possibility of obtaining good Coal in sufficient quantity for supplying the steamers in that quarter.

16. It was directed that a letter should be addressed to Captain Wroughton, with a view
of

of ascertaining the latest results of his operations, particularly with regard to the feasibility of establishing a Coal depôt for steamers in the neighbourhood of Chunar, from his discoveries in the Mirzapore Hills.

17. His Lordship then expressed his wish to see something done regarding metallic minerals, and particularly to see some results from the reduction of iron ores in the new furnace recently erected at the Mint. Major Forbes informed his Lordship that the furnace was not yet quite ready, but would soon be in a state to commence experiments.

18. A circular was directed to be sent to the different functionaries, regarding such ores as may be known to exist in their districts, and the native method and purpose of using them.

19. Letter to Colonel Cubbon should be written, requesting him to send samples of chrome ore from My-ore.

At a Meeting of the Coal Committee, held at the General Dispensary, Monday,
11th January 1841,

Special meeting,
January 1841.

Present:—C. W. Smith, Esq., President; Major Forbes, Captain Johnston, Members;
and the Secretary,

A LETTER from Major Carter to Major Henderson, member of the Committee, dated 13th October, was read, and that portion of it relative to the price of building boats particularly noticed—the amount for 500-maund boats being stated to be from 150 to 80 rupees per boat.

2. A paper on petroleum and other subjects connected with the objects of the Committee, was submitted by the secretary, as having been some time previously drawn up by him as the result of correspondence on the subject to which it relates, and circulated in the Committee, but not before entered on their proceedings. (*See Appendix.*)

3. Reports on the trial of different Coals alluded to in the Proceedings of the Committee for December 1840, and a second report on the Mergue Coal. An artificial fuel made up by Mr. Fisson, of coal-dust, mud, and lime, was found to keep up steam very well; but its cost is equal at least to that of Coal.

4. Ten maunds of Dearee Coal were next tried and lasted an hour, producing in that time 1,180 revolutions.

This Coal, Captain Johnston concluded, would not of itself answer for internal navigation, where it is necessary to have spare steam at command to make head against the river currents; but he proposes to try it, mixed with English Coal. The Committee, as an amendment to this proposal, have suggested Cherra Coal instead of English for the mixed fuel, as it may be delivered at Bauleah as reasonably as in Calcutta. From Bauleah it might be transmitted up to Dinapore at a very small additional expense, and there mixed with the Dearee Coal; and if found to answer, two new Coals would at once be brought into use, doubtless at a considerable saving upon the present rates of Burdwan Coal in the higher depôts on the Ganges. In all the Coals yet discovered on the western side of the Hooghly (the Nerbudda Coals only excepted), the bitumen occurs in small proportion compared with the carbon; while in Cherra, and all the Coals hitherto found to the eastward, the bituminous property predominates. Hence the former Coals burn without becoming soft and plastic, while the latter melt, and all the fragments unite together and cake.

It is therefore probable that a mixture of Cherra Coal with that of the less bituminous beds of Palamow would afford cheap and good supplies for inland navigation.

5. The results of Captain Johnston's trials of Dearee and Mergue Coals are valuable in connexion with the trials and remarks of Major Forbes and Captain Wilson on the same subjects, recorded on our proceedings for last month.

6. A letter from Captain Jenkins was read, giving cover to a letter from Mr. Landers, his special assistant for mining, to Lieutenant Brodie, principal assistant.

7. The following is a copy of the letter alluded to:—

“ To Lieutenant *T. Brodie*, Principal Assistant Commissioner of Assam.

“ Sir,

“ Am sorry to inform you, that sickness has obliged me to return to Seesagur, consequently my stay in the Naga Hills was but short; but, during that time, I visited what was pointed out to me as being two distinct stratas of Coal lying under each other, both situated halfway up the Namsany Purbut. The upper strata is six feet high, clay forming the roof and bed; it dips due south at angle of 40 degrees, the valley at that of 30 degrees; the Coal thereby burying itself prevented me from tracing it beyond 100 yards; but, from what I saw of it, am certain that it could be easily worked at a very trifling expense. The present road,

although easy, is long, but a footpath could be cut through the jungle, and would reduce the road to one mile and a-half.

"The under or supposed strata turned out to be nothing; it was merely the Coal worked from the upper strata, and formed into something like an outburst of a new Coal vein.

"Another Coal measure was pointed out to me on the very top of the Namsany Purbut, bearing due south from the above, but too far inland to be of any present use; but as to its probable extent, am sorry I cannot give you any information, as my sickness prevented me from visiting it.

"I have much pleasure in informing you, that I have found pieces of limestone all along the bed of the Deko river above the first rapid; also small pieces in a mountain stream immediately below the Coal strata mentioned in paragraph 1st. From the position in which I found the specimen below the Coal, am certain the main rock cannot be far distant. I shall forward the specimen to Captain Jenkins.

"With your permission, I shall proceed to Jeypore first, as soon as Mr. Furnell permits me, and finish the survey around Jeypore, Borchauth, and return to the Naga Hills by Teerogong; I shall then have time to examine the Namsang Purbut minutely.

"Seesagur, 29 November 1840.

"I have, &c.
(signed) "A. H. Landers.
"Special Assistant to Commissioner of Assam."

Probably the two Coal beds alluded to by Mr. Landers are those brought to notice near Joorhath, about two years ago, by Captain Jenkins.

8. Read a note by his Lordship the Governor General, appended to the draft of the proceedings of the last meeting, earnestly requesting the Committee to prepare for the public a statement of all the facts that have come before it, and the researches now in progress; also to lay down a series of stations for Coal depôts on the Burhampooter, stating the nearest points from which they may be supplied, as well as a similar series of depôts, &c., for steam communication with Moulmein, Noacolly, Dacca or Sylhet, Ramree, Amherst, Mergue, &c.

9. With regard to the Burhampooter, the secretary was directed to communicate with Captain Jenkins, and to suggest that Mr. Landers might be employed in raising Coal for the supply of depôts in Assam, from some of the most convenient Coal beds in their vicinity, rather as an experiment in the first instance; and the secretary was requested to prepare an abstract of the proceedings of the Committee, to be published together with the Reports, to the extent of 250 copies, for gratuitous circulation to the correspondents of the Committee.

10. A letter from Mr. Turner on making charcoal was read, together with a letter from Lieutenant Hutchinson regarding the operations carried on in the Mergue Coal-mine; also extracts of a letter from Captain Bogle.

11. Captain Bogle's letter was accompanied with a sample of good Coal from a place situated only four or five miles inland from the town of Ramree; unfortunately, the intermediate country between the coast and the coal is hilly and difficult, but Captain Bogle hopes that the measures adopted by Captain Williams will lead to the discovery of equally good beds in some more convenient situation.

12. A Report from Major Forbes on the quality of a sample of Coal received from Messrs. Gilmore and Co, was then read, but the owners decline to say where the Coal, which appears to be very superior, has been found.

February 1841.

At a Meeting of the Coal Committee, held at the Honourable Company's Dispensary,
Monday, 8th February 1841,

Present:—C. W. Smith, Esq., President; Major Forbes, Captain Johnston, and Captain Wilson, Members; J. McClelland, Secretary.

Mixture of Cherra
and Palamow Coal.

1. WITH a view of submitting to extensive and decisive experiment the fitness for purposes of internal steam navigation of a mixture of equal parts of Palamow and Cherra Poonjee Coals, it was agreed that Major Sage should be requested to send down to Calcutta at least 300 maunds of best Dearee Coal, received from Mr. Ravenshaw, and which might be delivered at a very reasonable rate compared with the present prices at Dinapore. This Coal is too carbonaceous, according to the result of experiments in ordinary furnaces, to keep up steam of itself, but when mixed with an equal proportion of Cherra Poonjee Coal, it may then answer all the purposes of a useful fuel; and as Cherra Poonjee Coal itself may be delivered as high up the Ganges as Bauleah, at a considerable reduction on the present prices of Burdwan Coal, it may still be carried higher up to Dinapore at a proportionably reduced rate, where its admixture with a still cheaper Coal might render its use very important.

With a view to the great interest of the subject, it was decided by the Committee that equal portions

portions of the Palamow Coal, on its arrival, should be distributed to the Mint, Cossipore Foundry, and the Steam Department, together with equal portions of Cherra Coal, and that the heads of these departments be requested to try the two Coals mixed together, and furnish the Coal Committee with separate reports of the result.

2. It has recently been discovered that 2,835 maunds of Adji Coal, delivered by Mr. James Erskine of Panamooky, on account of the Coal Committee at Cutwa in 1837, although condemned at the time as unfit for use, has been since quietly used on board the steamers by the contractor, for Burdwan Coal.

The contractor should be called upon to refund to the Committee at least the sum advanced for this Coal, at four annas per maund, its actual cost (Rs. 708. 12. 0.); and as he charged it to the Government at 9 annas 4 pies, the price of Burdwan Coal at the time, he would still have a clear profit of Rs. 949. 12. The mistake, considered as an experiment, is very favourable to the Adji Coal.

3. The Secretary will write to Captain Johnston, requesting of him to recover and transmit to the Committee the sum paid by the Committee for the Coal in question.

4. Read a letter from Mr. C. B. Taylor, offering to supply a sample of Rajhara Coal for trial, provided the Committee will agree to pay the expense, which Mr. Taylor seems to think will be considerable. The Committee desired Mr. Taylor to be informed that they had supposed the Coal alluded to to have been more conveniently situated than would now appear to be the case. Having already agreed to pay any fair reasonable demand (under 12 annas per maund) for a sample of 200 maunds for trial, the Committee decline to enter into any definite engagements on the subject.

5. Specimens of Coal received from Assam, supposed to be from the west bank of the Dikoo, but without particulars being communicated, were submitted to the Committee; also a letter from Captain Jenkins, enclosing one from Lieutenant Brodie, stating that the Coal alluded to in Mr. Landers' letter (*vide* paragraph 7, Proceedings for January 1841) is the same as that before found by Mr. Strong.

6. Major Forbes informed the Committee that he would supply the result of a trial of Oram's artificial fuel; and the President presented two specimens, with a memorandum from Mr. Fisson regarding a similar invention of artificial fuel from Slack Coal.

7. The secretary was requested to write to Captain Jenkins and Major Lister for the result of their experiments on the manufacture of fuel from charcoal and petroleums, and also to Captain Bogle for information as to the existence of limestone at Arracan.

8. A letter was read from Mr. Pontet, stating that he expects soon to be able to communicate further information regarding the existence of Coal at Beerbhoom.

9. An interesting communication from Lieutenant Ouchterlony was read, in which he proposed to transfer to the Government a Cornish miner and mining implements. The Committee have strongly recommended to Government that the miner be employed, and such part of the implements purchased as may be considered indispensable.

10. An official correspondence regarding the discovery of Coal at Port Natal, in South Africa, was received from the Government, originating in the publication of "Notes on South African Affairs, by Mr. Boyce," and the "Notices of the Cape and South Africa," in the "United Service Journal," January 1840, by Major Charters, R. A. The following extract is from Mr. Boyce's Notes: "Coal is found in the Sand river, between the Great and the Little Ingola river; and at the Blue Krans river (Natal country) we dug up some near the road between the Ingolas, of which I brought home with me a small quantity. This was taken from near the surface, and proves on trial to be Coal of second or third rate quality. We also found a small piece of Coal on the shore, about a mile east of the entrance of the Bay of Natal, but this might have been washed on shore from some vessel; however, there is no doubt but the country in the vicinity of Natal produces abundance of this valuable article." The following is from Major Charters' notice: "I have seen Coal of an excellent quality (not the recent Coal, which so often deceives the inexperienced, but that belonging to the true Coal formation) which had been brought from the second river on the western slopes of the Quath Lamba." Coal at Port Natal.

11. Captain Sir J. Alexander, who brings these statements to the notice of Government, adds: "I have just seen Major Charters, and he informs me that the Coal which he saw at Natal was shown him by the Rev. Mr. Archbell, a very respectable Wesleyan missionary, who himself found it *in situ* at the said river before mentioned; the emigrant Booro also told the Major that they used it constantly in their forges, and that the road to it from the port is good, and extends through very fertile country; the Coal was as good as the best English Coal, and not lignite or wood Coal."

12. Captain Johnston informed the meeting that he wished for the attendance of the Committee on board a steam-vessel on Saturday next, to try a Coal submitted to the Government for sale by Mr. Homfray, the locality of which the owner is desirous of keeping a secret. It was agreed that the Committee meet for the inspection of the above Coal on Saturday next, the 13th February.

TRIAL of COALS on board the "Enterprise" Steamer, on Saturday, 13 February 1841.

Present:—C. W. Smith, Esq., E. A. Blundell, Esq., Captain Johnston, and Mr. McClelland.

1. Tenasserim Coal.—The fires being low, and steam down, this Coal introduced, and in five minutes the steam-gauge rose to 2 lbs., the engines, at full work, making 34 revolutions; $3\frac{1}{2}$ maunds lasted 45 minutes, and left 16 per cent. of ashes.
2. Mr. Homfray's Coal.—This Coal was tried at a quarter before 12 o'clock, and the trial persisted in till half-past 12, being three-quarters of an hour, during which time the engines were almost motionless. The ashes of 1 maund and $31\frac{1}{2}$ seers of the Coal which was used amounted to 15 per cent.
3. Ramree Coal, Koeng Dyeng.—Eight minutes before one o'clock, this Coal was added to the fire; the steam immediately after rose, and the engines worked at 34 revolutions, steam gauge indicating the highest pressure, and still steam blowing off, when it was thought necessary to become more sparing of the fuel; thus three maunds lasted 58 minutes, the engines making from 30 to 35 revolutions. The ashes were then collected, and found to weigh only $3\frac{1}{2}$ seers, or about $1\frac{1}{4}$ per cent.
4. Second variety of Ramree, or Hoong Coal.—Three maunds of this Coal lasted 40 minutes, and left about 15 per cent. of ashes; steam-gauge low, and the engines below their work, and stopping occasionally for want of steam.
5. Kingtellie Coal, from Arracan.—This was a heavy, earthy Coal, which was found incapable of keeping up steam, while it left half its weight of ashes.
6. Cherra Coal was then tried, but the trial was not attended to; three maunds left $12\frac{1}{2}$ seers of ashes.

The following is a statement of the different Coals tried, in the order of their respective value:—

1. Ramree Coal, Koeng Dyeng	-	-	-	-	}	Note. — These results might be different in boilers with a greater draft than that of the boilers of the "Enterprise."
2. Cherra Poonjee	-	-	-	-		
3. Tenasserim	-	-	-	-		
4. Second variety of Ramree Coal	-	-	-	-		
5. Mr. Homfray's Coal, locality not stated	-	-	-	-		
6. Cap Island (Arracan) Coal	-	-	-	-		

March 1841.

At a Meeting of the Coal Committee on the 8th March 1841,

Present:—C. W. Smith, Esq., President; J. McClelland, Esq., Junior Member, and Secretary,

LETTERS were read from Captain Bogle, announcing the dispatch to Captain Johnston of 90 or 100 maunds of the Kingtellie Coal, situated on the seacoast, about 20 miles west of Sandoway, for trial. This proved to be a heavy, earthy Coal, and yielded half its weight of ashes. This Coal has been recently re-discovered, but, we regret to say, without any additional information regarding the natural or geological history of the bed, or topography of the place, to prevent every new-comer at Kingtellie announcing the existence of this Coal as a new fact, and, finding it not to be so, giving up all further interest in the matter.

Koeng Dyeng.

2. A sample consisting of Coal from the western side of Ramree island, at a place called Koeng Dyeng. This Coal is found four miles from the western beach, and only about one mile from a river navigable for small boats from its mouth to the above distance from the hill in which the Coal is found; three maunds of this Coal, tried on board the "Enterprise" steam-vessel, 13th February 1841, in the presence of Captain Johnston and the president and the secretary of the Coal Committee, proved superior even to Cherra Poonjee Coal.

3. A second variety of Ramree Coal, from a place called Hoong, was also tried on board the "Enterprise" steamer, and found to be a very fair Coal (*vide* Report 13th February); the locality is described to be a few miles south of the town of Ramree (*vide* Report on Arracan Coal, 1840); but Captain Williams now announces the existence of Coal south as well as north of Hoong, from which he has been requested to send 1,000 maunds to Kyouk Phyu for dispatch to Calcutta for trial, also 1,000 maunds from Muggee or Paget Island.

4. Captain Williams also states, that the Coal darogah has produced samples of Coal from Aeng, one of the divisions of Kyouk Keung.

5. A sample of Coal, together with the following account of it, has been received from Dr. Hinton:—"At about three miles to the southward of the northernmost part of the island of

of Ramree are two islands, connected with each other and the mainland by ridges of sandstone rock visible at low-water; the largest and outermost is called Saddle Island, the other was named Cap Island; both of them are chiefly composed of sandstone of different degrees of density and colour, with many shells, fossil plants, and branches of trees imbedded in it. On Cap Island, which is about a mile in circumference, a bed of Coal lying in slate-clay, and pointing nearly due west, so as to impinge upon the Saddle Island is readily distinguished, and in the opposite direction points with a slight curve towards the mainland. Here Colonel Hervey found the sample of Coal forwarded by Dr. Hinton, and pointed out its value to the natives; the bed appears to be situated below the influence of the tides, and is probably that which was discovered 10 years since by Lieutenant Foley, opposite to Kyouk Phyu Harbour, and found to be too sulphureous for use. Cap Island Coal.

6. With regard to the 9th paragraph of the Committee's Proceedings for February 1841, a letter from Government (No. 162, dated Fort William, 3d March 1841) was received, directing the secretary of the Coal Committee to enter into communication with Lieutenant Ouchterlony regarding the valuation and purchase of the mining implements therein referred to, and also informing the Committee, that the person brought by Lieutenant Ouchterlony to India as a miner, will be employed on the part of Government at Ramree or Sandowy.

A sample, consisting of 150 maunds of Cuttack Coal, being announced as received at the Mint, it was suggested that measures should be as soon as possible adopted for its trial, and that receipts should invariably be taken from the Mint, Cossipore, and Steam Departments, to which large samples of new Coals may in future be transferred for trial, to enable the Committee to know what samples they have on hand for trial, and how to account for them.

7. Read a letter from Dr. Cantor, accompanied with a specimen of Coal from a mine, situated within the walls of the city of Canton. Large supplies of this Coal are stated by Dr. Cantor to be used by the Chinese, although the English prefer Newcastle Coals whenever such are attainable. The existence of abundance of Coal in China has been recorded, Dr. Cantor observes, by Marco Polo, Du Halde, Abel, and lately by Mr. Davies. Canton Coal.

8. Read a letter from Captain Jenkins, stating that he has requested Mr. Landers to forward information of the result of his operations in Assam, and in future to supply quarterly reports of his proceedings for the information of Government. The Committee think that monthly reports should be furnished by Mr. Landers to the local authorities in Assam, in addition to the quarterly reports required by Captain Jenkins for the information of the Committee and of Government.

9. Read a letter from E. W. Blundell, Esq., Commissioner of the Tenasserim Provinces, announcing the discovery of Coal on our northern frontier within five days' journey of Moulmein. Mr. Blundell at the same time presented specimens of the mineral, which appears to be similar to that found at Mergue. The spot where the Coal occurs has not as yet been visited by Europeans. Mr. Blundell also presented specimens of iron ore from the same quarter.

10. A letter from Colonel Cubbon, announcing the dispatch of specimens of chromate of iron.

11. And from Mr. Erskine, proposing to supply 10,000 maunds of Adji Coal, next rains, at 6 annas per maund, delivered at Cutwa, and stating receipts for the delivery of 2,835 maunds of Adji Coal at Cutwa in 1837, on account of the Coal Committee (*vide* Proceedings, March 1841, paragraph 3), have been forwarded to Captain Johnston, to enable him to recover the value of the same.

At a Meeting of the Coal Committee, held 5th April 1841,

April 1841.

Present:—C. W. Smith, Esq., President; Major Forbes, Captain Johnston, and Captain Wilson, Members; and Mr. J. McClelland, Secretary,

A COMMUNICATION from Captain Jenkins, announcing the discovery of extensive beds of Coal close to the extreme end of the Caribari Hills, near the Burhampooter, at the exit of the river from Assam: a small sample of doubtful quality was first sent to Captain Jenkins, which led to the discovery of highly bituminous and good Coal, of which samples may shortly be expected.

The secretary was directed to present the thanks of the Committee to Captain Jenkins for this very interesting communication, and to inform him that the Committee is anxiously awaiting further particulars as well as samples of the Coal, and could wish to receive a sketch of the locations.

2. Communications were received from Assistant Surgeons Hinton and Spry regarding the Coal alluded to in the 5th paragraph of the Proceedings of the Committee for March 1841, and as might be expected from the account there given of Cap Island Coal, the communications in question render its use very doubtful in consequence of the very thin detached

beds in which it occurs at the surface, and the difficulties of any attempts to reach a workable bed, owing to the highest crops being scarcely raised above the level of the tides. Excavations in search of Coal were in progress on Ramree opposite to Cap Island, where indications of Coal were observed, but without any immediate prospect of success. As arrangements have recently been made to send a miner to Arracan, the Committee recommend that a sum, not exceeding 500 rupees, should be placed at the disposal of the Commissioner, Captain Bogle, to meet the expense of his commencing operations at Koeng Dyeng, on the western coast of Ramree, where the sample of Coal marked x, alluded to in Captain Bogle's letter to the controller of steam-vessels, was found (*vide* Proceedings of Committee, 8th March 1841, paragraph 2), and which (*vide* Report of Experiments, 13th February 1841, paragraph 3) proved to be of superior quality.

In consequence of the confusion arising from the practice of forwarding samples of Coal from various districts in Arracan, by ship conveyance, with paper tickets, which are lost or obliterated, the Committee will recommend wooden labels to be tied to each sample.

Adji Coal.

With regard to paragraphs 2 and 3 of Proceedings, 8th February 1841, Mr. Erskine writes that he has forwarded to Captain Johnston receipts of the Coal agents in charge of the depôts at Cutwa for 3,835 maunds of Adji Coal, delivered to them on account of the Coal Committee in 1837. Captain Johnston informed the Committee that he has no doubt the Coal in question was used by the contractors on board the steamers, but that it will be difficult now to obtain an account of it, though he will make every endeavour so to do. Mr. Erskine will, during the ensuing rains, be ready to supply Adji Coal at Cutwa at six annas per maund, higher stations at an advance, according to the boat-hire. A sample, consisting of 10 maunds, has been forwarded to Captain Johnston for trial. Major Forbes suggested that samples of less than 40 maunds are unsatisfactory, and it was agreed to request Mr. Erskine to send 200 maunds to the Cossipore Foundry, from whence the proper quantities for trial are to be at once issued to the several departments, 30 maunds to each.

4. With regard to the sample of Cuttack Coal alluded to in the 7th paragraph of the Proceedings, March 8th, it was arranged that 30 maunds should be issued for trial to each of the following establishments:—

The Mint.
The Steam Department.
Cossipore Foundry.
General Dispensary.

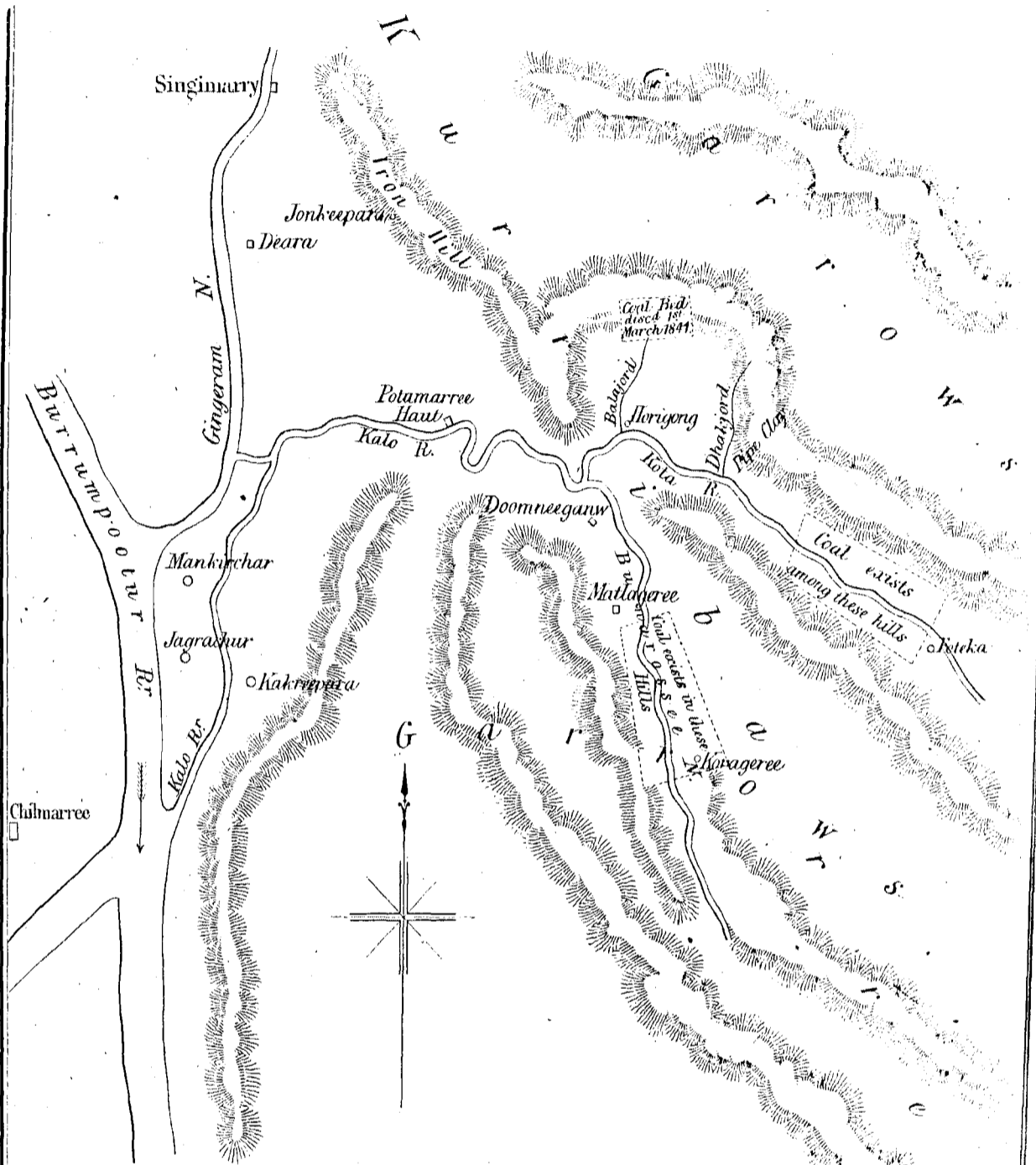
5. Read a memorandum from Captain Johnston, to the effect that Major Lister had dispatched 4,000 maunds of Cherra Coal to Dinapore, at Rs. 63. 12. per 100 maunds. This is particularly important, as exhibiting not only the rate at which the Cherra Coal may be delivered at Dinapore, but that the Sylhet boatmen have no objection, as has been alleged, to going higher up the Ganges than Bauleah; and although the rate is high, still it is less than that now paid at Dinapore for Burdwan Coal; and if the mixture of Cherra with the best description of Palamow and Soane Coal will answer for steam, a cheap fuel will thus become available.

6. Read a letter from Mr. James Pontet, forwarding a sketch-map of the situation and extent of the beds of Coal near Doohragepore, on the Burmany river, west of Moorshedabad, and at the same time remarking that want of time and experience prevents his doing more this season, and that he is more than ever convinced that it would be worth while to send a person who has been in the habit of tracing Coal beds, in order to examine the district.

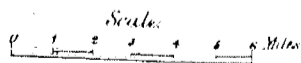
Iron ore.

7. Major Forbes read a Report on preliminary experiments performed at the Mint on Adji iron ore, with a view of ascertaining the proper proportion of ore and limestone for experiments, on a large scale, in the new furnace erected for the purpose at the Mint. The ores were of an inferior description, having been collected probably by native iron-workers, who selected the best for their own use; it yielded only from 25 to 30 per cent. of malleable iron. From some peculiarity of the red ironstones of Bengal, a difficulty is experienced in separating the metal from the slag, which Major Forbes states has not yet been overcome, so as to obtain, as is desired, cast-iron. It is, however, his intention to extend and modify the experiments with this view.

8. A letter was next read from Colonel Cubbon, Commissioner of Coorg (dated Bangalore, 26th February 1841), announcing the dispatch of specimens of iron ores from Mysore, consisting of three specimens of chromate of iron found in the Mysore, and two from a mine in the adjoining zillah of Salem, together with other samples of Mysore iron ores, as well as several samples of Mysore steel-wire, the finer sorts of which have a high reputation in the South of India. The secretary was directed to thank Colonel Cubbon for his obliging communication and the specimens, as well as for his offer to forward further information and specimens, should the researches still in progress in Mysore bring anything of importance to light on this subject.



Coal was found at Dhakjora & Doomneegann in the beds of the River Kalo and Bunnarosse which proves its existence among the hills through which it passes. The Coal Bed is situated 3 or 4 miles N. of Harageree near the Bologora. Boats of 50 or 60 m^{ds} go up the Kalo R. all the year round to Potamarree Hunt. But in the rains, boats of 100 or 500 m^{ds} can go to Harageree or Dhakjora.



6th April 1841.

(Sig^d) J. Bedford
Ass^t Engr Surveyr

At a Meeting of the Coal Committee held on the 3d May 1841,

March 1841.

Present:—C. W. Smith, Esq., Major Forbes, and J. M'Clelland, Secretary.

READ a Report from Major Forbes on the trial of a sample of Cuttack Coal received from Mr. Mills, Commissioner of that province. The Coal is of a dull slaty appearance, and although it burns and keeps up steam, yet it does so with difficulty, and on the whole appears to be a very unfavourable sample.

REPORT ON CUTTACK (OR TALCHER) COAL sent to the Coal Committee by Mr. Commissioner *Mills*, received in the Mint on the 27th of February and the 4th of March 1841.

THIRTY maunds were submitted to trial at the Mint 20-horse-power steam-engine, when it was found that about six maunds an hour were required to keep up the steam, and which it only did, as regarded firing, with considerable difficulty.

The consumption of the best Burdwan Coal, in an hour, is three maunds and five seers. It thus appears that, practically, the value of the Coal experimented on is less than half that of Burdwan Coal.

The 30 maunds of Cuttack Coal alluded to contained 5 maunds of broken Coal or dust, which did not admit of being burned in the furnace. On fracture it appeared slaty, and generally of a description not well adapted for furnace-work, or for keeping up steam.

(Signed) *W. N. Forbes*, Mint Master.

The appearance and quality of this sample fall far short of what the Committee had been prepared to expect; it is hoped, however, that Mr. Mills will continue his inquiries; and as a guide to those employed under him, the Committee have desired some specimens of good English and Native Coal to be sent to Cuttack.

2. Read a letter from Mr. Sconce, of Chittagong, accompanied with a sample of good coal, said to have been found in the bed of a river called Fermy, where it is said to exist in large quantity. Mr. Sconce does not, however, place much faith in his informants, who may have no object but merely to recommend themselves to favour, or to secure the rewards he has offered for the discovery of Coal in his district. The existence of Coal in the Tipperah Hills has always appeared probable to the Committee, and this idea has been particularly strengthened by the recent discovery of a succession of Coal tracts all along the coast from Arracan to Mergue; the probability is now that it will be found at intervals from Arracan to Sylhet, and the Tipperah Hills are a very likely place to find it. Mr. Sconce mentions the existence of salt springs in those hills, which is so far an indication of Coal that it affords good evidence of the presence of rocks which overlie the Coal formation.

3. Letters were then read from Captain Jenkins, Commissioner of Assam, accompanied with specimens of Coal from Mr. James Bedford, Revenue Surveyor, consisting of fragments of a dull earthy Coal from the Caribari Hills, alluded to in the 1st paragraph of the Proceedings for April 1841. The specimens were evidently picked up from the surface, and from long exposure had lost the freshness of good Coal; the secretary was directed to prepare an analysis of them, and write to Captain Jenkins to secure pottahs of the lands in which they are found. These communications were accompanied with a map of the district over which the Kalo river passes. The Kalo enters the Bramaputra opposite to the village of Chilmaree, and is navigable for 50-maund boats all the year to a place called Patumaree, about 18 miles from its mouth, and during the rains for 400 or 500 maunds boats to Hurigong, six miles still higher.

Caribari Coal, near Chilmaree.

Hurigong is therefore about 24 miles from the Bramaputra at Chilmaree, the whole of which distance is navigable during the rains to boats of 400 or 500 maunds burden. On the north side of this village there is a Coal bed, three or four miles distant, which was discovered by Mr. James Bedford. On the east, about 10 miles higher up the Kalo, there is also Coal, and also in a third situation, about six miles south of Hurigong, on the River Banarassee, a branch of the Kalo. The specimens sent to the Committee have been taken from the first-mentioned or Balajora bed.

4. Read a letter from Major Lister, stating that 20,000 maunds of Cherra Coal are ready, at the foot of the hills, to be dispatched as soon as the rivers rise, and as much more lying ready at the mines. It had been suggested, that with the view of giving the extent of the Mustuck mines a fair trial, they should be opened at the risk of Government; but Major Lister writes that Mr. Inglis, of Chhattack, has commenced working this mine, and intends to carry on operations on a large scale.

Sylhet Coal.

5. Read a letter from Captain Smyth, Engineers, Superintendent of the Nuddea Rivers, stating that the season is now too far advanced to allow of his visiting the Coal beds at Docbradgapore, but that he has persons out making inquiries, by which his own movements will afterwards be regulated. Resolved, that a copy of Captain Smyth's letter be transmitted to the Secretary to Government, for the information of the Right Honourable the Governor General.

6. Read a letter from Lieutenant Ouchterlony, Madras Engineers, dated 24th April 1841, stating that, in consequence of the want of communication with the coast, the miner and his implements have not been forwarded to Arracan, but hoped to be able to send him on the "Enterprise" steamer to Calcutta.

7. Read a memorandum from Captain Johnston, to the effect that Mr. C. B. Taylor is disappointed that the Coal Committee have not authorised him to forward 200 maunds of the Palamow Coal (referred to in 4th paragraph, Proceedings 8th February), to Dinapore, at the public expense. The secretary was requested to inform Mr. Taylor that he is authorised to send a sample, consisting of 200 maunds, of the Coal he proposes to supply to Major Sage at Dinapore, and that the Committee will recommend the expense to be granted to Mr. Taylor, provided it be not in excess of 8 annas per maund to Dinapore, all charges included.

8. A letter from Mr. Wilkinson (in reply to the Committee's Circular of 25th March 1841), on the minerals of Nagpore Territory, was submitted to the Committee, and the secretary directed to return the thanks of the Committee to Mr. Wilkinson.

9. It was stated that sulphate of iron, an article of much use and importance in the arts as a substitute for sulphuric acid in many chemical manufactures, is sold in the bazaar at 8 rupees per maund, although it may be produced at a nominal expense from refuse or pyritous Coal; Coal particularly suited to the purpose is abundant both in Sylhet and Arracan. As the consumption of sulphate of iron would become considerable if the price were moderate, the secretary is directed to write to Captain Bogle and Major Lister on this subject.

True Abstracts,

(signed) *J. McClelland,*

Secretary to the Coal Committee.

Calcutta, May 1841.

TABLE of INDIAN COALS Analysed in the Laboratory of the Honourable Company's Dispensary, from January 1839 to August 1840, in continuation of Prinsep's Table.—Journal Asiatic Society 1838, p. 177.

No.	LOCALITY.	QUALITY.	Specific Gravity.	Composition in 100 Parts.			FROM WHOM RECEIVED.
				Volatile Matter.	Carbon.	Earthy and Ferruginous Matter.	
60	Moulmein - - -	Cannel Coal - - -	1.177	42.8	54.6	2.6	Mr. Blundell, 7th May 1839.
61	Hoong, south of Ramree, six miles.	Caking Coal - - -	1.32	36.	49.	15.	Captain Bogle, 1st June 1839.
62	Tyroo Ghat, Assam - -	Caking Coal - - -	1.3	40.	55.	5.	Captain Jenkins, 3d August 1839.
63	Palamow Mirall - - -	Slate Coal - - -	1.26	41.	50.	6.	Mr. Tytler, Steam Department.
64	Palamow - - -	Slaty Crop Coal - - -	1.48	32.	58.	10.	Mr. Tytler, specimen marked Palamow.
65	Palamow, "Singra" - -	Slaty Crop Coal - - -	1.2	25.	63.*	12.	Mr. Tytler, specimen marked Palamow 10th September 1839.
66	Mergue - - -	Caking Coal, excellent -	1.27	55.	40.	5.	Mr. Blundell's Assistant, Lieutenant Hutchinson, 27th August 1839.
67	Byrung Ponjie, Sylhet -	Caking Coal, excellent -	1.3	34.	64.5	1.5	Major Lister, 4th September 1839.
68	Byrung Ponjie, Sylhet (variety).	Slaty, inferior - - -	1.4	25.	29.	46.	Major Lister, 4th September 1839.
69	Byrung Ponjie, Sylhet (variety).	Surface Coal - - -	-	30.	60.	20.	Major Lister, 4th September 1839.
70	Byrung Ponjie, Sylhet (a different sample).	Caking Coal - - -	1.3	51.	42.	7.	Major Lister, 2nd January 1840.
71	Chuppra, on the Soane -	Slate Coal, mixed - - -	1.5	32.	57.5	10.5	Mr. Ravenshaw, January 1840.
72	Borneo - - -	Slate Coal, excellent -	1.27	59.6	34.	6.4	Captain Johnston, 18th April 1840.
73	Boorhath, Assam - - -	Caking Coal, excellent -	1.2	45.	52.7	2.3	Lieutenant Strong, 24th June 1840.
74	Boorhath, Assam (another bed.)	Cannel Coal, excellent -	1.28	44.	48.	8.	Lieutenant Strong, 24th June 1840.
75	Cheduba, Arracan - - -	Cannel Coal, inferior -	1.30	46.8	41.	12.	Captain Bogle, July 1840.
76	Khota, Singrowly - - -	Middling - - -	1.29	54.	32.2	13.8	Captain Wroughton, 22d September 1840.
77	Jubbulpore - - -	Excellent - - -	1.49	50.	47.1	2.9	Dr. Spilsbury.
78	Near Dearee, the Soane -	Middling - - -	1.42	37.6	58.1	4.3	Mr. Ravenshaw, 24th November 1839.
79	Qulimany (Cape) - - -	Surface Coal - - -	1.6	23.2	40.16	30.6	From South Africa (Mozambique).
80	Tavoy River - - -	Cannel Coal - - -	1.72	62.	28.26	9.74	Mr. Blundell, February 1841.
81	Chitagong, or Tipperah Hills.	Good Slaty Coal - - -	1.375	64.6	24.4	11.	Mr. Sconce, April 1841.
82	Petchelee Gulf - - -	Anthracite - - -	1.71	20.	74.	6.	Received through Captain Johnston April 1841.
83	Doobradgepore - - -	Slaty Coal - - -	1.4	42.	38.	20.	Mr. James Pontet, May 1841.

J. McClelland, Secretary Coal Committee.

* The large proportion of carbon in this Coal would render it an excellent fuel if mixed with Cherra Coal, in which bitumen preponderates, and both might be had more reasonably at Dinapore than Burdwan Coal.

Dr.

COAL COMMITTEE in Account with GOVERNMENT.

Cr.

		Rs. a. p.	Rs. a. p.			Rs. a. p.	Rs. a. p.
1837	To Secretary's salary from 25th March to 15th December 1837, being 8 months 20 days, at 100 rupees per mensem	866 10 8		1839	By J. Erskine, 434 maunds of Adji Coal sent to Calcutta Mint at 4 annas 9 pice per maund	127 8 -	
	„ Secretary's salary from 15th December 1837 to 15th December 1838, being one year, at 300 rupees per mensem	3,600 - -			„ 2,835 maunds of Adji Coal sent to Cutwa, at 4 annas per maund	708 12 -	
	„ Secretary's salary from 15th December 1838 to 1st February 1839, being 1 month 15 days, at 100 rupees per mensem	150 - -	4,616 10 8		„ Adji ironstone sent to Calcutta Mint	Rs. 396 7 -	
1838, August	„ James Erskine, an order on the Burdwan collector for	500 - -			„ Refunded on 18th November 1840, and paid into the general Treasury	103 9 -	
	„ James Erskine, an order on the Burdwan collector for	836 4 -	1,336 4 -			500 - -	1,336 4 -
1837, July 10	„ Lieutenant Don, for travelling charges, to examine the coal at Suckree Gully	- - - -	83 5 9		„ Geo. Loch, Esq., 1,000 maunds of Sylhet Coal sent to Dinapore, at 21 rupees per 100 maunds	210 - -	
„ September 27	„ George Loch, Esq., an order on Collector of Sylhet	- - - -	425 8 -		„ Conveyance from Terroghat to Pandwa, at 1 rupee per 100 maunds	10 - -	
1838, February	„ George Osborne, Esq., travelling charges for the investigation of the supposed coal at Bidgegur	- - - -	240 - -		„ Expenses of a shed at Pandwa	5 8 -	
„ December	„ Captain Hannay, an order for	- - - -	248 6 -		„ Boat-hire for three boats of 300 maunds, 400 maunds, and 100 maunds from Sylhet to Dinapore	200 - -	
„ May	„ Mr. J. Pontet, as advance, an order on Baugleporer Collector for	Rs. a. p. 500 - -					
H 1839, June	„ Mr. J. Pontet, an order on Baugleporer Collector for the balance of his account	210 11 4	710 11 4		„ September 5	„ Captain Hannay, 800 maunds of Joypore Coal, transmitting to the banks of the Bramaputra, and 223 maunds 32 seers of same Coal received at Calcutta Mint	248 6 -
„ December	„ Messrs. Inglis & Co., for 500 maunds of limestone from Cherra, for the reduction of native iron ores at the Mint	- - - -	250 - -		„ Mr. J. Pontet, 10 maunds of Coal forwarded to the Mint as sample; 400 maunds of same Coal received at Calcutta Mint		710 11 4
„ July	„ Major Forbes, an order from Government on sub-treasurer for	- - - -	1,945 10 -		1839, October	„ Messrs. Inglis & Co. 500 maunds of limestone from Cherra, sent to Calcutta Mint for the reduction of native iron ores	250 - -
1840, May	„ A. T. M. Mills, Esq., Commissioner of Cuttack, for travelling charges paid Mr. R. Beetsen, for visiting the Talcher Coal Mine	- - - -	65 - -		„ Iron smelting furnace, built at the Mint		1,945 10 -
„ April	„ Captain J. Woodley, for expenses of Committee when trying the quantity of Coal on board Jumna steamer, 12th and 13th March 1840	- - - -	80 - -		„ July	„ One almira for papers	Rs. a. p. 24 - -
1838, May	„ Contingent expenses from 25th March 1837 to 1st May 1838, including Rs. 161. 10. for printing extra copies of first reports	- - - -	531 10 -		1840, August	„ Two mineral cabinets, at Rs. 61. 8. each	123 - -
	„ A writer's wages from March to May 1839, being 3 months, at 15 rupees per mensem	Rs. a. p. 48 - -			„ October	„ Two mineral cabinets, at Rs. 61. 8. each	123 - -
	„ A writer's wages, from 11th June to 7th August 1839, being 1 month 26 days, at 30 rupees	56 - -			„ November	„ One table	24 - -
	„ A writer's wages for August 1839, at 16 rupees per mensem	16 - -			„ A book, named "Lardner's Cyclop. Manuf. in Metal"	15 - -	
	„ A writer's wages, from September to 21st November 1839, being 2 months 21 days, at 20 rupees	53 15 -			„ June	„ A book, named "Turner's Chemistry," fifth edition	12 - -
	„ A writer's wages from December 1839 to February 1840, being 3 months, at 16 rupees	48 - -					
	„ A writer's wages, from March to September 1840, being 7 months, at 20 rupees	140 - -					

APPENDIX.

APPENDIX, No. 1.

A TABLE showing the EXPENSE of Transporting SYLHET COALS by Water to the different STATIONS on the Ganges, by *George Loch, Esq., c. s.*

Price of 100,000 maunds, at 22 rupees per 100 maunds - - -	Rs. 22,000	Price of one 600-maunds boat for one month, at 3 rupees per 100 maunds - - - - -	Rs. 18
Salary to local agent, at 50 rupees per mensem - - - - -	600	One manjy, at 4 rupees - - - - -	4
Expense of conveying the Coal from Terriah Ghat to Pandua - - -	2,000	Six dandies, at 3 rupees each - - -	18
Expense of building a depôt - - -	200		
	Rs. 24,800		Rs. 40

STATEMENT of the probable COST of SYLHET COAL at the different DEPÔTS.

1. Station to which Coal is to be Dispatched.	2. Distance from and to Sylhet. Mos. dys.	3. Quantity of Coal required. Mds.	4. Boat of 600 Maunds.		5. Price of Coal per Maund on delivery at Chattuk Depôt. As.	6. Total Price of Coal at Chattuk Depôt. Rs. a. p.		7. Expense of Carriage to various Stations. Rs. a. p.		8. Total of Columns 6 and 7. Rs. a. p.		9. Rate for 100 Maunds on Delivery. Rs. a. p.		10. Rate per Maund on Delivery. Rs. a. p.
			No.	Men.										
Butwa - -	1 15	8,000	16	112	4	1,984	- -	960	- -	2,944	- -	36 12 9	- 5 10	
Berbampore -	1 15	8,000	16	112	4	1,984	- -	960	- -	2,944	- -	36 12 9	- 5 10	
Bulna - -	1 15	8,000	16	112	4	1,984	- -	960	- -	2,944	- -	36 12 9	- 5 10	
Commercolly -	2 0	8,000	16	112	4	1,984	- -	1,280	- -	3,264	- -	40 12 9	- 6 6	
Dardah - -	2 0	8,000	16	112	4	1,984	- -	1,280	- -	3,264	- -	40 12 9	- 6 6	
Dolgong - -	2 0	8,000	16	112	4	1,984	- -	1,280	- -	3,264	- -	40 12 9	- 6 6	
Dajmehal -	3 0	8,000	16	112	4	1,984	- -	1,920	- -	3,904	- -	48 12 9	- 7 9	
Dlongyr - -	3 0	8,000	16	112	4	1,984	- -	1,920	- -	3,904	- -	48 12 9	- 7 9	
Dinapore -	3 0	8,000	15	112	4	1,984	- -	1,920	- -	3,904	- -	48 12 9	- 7 9	
Dazeeppore -	4 0	8,000	16	112	4	1,984	- -	2,560	- -	4,544	- -	56 12 9	- 9 1	
Durzapore -	4 0	8,000	16	112	4	1,984	- -	2,560	- -	4,544	- -	56 12 9	- 9 1	
Dhababad -	5 0	12,000	24	168	4	2,976	- -	4,800	- -	7,776	- -	97 3 2	- 15 6	

(signed) *G. Loch, Deputy Collector.*

APPENDIX, No. 2.

ANSWERS to Queries regarding the manufacture of Cast Steel by *Mr. W. Turner*, late in the service of the Raja of Travancore, and formerly employed in one of the largest Foundries in England (*vide* Proceedings, October 1839, paragraph 4).

Desiderata and queries respecting the manufacture of Wootz, or Indian Steel.

1. Specimens of the iron ore in its natural state.

2. From what mine, and in what district procured?

1. I herewith forward you specimens of iron ore: first, in its natural state; secondly, roasted ready to be broken and mixed with the limestone or other flux; and, thirdly, the iron ore mixed with limestone as flux.

2. My iron marked in the question No. 2 is found in the Ernceal district, not above two miles in a direct line from the Oodag-herry Fort.

REPORT RELATING TO THE

3. The first process of smelting the ore, in what kind of furnace, and what fuel employed?

3. The first process of smelting. The ore is previously roasted in a kiln; after its being kilned, is broken to the size which you will find mixed in one of the small boxes. I send you a rough plan of my furnaces, &c., as I am not a draughtsman, but a practical mechanic. Such is the plan of my present furnace and foundry; the whole expenses of which, together with the machinery, may not exceed 8,000 rupees. The fuel is charcoal, made under my superintendence, and will carry a burden equal to coke.

4. Specimens of the first running and scoria.

4. Specimens of the first and second running are enclosed in the box.

5. Specimens of all the subsequent processes, and descriptions of them until completed in the form of the flat cakes in which it is usually made and exported from India.

5. The first process used by me is to charge the cast steel crucible with the quantity of iron required, together with a certain quantity of bone ashes. There may be added a small portion of burnt leather, and a small quantity of Kisheygrey cast iron to give it a portion of carbon after its being decarbonized. It is necessary to anneal it 15 or 16 times; if it is made in this way, it is immaterial into what kind of an ingot or mould the steel is poured; as when the steel is fluid it will run into anything, as would fluid iron; but the care in annealing it after is everything.

6. In what kind of crucible is it melted?

6. I have made cast steel in bars of 14 pounds weight; but I have found no crucible in India to stand more than six.

7. In what substance or materials is the fluid metal poured, whether sand or wood? Is it poured on a flat surface or into a cavity; if into a mould, what is the nature of that mould?

7. The substance of cast iron, together with the malleable iron and steel as produced from the ore, are contained in separate boxes. It is needless to ask me of moulding, or the nature of it.

8. Are the cakes left to cool in the crucible or are they poured out?

8. The steel is sometimes left to cool in the crucible, and sometimes the crucible is crushed to the form the steel is required.

9. Is each cake the produce of one crucible, or is it poured from a larger quantity?

9. Each ingot or mould may be poured from one to a dozen crucibles; but each man should take care to be ready at one time if a large is required.

10. A crucible fitted with materials ready to put into the furnace, for fusion the last time.

10. A crucible filled with materials ready to be put into the furnace for fusion the last time is impossible for me to mention, there not being given any pressure or measurement of draught or blast.

11. A crucible with the mass left in it, as taken out of the furnace of the fusion.

11. I send you a crucible with the mass in it, but not properly fused, in order to show you and the gentlemen of the Committee what size pieces are to be put in previous to introducing the blast into the furnace: I send you also pieces of steel produced from the two different ores.

LIST of SPECIMENS delivered by Mr. *Turner* to the Master Attendant at Quilon, to be sent to Calcutta by the first opportunity, in order to illustrate the above remarks.

1. Iron ore in its natural state.
2. Ditto, toasted.
3. Ditto, broken and mixed with limestone ready for the furnace.
4. Cast, still not properly fused in crucible, but showing the method of putting it into the crucible; and other specimens of malleable cast and wrought iron and steel as produced from the different ores.*

* The above interesting specimens are still retained at the Custom House of Quilon. The officer in charge of that Department has been requested to forward the package to Calcutta, addressed to the Secretary of the Coal and Iron Committee, or in the event of no vessel bound to Calcutta touching at that port, to send it to Bombay or Madras to the care of the Mint Master at either of those Presidencies for the Coal Committee. The questions on the margin were proposed by the Royal Asiatic Society, and a copy of them forwarded to the Governor General in 1837, and referred by his Lordship to the Committee.

APPENDIX, No. 3.

MEMORANDUM for the Information of the Coal Committee (*vide* Proceedings, September 1839, para. 3).

ON the 28th of August, I made trial of 10 maunds of the Mergue Coal discovered by Lieutenant Hutchinson in a river with the experiment steam vessel from Calcutta to Barrackpore. I commenced with the best Burdwan Coal, and the engines worked up to 30 revolutions between 12.27 p.m., and 2.32, being two hours and five minutes, 10½ maunds of Mergue Coal was consumed, the engines varying between 28 and 30 revolutions, but no steam blowing off; there was little, very little residuum, and the fires burnt with a bright crackling flame, the Coal having been subjected to many transfers, was small and mixed with a great deal of dust. Between 3° 36' and 5° 36" of the same day, being two hours, nine maunds of Burdwan Coal was consumed, the steam being kept well up, and the engines fluctuating between 28 and 30 revolutions; the Burdwan Coal was of the best description, and entirely free from dust. My impression is, that the Mergue Coal is quite equal to the best Burdwan Coal, and in one point preferable in giving less labour to the stokers. The Mergue Coal experimented upon has all the appearance of being gathered from the surface, and of having been subject to the overflowing of the river near which it is found. Should this have been the case, there is every reason to expect an improvement of quality as the mine is more deeply entered into. Since our Committee last met, I have no further communications from Tenasserim respecting Coal, but I have the pleasure to hand to the Committee specimens of iron and lead ores gathered in those provinces, and forwarded to me by Mr. Edward Rilly of Moulmain, with a memorandum description of the ores, and the sites whence they were taken.

Trial of Mergue
Coal by Captain
Johnston.

(signed) J. H. Johnston.

Calcutta, 9 September 1839.

APPENDIX, No. 4.

Major Sage's REPORT ON PALAMOW COAL (*vide* Proceedings, March 1840, para. 7).

Dinapore, 29 February 1840.

To the Secretary to the Coal Committee.

Sir,

YOUR letter to my address, dated 19th October 1838, has only now been put into my hands, and the period which has elapsed may render such information as I have to offer to the Committee of little value. There may, however, be some portion of it not altogether worthless, and as I have long been of opinion that the Coal fields of Palamow have met with unmerited neglect, I trust this communication may have the effect of placing that district and its resources in a more prominent situation before the Government than it has hitherto held.

2. The situations in this neighbourhood, as far as my knowledge extends, at which Coal is found, are Singra, the Gorassan Nullah, and the neighbourhood of the village of Hotar, on the Burra river. These sites are all in Palamow, and are distant from the Soane, which is navigable during the rains, from 60 to 35 miles.

3. A depôt for the produce of these Coal fields would, in the existing state of things, be most conveniently formed at Bunder Ghaut, on the Soane, which river is navigable all the rains from this point for boats of 600 maunds burthen. The expense would be for land carriage to the Soane, including the raising of the Coal, four annas per maund freight from Bunder Ghaut to Dinapore, including shipping, &c., two annas per maund; total, per 100 maunds, Rs. 37. 8.

4. I am not aware that the mines alluded to above have been worked since the Cole War, previously to which I had supplies of Coal brought from Singra every year; nor am I of opinion that there is at present either capital or energy sufficient in India for individual enterprises of such magnitude, and where the returns, though certain, must necessarily be slow; I therefore despair of seeing these mines worked, unless the Government were to take the matter in hand, and by a cut connect the Coyle, Gorassan, and Gungary rivers with the heads of the Great Pompon, when, by a bund across the Coyle, granite being in abundance on the spot, and levelling and locking the Pompon, a depôt might be formed at Futwah, below Patna. The Great Pompon would thus become a canal, for which it is admirably suited, and the Coyle converted into a basin of water, from which the canal could be constantly fed.

5. The value of these Palamow Coals is not, I think, known, or they would not have been so long neglected. When I first established the fact, in 1830, of these mines yielding a good and useful fuel, it appeared desirable to test the value of the Coal as compared with that of Burdwan, and a specimen was selected for this purpose from Singra, colour

partly velvet, partly iron black massive lustre, shining, resinous, the different layers varying considerably—principal fracture, slaty cross fracture; small-grained, uneven fragments, approaching cubical, easily frangible; specific gravity 1.30; burns with little flame, and gives but little or no smoke.

6. (A.) One hundred grains in a close vessel were exposed to a heat gradually raised to redness, and kept so, until everything volatile had been driven off. The coke remaining in the vessel had nearly the appearance of the original Coal; its weight amounted to 53 grains.

(B.) It was now put into a platinum crucible, and kept burning until everything combustible was entirely dissipated, the ashes or earthy matter remaining, which were of a greyish white colour, were found to be a mixture of sulphate of lime, silica, and alumina, weighing together 6.8 grains.

(C.) The volatile matter driven off in experiment (A.) had partly made its escape in the form of gas, and partly condensed into a liquid, which, on examination, proved to be principally water, with a small quantity of bituminous matter and a strong ammoniacal odour.

7. The same experiments for the sake of comparison were made with the Burdwan Coal, with somewhat different results; a much greater quantity of tarry matter was given off, and the coke was found fused into a solid piece; it weighed 59.8 grains, and, when burnt to ashes, left 13.6 grains of earthy matter; from these, and a number of similarly conducted experiments, the following proved to be the composition of the Coals.

	Dinapore.	Burdwan.
Coke - - - - -	46.2	46.2
Volatile matter - - - - -	47.0	40.2
Earthy matter - - - - -	6.8	13.6
TOTAL - - - - -	100.0	100.0

8. Taking these results into consideration, I would propose in reply to your 4th paragraph, Futwa (pursuing the means pointed out for opening the communication) as a general depôt, for Colgong, Rajmahal, Monghyr, Dinapore, Gazeepore, Mirzapore, and Allahabad, and, for reasons which will be adduced hereafter, I will select Cutwa or Culna, as a general depôt for Berhampore, Calcutta, Comercolly, Surdah, &c. I had this subject in view many years ago, and have only to extract from a letter placed before the Government of that day to put the Committee in possession of what even then appeared to me a matter of some importance.

9. It may not be unworthy the consideration of Government, whether it may not be highly expedient to endeavour to render Coal cheaper to the public than it is now furnished. The shafts of the Burdwan mines, sunk by the late Mr. Jones, are, I understand, in the same state as when left by that gentleman: they have not been in any degree deepened, but merely extended, as Coal was wanted, horizontally; and there is every reason to believe, that up to the present day nothing more than what in England are called "firsts" and "seconds" have been brought into the market, the main, or Coal, remaining untouched.

10. It being obviously the interest of Government as well as of the public to secure a good and cheap fuel ere the progress of agriculture shall deprive Calcutta and its environs of the supplies at present furnished by the Sunderbunds and Saltwater Lakes, and which the introduction of steam-engines into general use, whether for the purposes of navigations or manufactures, must soon make an imperative necessity, it would, I am of opinion, be most advisable that the Burdwan mines should be accurately surveyed by competent persons, and their extent ascertained by boring.

11. Mr. Jones supposes the Coal to pass under the whole valley of the Ganges, and to rise again in the Sylhet Hills. This certainly would appear, from the known characteristics of Coal formations, to be most probably the case, as no rock intervenes to terminate its course.

12. If, as Mr. Jones supposes, it does take that direction, and which he was led to conjecture from its inclination, it would underlie the Hooghly at its most accessible depths, from Kinagur to Cutwa, and I would, therefore, advise, that no ordinary means should be taken to ascertain the point, commencing first with the line from Nuddea to Cutwa, and thence along the Adji river.

13. Should a vein or continuation of a vein be discovered on this line in a part or parts having water communication with the Presidency at all times of the year, the object would

would at once be attained. But supposing the line from Nuddea to Cutwa affords no Coal, and the further line of the Adji did, at points not accessible in the dry season, yet as there are large quantities of iron ores in the neighbourhood, it might answer extremely well to have a rail or train road constructed from the Coal pits to the nearest navigable part of the Adji or Hooghly, while from a jetty the waggons might be unloaded directly into the boats, and a constant and cheap supply of fuel be thus made available to the public and the Government.

14. Should, however, a correct survey of these lines not encourage the idea of Coal in sufficient quantities, and good—being within accessible depths, on the Adji, or from Cutwa to Nuddea—still it would be advisable to ascertain the practicability of connecting the present mines by means of a canal with the Bankakal, which runs by the town of Burdwan, and meets the Hooghly near Culna within the reach of the tides.

15. I have reason to suppose it would not be expensive or difficult to render this nullah navigable at all seasons. The section of its bed is deep and of little width, and its banks are protected by hard clay. I have also understood the late Raja of Burdwan was so anxious to have the Bankakal made navigable, that he would contribute partly to the expense.

16. From the head of the nullah to Mudjea, the lowest Coal mine is about 30 miles, and the whole distance is a low dead flat country, through which a narrow canal for Coal boats could be constructed at an expense not exceeding 60,000 rupces.

17. The expense of opening these communications with the abundant fields of Coal which lie in the Pachete and Palamow countries would be amply repaid by the increased consumption caused by the extension of steam communication, to say nothing of opening a direct intercourse with a country abounding in iron, timber, granite, lime, and Coal, for such is the country of Palamow, a description of the Coal fields, which will be found in the "Gleanings of Science," No. 19, July 1830, page 217.

I have, &c.
(signed) *Wm. Sage.*

APPENDIX, No. 5.

SECOND REPORT of Mr. *Ravenshaw* on PALAMOW COAL (*vide* Proceedings, March 1840, para. 7).

DURING my late tour in Behar, I made particular inquiries from the natives regarding the existence of Coal in the hills to the S. W. of Pergunnah Juplah and north of the River Coyl, which unites with the Soane, a little below Rhotas. Though it was generally understood to exist, I could find no one who had visited the site, or could describe its precise locality. I, therefore, left instructions with several natives to send me any information they might be able to obtain on the subject, and if the site should be discovered, to ascertain the size of the mine, and the expense of digging and transporting the Coal to the nearest navigable river. In pursuance of these arrangements, a native of respectability who resides at Hoosseinabad, proceeded to the part of the country, which public rumour assigned as site of the Coal beds, and he has just returned, bringing with him three maunds of the mineral. Palamow Coal.

2. He states that the mine is on the side of a hill near the village of Sangur, which is situated on the banks of the Amanut Nuddee, a mountain stream, which flows into the Coyl river, about a quarter kos distant. Sangra is about four kos north-east from Palamow, and 16 kos south-west from Hoosseinabad. The quantity of the Coal he represents to be very great, to use his expression, "Lacks of maunds." Of the quality I am no judge; it is of a duller colour than the Burdwan Coal, with which I have compared it, and does not appear to burn quite so well; however, if it will answer for steam purposes, it is all that is required.

3. The country is said to be more or less hilly all the way to Hoosseinabad, and the road impassable for carts, but the Coal can be transported on bullocks, which carry between three or four maunds each. The hire per bullock to Boodun Ghat on the Soane (two kos beyond Hoosseinabad) is one rupee each. Boats of 1,000 maunds burden come up to this ghat from Patna, the hire to which place is stated at 20 rupees, and the whole expense of digging and conveying 1,000 maunds to Dinapore as per annexed account, is estimated at Rs. 424. 9., or 6 a. 9 p. per maund. It would be necessary, however, to appoint a small establishment on the spot to look after the Coolies or Dhangurs, which might increase the expense to seven annas per maund; but, on the other hand, if a road were made by Government, and carts employed, a considerable reduction might be effected. Even at seven annas per maund, I imagine, the saving to Government would be great, as I understand the Burdwan Coal cannot be landed at Dinapore under one rupee per maund.

4. If the Coyl river were navigable, there would be only half a mile of land carriage, but my informant states, that the bed is too rocky to admit of boats coming up at any time of the year.

5. The native states, that after leaving the mine, he was informed that a Mr. Taitoo (so he pronounced the name) had proceeded thither from Dinapore by the circuitous route of Mongeah and Legsigjee on the south bank of the Coyl Nuddee. If this be true, and he should have been deputed for the purpose by Government, my present communication will be of no use, as that officer will probably have made all the necessary inquiries with respect to the practicability and advantage of working mine—but if not, I would suggest the deputation of an officer to examine the mine, and report on the feasibility of constructing a cart road from Sangra to Hoosseinabad, or of rendering the Coyl navigable.

6. A rough sketch, showing the locality of the mine, is herewith submitted for the information of Government.

I have, &c.
(signed) *E. Ravenshaw*,
Officiating Commissioner.

Commissioner's Office, Patna Division,
9 April 1839.

APPENDIX, No. 6.

REPORT on PALAMOW COAL, being a Letter from *E. C. Ravenshaw*, Esq., Officiating Commissioner of Patna, to the Secretary to the Government of Bengal, dated 6th January 1840 (*vide* Proceedings, March 1840, para. 7).

Palamow Coal.

WITH reference to your letter, No. 161, dated 11th July last, instructing me to adopt measures for laying in a supply of the Coal of Koila Nuddee at Dinapore, I have the honour to report, for the information of Government, that Cazeé Mahanuddee of Purgunnah Jupla, having communicated to me the discovery of another mine at a place called Chuppree, two kos south of the Soane river, before its junction with the Koila Nuddee, and having submitted an estimate of the expense of conveying it to Dinapore, which amounted to only 4 *a.* 5½ *p.* per maund, I advanced to him the sum of 300 rupees to enable him to commence operations immediately.

2. The specimen of Coal forwarded to me from this mine appeared precisely similar in quality to that from the Singra mines, but after digging 100 maunds the Coal is stated to have assumed a more stony character, and the Cazeé therefore abandoned the mine, and proceeded to the old mines of Singra and Meeral, near the banks of Koila Nuddee. He has completed the excavation of 4,000 maunds, of which he has conveyed on bullocks 400 maunds to Dearee Ghat on the Soane, a distance of 16 kos, and 1,600 maunds to Pokree, half way between Singra and Dearee Ghat. The expense incurred, including the transport of 100 maunds from Chuppree to Dearee, amounted to *Rs.* 518. 8. 8. For transporting the remainder of the Coal to Dearee, and thence to Dinapore, the Cazeé applied to me for a further advance. The expense (as per enclosed estimate submitted by the Cazeé) of conveying the whole at Dinapore is *Rs.* 1,510. 3., of which *Rs.* 10. 3. was expended on the Chuppree Coal, leaving 1,500 rupees or six annas per maund as the total expense of transporting 4,000 maunds to Dinapore. I have accordingly to solicit the sanction of Government to the disbursement of *Rs.* 1,510. 3. on the above account.

3. Owing to the shallowness of the Soane at this season, I fear the Coal cannot be transported to Dinapore until the next rainy season, *i. e.*, July. I have directed the Cazeé to convey the whole of the 4,000 maunds on bullocks to Dearee Ghat without delay, where it will be placed in depôt until a favourable opportunity may present itself of conveying it to Dinapore. If a heavy fall of rain should occur in this month, similar to that which occurred last year at this time, it is probable that the Coal may be moved sooner than anticipated.

4. In future (supposing the Coal to answer) it will be advisable that the total quantity required for the steamers in one year should be excavated, and conveyed to Dearee Ghat during the cold weather when the hire of bullocks is said to be cheapest, and from Dearee it can be annually conveyed to Dinapore in July or August.

5. If it be thought expedient, I think I shall be able to procure a contract for the annual supply of any quantity of Coal at six annas per maund, but until the Coal has been pronounced sufficiently good in quality for steam purposes, it would not be advisable to subscribe to such terms. The Cazeé brought 24½ maunds of Coal to Dinapore in one of his own carts, for which no charge has been made. As I was directed by Government to forward a portion of the Coal to Calcutta for trial, I instructed Mr. Kidd, the agent for steamers at Dinapore, to transmit the 240 maunds to the Mint at Calcutta, and he reported on the 30th December, No. 1, that he had shipped it, on the 23d idem, in 13 bags on board a steamer, commanded by Captain Somerville. It may be proper to mention that four or five maunds of the Chuppree Coal, brought by the Cazeé as a specimen, has been inadvertently mixed up with the Singra Coal. It will probably be distinguished by its strong character, approaching to anthracite, if it be not entirely composed of that mineral.

6. It is possible that the Coal might be procured at a cheaper rate than even six annas per maund, for in every estimate yet furnished, the hire or carriage, &c., has differed considerably.

siderably. It will be observed that the hire for bullocks in the present estimate greatly exceeds that in the last. The cause of this will be inquired into, but it shows that we have as yet no fixed data by which to calculate the exact cost. A knowledge of the mode in which Coal is conveyed from the Burdwan Mines to Calcutta, and the details of the expense, might be a useful guide in the present instance. To the amount of the estimate it will, in future, be necessary to add a small sum, by way of "malikana," to the proprietors of the mehal in which the mines are situated, as they have already informed the Cazeer that they will not permit any more Coal to be taken away unless they receive something for granting the privilege of excavating the Coal.

Commissioner's Office, Patna Division,
Sarun, 6 January 1840.

I have, &c.
(signed) E. C. Ravenshaw.

APPENDIX No. 7.

TOTAL Expense of Transporting Coal from Singra and Mural Hills.

	Rs. a. p.	Rs. a. p.
2,000 Coolies' hire for carrying 4,000 maunds of Coal, at 15 Coolies per rupee (or 6 pie each), the exchange being at 22½ gundahs per rupee - - - -	133 5 4	
1,000 maunds Singra Coal.		
3,000 maunds Mural Coal.		
100 Bullocks, conveying 400 maunds of Coal from Singra to Dearee Ghat, distance of 16 coss, at Rs. 1 4 a. each bullock - - - - -	125 - -	
400 Bullocks, conveying 1,600 maunds of Coal from Singra to Pokhree, eight coss distance, at 11 annas each -	250 - -	
		508 5 4
50 Coolies' hire for digging 100 maunds of Coal at Chuppre Hill - - - - -	3 5 4	
25 Bullocks, conveying ditto from Chuppre to Khota, two coss distance, at four annas each - - - - -	6 4 -	
1 Boat hire ditto from Khokah to Dearee - - - - -	- 8 -	
2 Coolies' hire conveying Coals from boat - - - - -	- 2 -	
		10 3 4
		518 8 8
Received from Collector of Behar - - - - -	300 - -	
Ditto from Mr. Kidd - - - - -	10 - -	
		310 - -
Balance due - - - Rs.		207 8 8

Advance wanted for Transporting 2,000 Maunds of Coal now at Singra Hill.

500 Bullocks' hire, conveying 2,000 maunds of Coal from Singra to Dearee, 16 coss distance, at Rs. 1 4 a. each	625 - -	
400 Bullocks' hire, conveying 1,600 maunds of Coal from Pokhree to Dearee, 8 coss distance, at 10 annas each	250 - -	
		875 - -
Boat hire, conveying 4,000 maunds of Coal from Dearee to Dinapore - - - - -	80 - -	
Wages from chowkedars to take care of the Coal, and coolies' hire to put on boat - - - - -	36 10 4	
		116 10 4
		991 10 4
		518 8 8
TOTAL - - - Rs.		1,510 3 -
Deduct for 100 maunds of Chuppre Coal - - - - -		10 3 -
Total expense of 4,000 maunds, equal to six annas per maund - Rs.		1,500 - -

Commissioner's Office, Patna Division,
6 January 1840.

(signed) E. C. Ravenshaw,
Officiating Commissioner.

APPENDIX, No. 8.

LETTER from Major *Carter* to Major *Henderson*, Member of the Coal Committee.
Vide Proceedings of the Coal Committee for January 1841, para 1.

Cherra Poonji Coal.

IN as far as three months' anxious examination and inquiry as to the best method of obtaining a quantity of Coal from the Cherra Mine enables me to speak, the Coal Committee are most welcome to any information I can afford, although I fear they will find it of little value. You are aware that the mine which yields the Coal tested with the Burdwan is situated near the summit of a ridge which nearly surrounds the station, above which it rises about 300 feet. There is no difficulty, beyond the mere labour of quarrying the Coal, in obtaining any quantity. There is at present an extent of about 300 yards, forming two sides of a triangle exposed, the thickness of the seam being from 12 to 7 feet. There is also a small mine, distant about 100 yards from the above, which is even thicker than it, and I rather think a better Coal, though all appears good. The grand difficulty, therefore, in obtaining any desirable quantity rests in the want of carriage, and to overcome this the attention of every one on the spot has been directed. By the present method of using Cossia Coolies, nothing more can be done than has been effected by Lister and H. Inglis, and no private individual could have done what they have; for the work is exhausting, and, I believe, unpopular with the inhabitants, although they have been well paid. You will have been informed that the horizontal distance from the mine to Teria Ghaut is about eight miles, and the height of the mine about 4,200 feet above the river. Had this ascent been divisible equally through the distance, a practicable road could have easily been constructed; but unfortunately, for about three miles from the pit, and somewhat less than one from the river, there is little slope; consequently, the whole ascent is thrown on the four miles between these two comparatively level spaces, before any other description of carriage other than coolies can be used effectively. It will be necessary so far to lengthen the road as to reduce the ascent from one foot in about six to one in 10, or even 12; and this can be done at a very trifling expense, the soil offering very little impediment in the shape of masses of rock or strata, although, of course, some blasting must be expected. Judging by the quantity of work already done by Lister, it would, I think, be impossible to find one more capable of executing this. Trains, slides, roads, and machinery have all been suggested as suited to this steep portion of the road, and no doubt 1,000 or 1,200 feet could be overcome by some of the simpler forms of machinery; but I doubt whether by their use much, if any, reduction in cost would be effected by the double lifting. At each pulley breakeage would occur, besides the necessary establishment for working whatever engines might be used, and carriage of the Coal from one to the other. After weighing every suggestion of others, and every plan that occurred to myself, I have little doubt but small bullocks are the best if not the only mode by which a quantity, to be of any importance to such a port as Calcutta, can be brought down at such a cost as to be desirable. There is abundance of forage for any number. I know they traverse Southern India in vast numbers, and have scarcely a march in which hills do not occur, the roads often covered with gravel more injurious to the feet than that in the Cherra hills; still it will be necessary to induce private enterprise to make the experiment, so as to have the lowest cost at which the thing can be done ascertained. In regard to boats, were there a demand, I do not contemplate any difficulty in the supply; good 500-maund boats are built at Sylhet, Chattuck, and various other places in the neighbourhood, for 150 to 80 rupees, and the whole population may be termed aquatic. Cherra offers advantages for the supply of Madras and Ceylon, which I have not seen adverted to. Vast numbers of seagoing vessels carry salt up to Naraingunge and other places on the Megna; these could be laden in five or six days from Cherra, and in the cold weather could cross the bay without danger; indeed, numbers of similar craft carry bin* to the coast from the port of Arracan. I mentioned that I thought Lister and H. Inglis had done as much as can be expected with the natives: they are both very anxious, and have much influence; yet I doubt if, in future years, they could do what they now have accomplished, from a cause which, however inimical to your researches, will be viewed favourably by Government—the increasing traffic of the country under their superintendence. The export of iron, cotton, and potatoes is great; the latter has increased from a few maunds at present to many thousands, every one of which take the labour of a man three days or four, according to where they are grown, to transport to the ghaut.

Bullocks proposed
as the best means
for its conveyance.

If the road were completed at the moderate slope of 1 foot in 12, small carts might be used perhaps, but even then I doubt if the laden bullock would not be cheaper; for at least one man would be necessary to each cart, whereas one could drive four or five of the others, who would have nothing to bring back, while an empty cart up a continued ascent would be as exhausting as a laden one down.

You, as a practical mechanic, can tell better than I what would be the advantage, in regard to expense, of employing machinery to lower the Coal; even 2,000 feet, on a horizontal distance of, say, one mile. I think it would increase it, for from the nature of the country, a direct line could not be attained; consequently, one machine and one set of tackle would not answer.

I enclose

* A black pea, on which cattle are fed.

I enclose you a view, done by Hone of the 57th, of the mine at Cherra; the hill is about 300 feet high, and the Coal stratum about 80 or 90 from the top. The smaller mine, and which has been worked by Government, is in the nook to the left; the Coal is there nearly 15 feet thick; it is 12 just behind the angle where it ceases in the sketch. You have now, my H., the result of my cogitations on the subject of Cherra Coal, which may be resolved into this: Make a road—which, with the aid of a couple of hundred convicts* from Sylhet, where they appear abundant, would, I think, be accomplished under 2,000 rupees—and the Coal will come down, whether by means of private or public exertions will not matter.

13 October 1840.

Ever, &c.
(signed) H. Carter.

APPENDIX, No. 9.

NOTES from CORRESPONDENCE by the Secretary regarding Petroleum, and other subjects connected with the business of the Committee. *Vide* Proceedings, para. 2, January 1841

CAPTAIN BOGLE, the Commissioner of Arracan, in a letter dated 18th July, reports the dispatch of four jars of petroleum, the produce of three wells of that mineral close together, at a place called Laidong, about five or six miles distant from Ramree town, on the island of the same name. The situation of the wells is further stated to be only two or three miles distant from the Cheduba roadstead, with a good road all the way. The wells are about 8 or 10 fathoms deep, and around them, the surface is scantily covered with stunted jungle. The wells are, however, very unproductive, not yielding above 10 or 12 maunds of petroleum in three months. To collect this the people descend by ladders, and apply earthen pots to the places from which the oil exudes, returning about the time when they expect to find them filled. At present there being no way of getting quit of the water, the only season during which the oil can be collected is during the months of February, March, and April. Captain Bogle thinks, if the wells were covered in and pumps employed, the work might probably be continued longer. Captain Bogle also thinks that if these wells were carried down to the depth of the petroleum wells in Ava, that a more abundant supply of oil might be obtained.

Petroleum and
Naphtha at Arracan.

The oil is however, Captain Bogle thinks, inferior to that of Yenangming in Ava, being thinner, and not congealing when exposed to the air. The Mugs use petroleum oil for their hair, and as a varnish for mats, and all the ornamental woodwork of their houses, for their polum-leaf books, &c., as it destroys insects and vermin; it is also a preservative against white ants. When burnt, Captain Bogle says it emits much smoke, and yields a strong offensive odour, which is at all times strong and disagreeable.

The number of wells about Ramree might, he thinks, be much increased as well as on Cheduba, where there are five wells much superior to those of Ramree, both as to the quality and quantity of the petroleum, but no attention is paid to them. Captain Bogle is of opinion that the Cheduba wells might be made to produce 1,000 maunds per annum, which, at the rate petroleum there sells for at present, would be worth 5,000 rupees. In fact, Captain Bogle states, there is no limit to the quantity which an enterprising man might obtain at a very trifling cost. On Flat Island, near Cheduba, Captain Bogle remarks, there is also a petroleum spring.

Such is Captain Bogle's account of these mineral oils; but as he has furnished the Coal Committee with four jars of them from different springs, we are enabled to add the following remarks: Two of the specimens furnished by Captain Bogle are naphtha, the purest of all bituminous oil, of pale straw yellow colour, perfectly thin and transparent, volatile and unctuous, with a resinous aromatic odour, and burn with a clear bright flame like olive oil, which they resemble in colour and transparency: specific gravity, 80·2. We should suppose both these specimens are the produce of the same spring.

Naphtha is a rare mineral production in a state of perfect purity, and we believe there are but two springs from which the supplies for Europe are derived. The one is situated at Monte Ciario, near Piacenza, in Italy, and the other near base of the mountains of Bucktiavi, between the city of Bruster and the valley of Ramharmous. We regard the Laidong naphtha from Ramree as pure as that of either of the two celebrated fountains alluded to. Hitherto, when bituminous oils were required for use, either in medicine or the arts, that of the celebrated wells of Yenangming in Ava has been used, which is rather a mineral tar than either petroleum or naphtha, yet Dr. Fleming remarks that in chronic rheumatism he found it of much greater benefit than the more costly cajeput oil; and if Dr. Fleming had been acquainted with the more pure bituminous oil of Ramree, we think he would have spoken of it even in higher terms: for while it is still a purer form of bitumen, it is capable, from its fine colour and transparency, of entering into the most elegant mixtures. The dirty tar-like and putrid appearance of the Aya petroleum would necessarily exclude it from the general list of remedies, except in veterinary practice, in which

* The suggestion regarding the employment of convicts is very important, particularly as the climate is found to answer admirably at Cherra for people from the plains.

which it is still used; but none of these objections apply to the Laidong naphtha, which, while it possesses the qualities of the other bituminous oils in the highest degree, presents the most agreeable appearance.

The other two specimens received from Captain Bogle are petroleum of different degrees of purity, but both very fine—one in particular, which is almost as pure as naphtha itself; but it is high-coloured, like brown sherry; its specific gravity is 81.2. The third specimen, also petroleum, is of still higher colour and somewhat opaque, is also a good petroleum: specific gravity, 82.4. These last two specimens are, doubtless, the produce of two different wells; but as the jars were not numbered, nor the peculiarities by which the three wells are distinguished from each other pointed out by Captain Bogle, he will still have to distinguish the naphtha well from those producing the petroleum, which he will be enabled to do by the colour of the liquid—the naphtha being pale yellow and perfectly transparent, while the petroleum is brown and slightly opaque.

The petroleum of Laidong would be useful in the arts as a varnish for preserving objects from insects, a purpose for which the Ava petroleum (which is, in fact, mineral tar) is quite unfit, from its dirty appearance and opacity.

Petroleum in Assam. Petroleum has also been plentifully found by Captain Hannay in the Jeypore Coal district of Upper Assam, where it presents itself rising from beds of Coal. Mr. Griffith and Lieutenant Bigg also found springs of petroleum at Namroop, in Upper Assam.

Petroleum in Sylhet. Petroleum is also a product of the Sylhet district. Major Lister, Political Agent in the Kasyah Hills, reports, in a letter to the Coal Committee, dated 15th May last, that there are three localities, 10 or 12 miles distant from each other, where springs occur, but not being an article of trade, the petroleum is only used for medicinal purposes. We have been favoured by Mr. H. Inglis with a sample of petroleum from one of these localities, and find it to be very pure, yielding no precipitate with alcohol, and of a clear red colour: specific gravity, 89.5. What we have said of the Laidong petroleum applies to this, which would be an useful varnish as a protection against insects.

Petroleum on the Euphrates.

On remaining for a certain length of time exposed to the air, petroleum assumes a solid form, in which it is found in many parts of the world, but particularly in Persia. Lieutenant Lynch, recently engaged in a survey of the Euphrates, turned the asphalt, which seems to be very abundant along the shores of that river, to account in the manufacture from it of an artificial fuel by mixing it with charcoal. The fuel was made up into the form of bricks, and, from the highly inflammable nature of both its materials, promises to become a useful fuel for long voyages, from its lightness and small bulk. In Calcutta, where petroleum sells for 15 rupees per maund, and charcoal for three or four, Lieutenant Lynch's fuel would be very expensive; but manufactured on the Euphrates, its price would probably be lower than of coal supplied on that river. As naphtha, petroleum, and asphalt are but the volatile bitumen of Coal, so their presence in any country may be regarded as an indication of the existence of that mineral. The first of these substances is bitumen in the purest form, collected before it has remained exposed for any length of time to the air; the second is when the substance has changed to a darker and more opaque form, which passes into asphaltum. As petroleum springs are usually situated in Coal districts, we infer from the presence of petroleum on the Euphrates that Coal also will be discovered on the banks of that river.

(signed) *J. McClelland,*
Secretary Coal Committee.

APPENDIX, No. 10.

JUBBULPORE.

Nerbudda Coal.

It had been understood in the Coal Committee, that a trace of Coal had only been found in sinking wells at Jubbulpore, and that the only good beds of Coal in the Nerbudda Valley were those brought to notice by Major Ouseley, near Hosingabad.

We have lately been informed, however, by Captain Ludlow, that an excellent Coal is found close to Jubbulpore, and furnishes that station with fuel. A specimen of this Coal, which bears the appearance of the best Burdwan kind, has been furnished by Captain Ludlow, who has kindly promised to induce some of his friends at Jubbulpore to procure a description of the mines in that vicinity.

APPENDIX, No. 11.

IRON.

Kasya Iron Ore.

A SAMPLE of the ironsand, a magnetic iron ore from which the Kasyas manufacture iron, together with nodules of iron pyrites from Cherra Poonjee, has been forwarded to the Coal Committee by Major Carter. Mr. Landers also has presented a specimen of iron pyrites, together with specimens of rocks, from the same quarter.

APPENDIX, No. 12.

MEMORANDUM by Captain *J. H. Johnston*, Controller of Steam Vessels, on the Trial of Coals, &c. *Vide Proceedings for January 1841, para. 3.*

MEMORANDUM.

I HAVE the honour to report to the Marine Board that, accompanied by *C. W. Smith*, Esq., C.S., President of Coal Committee, and *J. McClelland*, Esq., the secretary, I proceeded, on the "Lord William Bentinck" steam-vessel, to make trial of some manufactured fuel and two specimens of Coal from the Mergue and Dearee mines.

2. The first trial was made of fuel in the form of bricks, prepared by *Mr. Fisson* with the dust of the English Coal. The fires had been lighted and the steam got up with Coal from the Raneegunge Colliery; after starting from Chaundpaul Ghaut, the fires were allowed to burn down, and the engines to exhaust the steam. The Coal bricks were then thrown on, and when the steam began to blow off, the engines were started, and the fires again allowed to burn down; by which process the furnaces were supposed to be cleared of the Raneegunge Coal, and the remaining fuel to be of the nature on which the experiment was now to be made. I will here remark that the same process was adopted previous to making the experiment on each different sort of fuel. Trial of Coals.

3. The engines stopped, having exhausted the steam, at 11.3, when nine maunds of brick-fuel having been placed in the boiler-room, the furnaces were supplied from it; and at 11.6 the steam was again up in the boiler, the engines were started at full power, making 21 revolutions. The steam-gauge indicating 3lb. pressure, it gradually fell, and the revolutions decreased to 20, until 11.40, when the engines stopped, the last 8 or 10 revolutions having been made with a gradual diminution of speed. At 11.43 the steam was again up, and the engine started at 21, 20½, 20, 19, until 12.10, when the nine maunds of fuel being expended, the fires burned down, and the engines stopped at 12.15, having in the lapse of one hour nine minutes, including three minutes the engines were at rest, made 1,300 revolutions, with the consumption of nine maunds of fuel; and by proportion, had ten maunds been expended, the time occupied would have been 1 hour 16 minutes and 40 seconds, and the revolutions 8,454. Artificial fuel.

4. The result of this experiment is far more satisfactory than that reported, in my memorandum of the 16th March, on Coal bricks made with the dust of Burdwan Coal. I shall endeavour further to improve on this last specimen, and have little doubt of success.

5. At 12.45 I started the engines with 10 maunds of Dearee Coal (*Mr. Ravenshaw*); at 1.45 the engines stopped; the steam-gauge never indicated more than two pounds pressure; the engines maintained barely 20 revolutions; the fire required much stirring and poking, and once, at 10 minutes after 1, the revolutions declined to 16. Of this Coal 10 maunds were consumed in an hour, during which time the engines made 1,180 revolutions. This Coal will not answer for internal navigation, as it will not keep up the steam for the full power of the engines; I will try it mixed with a proportion of English Coal, and report the result. Dearee Coal.

6. Ten maunds of Coal from Lieutenant Hutchinson's mine in Mergue were now tried. The engines were started at 2.30 and stopped at 3.35; the gauges during the experiment indicating a pressure of little more than two pounds, and the engines making 21 and 20 revolutions. The result was 10 maunds of coal consumed in one hour and five minutes, and the engines supplied with steam for 1320 revolutions of the wheel. My expectation of this Coal has been disappointed; it is the first time I have had an opportunity of trying it in the furnaces; the analysis* of specimens sent up when the Coal was first discovered promised a better fuel; the Coal may have deteriorated from exposure, and from the overflowing of the nullah contiguous to the mine, which occurred during the last rains. The 20 tons received by the "William Dampier" is all in small pieces, very thinly coated with mud; judging from the trial made yesterday, I should pronounce the Coal inferior to the Coal of Raneegunge; there is a great deal of residuum, and amongst it a large proportion of slate. Mergue Coal.

*Specific gravity 1.27	
Water	- - †18
Volatile matter	- - 37
Carbon	- - 40
Ferruginous matter	5
	100

†Note by the Secretary.—The Coal must have been too much heated in drying, and volatile matter driven off as well as "water."

Steam Department, 28 November 1840.

(signed) *J. H. Johnston*,
Controller.

I am sorry to see an account of the Mergue Coal so little encouraging and so unexpected; perhaps, however, the specimen was an unfavourable one, and affected by the causes which Captain Johnston adverts to. Mergue Coal.

(signed) *H. M. Parker*.

This is still serviceable Coal; from its appearance there is reason to think that it has been taken from the surface, and that when the bed has been properly worked a better quality will be found.

C. W. Smith,
Chairman of the Coal Committee.

REPORT RELATING TO THE

APPENDIX, No. 13.

No. 287.—MEMORANDUM.

IN continuation of my memorandum of the 28th November (No. 281), I beg to report that, desirous of making a further trial of the Mergue Coal in furnaces of more powerful draught than those of the "Lord William Bentinck," I got the steam up on board the "Ganges" on Thursday the 10th instant, and having weighed 18 maunds of picked Mergue Coal, I charged the furnaces with a quantity of the same Coal, raised steam, and worked it down again to clear the furnaces of English Coal, with which the steam had, in the first instance, been got up.

2. At 11.53 we began to throw on the fires the 18 maunds of Mergue Coal, the engines at this time making 24 revolutions, the steam-gauge standing at $1\frac{1}{2}$; at 12.10, the revolutions had increased to $25\frac{1}{2}$, steam-gauge $1\frac{1}{2}$; at 12.20 the revolutions were 27, gauge $2\frac{1}{2}$; at 12.35 revolutions 28 and 29, steam-gauge $3\frac{1}{2}$, and the steam blowing off; at 12.50 the whole of the 18 maunds had been thrown on the fires, and they were allowed to burn down gradually until 1.10 p.m., when the revolutions having diminished to 24, and the steam-gauge standing at $1\frac{1}{2}$, the same points from which the trial had commenced, the experiment was completed. English Coal was thrown on to get up the steam. Previous to commencing the trial at 11.53 a.m., the ashpits had been cleared from ashes; and at 1.10 p.m., when the trial had terminated, the ashes were drawn from the ashpits; and 36 hours after, when the water thrown upon them to prevent accident had been well drained off, they weighed 4 maunds 32 lbs.

3. This trial has been more satisfactory than that of the 28th ultimo on board the "Lord William Bentinck," whose boilers have less draught, inasmuch as the Coal has been found capable of raising the steam to the blowing-off point, and of maintaining the full speed of the engines. The quantity of Coal expended was considerable, and the residuum bore a very large proportion to the original quantity of Coal; but on examination of the ashes, I detected a large proportion of unburnt Coal in very small pieces, which had fallen through the bars, and this loss of fuel it will not be easy to remedy. The Coal being non-bituminous, or containing very little bitumen, will not coke, and consequently the smaller particles, though they might be separated from the ashes and again thrown on the furnaces, would immediately fall again through the bars; and if, to prevent this, the bars were placed much closer together, the draught would be impeded, and the Coal would not burn at all.

Trial of Coals.

4. The result of the above trial has been 18 maunds of Mergue picked Coal consumed in the furnaces of an 80-horse engine in 1 hour and 17 minutes, furnishing 2,015 revolutions, or 4,030 cylinders of steam.

5. Twelve maunds of English Coal, ex the "William Jardine," were now subjected to a similar trial; they lasted one hour and four minutes, furnishing 1,905 revolutions, 3,810 cylinders of steam, and leaving a residuum of 50 lbs. of ash.

6. On the 11th instant I put $3\frac{1}{2}$ maunds of Dearee or Mr. Ravenshaw's Coal into two furnaces of the "Ganges" boiler, the other two furnaces being charged with English Coal. The Dearee Coal burnt much brighter than in the "Bentinck's" boilers, and the steam was well kept up for 40 minutes, when the fires in the Dearee furnaces grew very dull and the steam went down; the residuum was 12 lbs. of ashes from the Dearee furnaces.

7. This Coal appears to me to be nearly all carbon, with a very small proportion of bitumen; the residuum is an almost impalpable white powder. The Coal will not answer alone for steamboats; but, combined with good English Coal, would, I have no doubt, keep up steam. I shall obtain a further quantity for trial in this way, and report more fully upon it.

Steam Department, 12 December 1840.

(signed) J. H. Johnston,
Controller.

APPENDIX, No. 14.

EXTRACT of a Letter from Mr. W. B. Turner, late Superintendent of the Rajah of Travancore's Iron Foundry,* on the Method of making Charcoal, &c. *Vide* Proceedings, January 1841, para. 10.

On making charcoal.

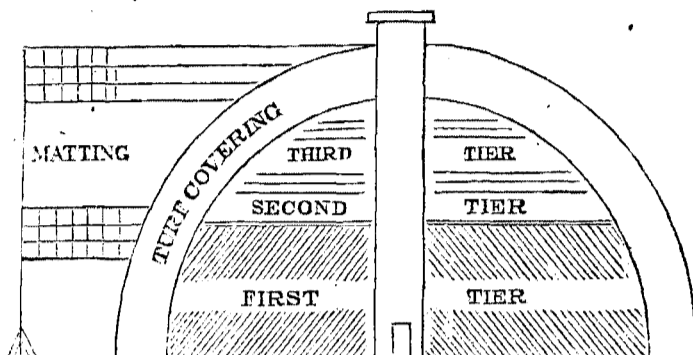
1st. The wood should be cut into pieces of from two to three feet in length.

2d. The wood should be sorted into three different sizes, taking care that the crookedest part

* Now Engineer on board the "Scaforth," Ceylon Colonial Government Steamboat.

part of the wood be cut at the bend, so as to throw it as straight as it will allow, in order that the wood may lay closer together.

3d. The ground on which the charcoal is to be burnt should be cleaned in a circle of from 20 to 25 feet diameter; there should then be a small round hole dug in the ground, of from 14 to 15 inches diameter, as may be perceived by the following drawing :—



4th. This being done, a small brick chimney or flue should be built in the centre of the kiln, and the second-sized wood should be placed around it, as near perpendicular as possible; it will stand on its end, and when the wood runs crooked, care should be taken to fill up the cavity with short pieces, in order to render the whole mass as solid as possible. This being completed, is called the first tier of the kiln when it is so filled as to reach the outside of the circle.

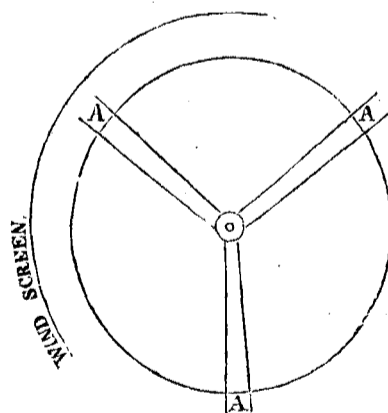
5th. The largest of the wood should be always sorted out for the second or horizontal tier, and should be laid as close as it is possible to the perpendicular or first tier, care being taken to fill up the vacant spaces as before mentioned; this tier should be raised in thickness equally, or a little more in height than that of the perpendicular of the first tier; the largest of the wood should always be placed in the heart of the kiln, in order to receive the largest portion of heat during the process of charring.

6th. Or last tier; the centre part should be filled up with the short pieces, perpendicular as the lower or bottom tier, and overlaid with small or short pieces in a sloping direction, in order to render the top of the kiln round, or like the top of a common coke-fire; this being completed may be called the finishing of the stacking process.

Making Charcoal for smelting iron.

7th. The whole mass should be covered over with reeds or dried grass when procurable, and then be covered with turfs, taking care to lay the grass side next to the wood, and laid as close together as possible to render the whole covering of the kiln as airtight as possible; when the whole should be covered or plastered with wet earth, in order that none of the heat may evaporate through the covering.

8th. This being completed there should be three holes, of about 12 inches diameter, made at the bottom, at right angles, in order to admit air, as you will perceive by the mark or letter in the following sketch:—



All being now completed, the kiln is ready for firing, which should be done by putting a few good pieces of lighted fire down the centre chimney or flue; when the whole mass is found to be well on fire, care should be taken to stop the lower air-hole on the wind side, in order to draw the fire on the wind side of the kiln. In windy weather it is necessary that a sheet, or a screen of mats, should be placed on the wind side of the kiln, as it sometimes happens that the air gets in, which makes the kiln burn, so that one

man is scarcely able to manage it; in this case it is generally found necessary to stop up all the air-holes; care should be taken never to admit of any fire being seen through the covering of the kiln, or any of the smoke to escape, excepting through the centre flue or chimney.

9th. Charcoal made after this process is proved to weigh twice the weight of the common native-made charcoal; it will also support a burden nearly equal to the first sort of coke. It has smelted ore, and also remelted old shot and shell, at the rate of one ton to one ton five cwt. of charcoal.

10th. The beauty and saving of making charcoal by this process is, that the pieces of wood as small as a finger will become charcoal, when lying or standing in the kiln, by the side of a piece of wood of from nine to ten inches in diameter, and the smallest piece will not be the least consumed. The centre flue or chimney should be kept open as long as any smoke is seen to escape from it; but when it has done smoking, the whole kiln, together with the chimney or centre flue, should immediately be stopped up airtight, when the fire will go out, and the kiln will be ready to draw for use in 24 hours.

11th. People ignorant of this process of charring have actually taken the wood to have been half burned until they have taken a piece and broke it, when, to their astonishment, they have found the thing they thought half-burnt wood to be excellent sound charcoal; and many people have balanced a piece across their hand and struck it with another, when it would give a sound similar to a bell. I have often been obliged to break this charcoal into short pieces, in order to keep my furnace or cupola from scaffolding or hanging with its burden.

APPENDIX, No. 16.

EXTRACT of a LETTER from Captain *R. Wroughton*, Revenue Surveyor, Mirzapore District, to *H. M. Elliot*, Esq., Secretary to the Sudder Board of Revenue, North-Western Provinces, 30 April 1840.

Singrowlie Coal.

2. I HAVE the honour to report, for the information of the Sudder Board of Revenue North-Western Provinces, that in prosecuting the survey of Purgunnah Singrowlie of this district, I have discovered a Coal-field, extensive, near the surface, and producing mineral of an excellent quality. The survey is not sufficiently advanced to admit of my placing before the Board an accurate map of the country intermediate between Singrowlie and the Ganges; but the accompanying rough sketch (No. 1) will sufficiently exhibit the position of the carboniferous formation with relation to the Soane River, and Mirzapore on the Ganges; while a second sketch and section-map, which are also submitted, will illustrate the site of the field with regard to Kotah, and show the various deposits of shale, sandstone, &c., alternating above and below the coal.

2. By this opportunity, I beg leave to forward specimens of the strata referred to in the section-map, and which have been excavated from a few feet below the surface, and particularly recommended to the notice of the Board; the specimens of coal (small-sized, and in duplicate) from B pit, No. 2 stratum, and C pit, No. 5 stratum. I have carefully examined both the specimens, and though they were obtained at points somewhat distant from each other—the one mixed with the solid amalgam of mercury, the other free of that mineral—the elements of each muster are much the same, and both samples are of excellent quality.

The specific gravity of specimens from B pit (No. 2), is 1.205; that from C pit (No. 5) 1.255, and the composition determined on 100 parts—

Specimen.	Volatile Matter.	Carbon.	Ash.
B Pit, No. 2 - - - - -	44.2	54.3	1.5
C Pit, No. 5 - - - - -	42.5	55.	2.5

3. The peculiar wild and rugged features of the Mirzapore district have rendered the survey duties very difficult and laborious; in the endeavour to execute that office satisfactorily, my time has been constantly occupied; so much so, I regret to say, as to prevent my pushing geological researches to any considerable extent, and the field for such inquiries is an admirable one. I am unable, therefore, at present to forward a full report upon the Coal formation of Singrowlie, but hereafter shall be happy to supply one, if the subject appears to the Board of sufficient importance. To effect the purpose properly, however, it will be necessary that I be provided with boring implements from the Chunar Magazine, as well as the services of an invalided sapper now at Chunar; and also

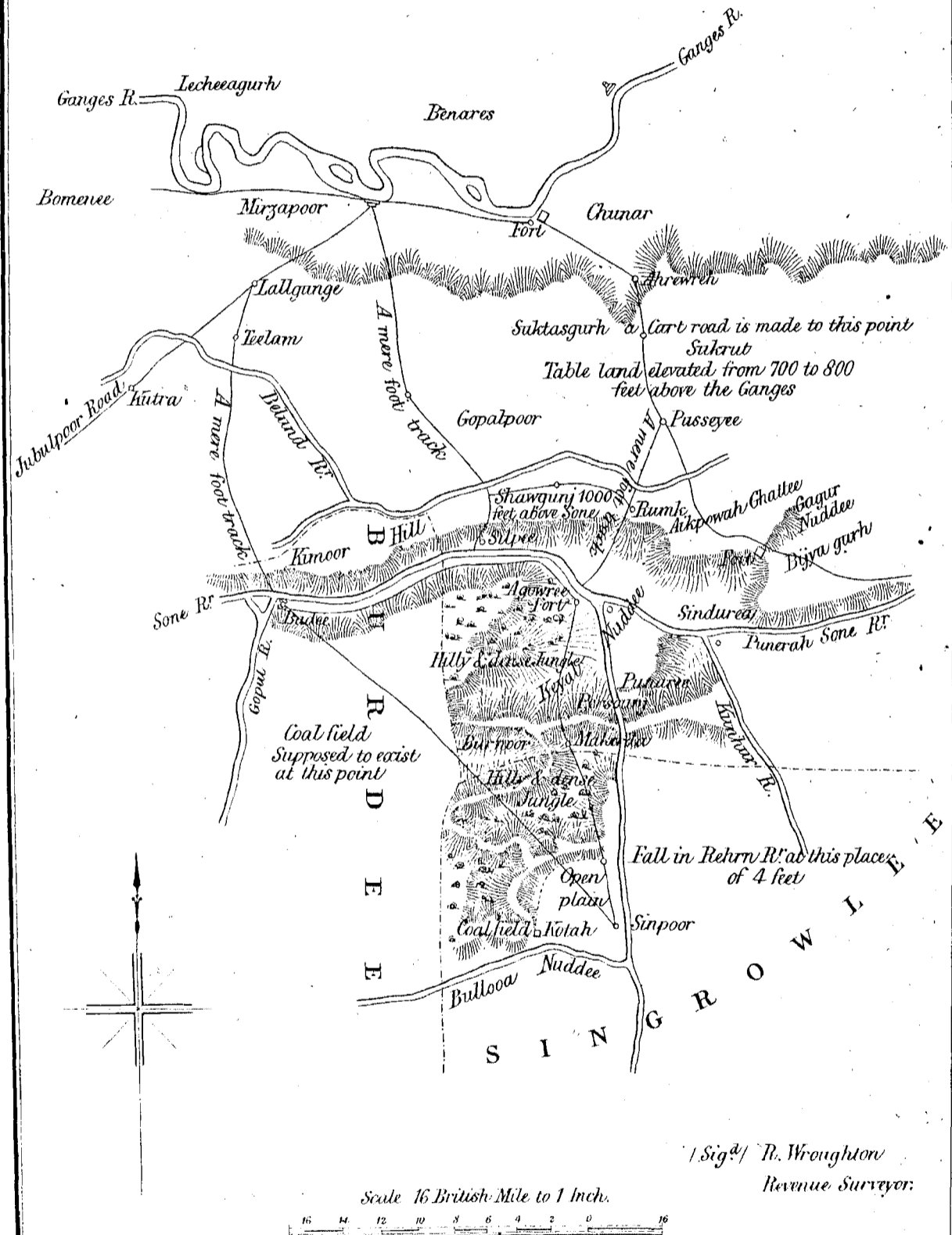
Rough Sketch

Shewing position of the Singrowlee Coal Field

SITUATED IN THE

VILLAGE OF KOTAH,

with relation to the Sone & Ganges River.



/ Sig^d/ R. Wroughton
Revenue Surveyor.

True Copy

Sec^d to the Coal committee.

also that the expense incurred upon the requisite boring experiments be paid by the Government, an extent of assistance the Board will, I trust, not consider unreasonably solicited.

4. Referring to Arrowsmith's map of Hindoostan (1816), the Singrowlie Coal deposit is situated as near to Chunar on the Ganges as the Palamow mines are from the Soan river. I am given to understand that the Palamow colliery is now working for the purpose of supplying Coal to Benares, Dinapore, Mirzapore, and Allahabad, and if the rumour be correct, the more convenient availableness of the Singrowlie Coal renders the discovery of it, even thus far conducted, a matter of advantage; but many reasons induce me to believe that I can pursue the Kotah strata to some situation on, or adjacent to, the Goput river, which forms a conflux with the Soan at the town of Burdie, from whence the Coal could be conveniently and cheaply transported by a road uniting with the grand Mirzapoor and Jubulpoor thoroughfare to the Ganges. Burdie Pergunnah is, I believe, within the territory of the Rewah Raja, whose good-will and aid will, I conclude, be secured to me in the event of my being directed to institute inquiries for Coal in that quarter.

5. Should it so happen my conjecture upon finding Coal at Burdie proves visionary, the transport of the Kotah Coal to the Ganges could be contrived at a less expense than that now incurred for conveying Coal from Bengal to Mirzapoor and Allahabad, for it is generally agreed by those who have considered the question, that a bullock-load (or 2½ maunds) when Brinjarrah cattle are employed in numbers, can be brought from the Soan at Agharee to Chunar on the Ganges for 10 annas, or at about 4 annas per maund; the same charge for carriage would be incurred in carrying the Coal from Kotah to the Soan, and if it can be carried at 1 or 2 annas per maund, the entire cost, for delivering it at Chunar will be 9 or 10 annas, which is 3 or 4 annas a maund less than what is now paid at Mirzapoor for the Burdwan Coal, but I am of opinion that the above estimate would be materially lessened if a cart road was established between Chunar and the Soan.

6. Saving the Jubulpoor great road which skirts a portion of the western side, and the road parallel and near to the Ganges, which runs from Chunar *viâ* Mirzapoor city to the Touse Nullah, there is no route whereby a wheel carriage can traverse the central, southern, and eastern parts of this extensive district. All communication in the shape of traffic is now carried on by laden bullocks, a means of conveyance expensive, and at the same time precarious and insufficient; I say precarious, because in crossing the several mountain streams that intersect the table land, the bullocks constantly lay, or fall down in the water and destroy their load; while no weighty or bulky article admits of being transported by such a mode.

7. If cart roads were constructed on the foot tracks now existing between Mirzapoor, Gopalpoor, Ghoraweel, and Silpee on the Soan; and again between Ahrorah, Sukout, Pussegee, Romp, Aykpowah Ghaut, and Run Buhardurpoor, on the Soan, the convenience would be hailed as a blessing by the people, and be the means of bringing the valuable productions of the Southern Pergunnahs, at this time almost shut out from any communication with either Mirzapoor and Benares, to a ready and profitable market.

8. An excellent road from Chunar, to about three miles beyond Ahrorah, and which is to extend to Seekrut, is already constructed; from thence to Romp, the country is flat, and the strong Argil soil resting on sandstone, could, at a trifling expense, be rendered traversable for carts; adjacent to Romp is the Aykpowah "Ghatee," or passage in descent over the Kymoor Hill to the Soan valley, a fall of 1,000 feet, particular points of this "Ghatee" are precipitous; and here there would be difficulty, but even this might be surmounted, and a passable thoroughfare for carts be constructed at a moderate sacrifice of labour and money, and which would be infinitely compensated by the benefit it would confer upon an extensive community.

9. The Board will, I trust, pardon my offering an opinion thus voluntarily upon a subject, unconnected with my immediate occupations; but having ascertained that the proposition is both feasible and universally desired, and that if carried into effect it would render the Singrowlie Coal deposit a discovery of much importance to the Government and the public, I cannot withhold it.

In conclusion, I beg to apologise for having occupied so much of the Board's valuable attention, but if this attempt to be useful should be favourably received, I shall have reason to be gratified.

Camp Ahrorah, Chunar,
30 April 1840.

I have, &c.
(signed) R. Wroughton, Captain,
Revenue Surveyor.

ABSTRACT of the PROCEEDINGS of a COMMITTEE for the Investigation of the COAL and MINERAL RESOURCES of INDIA, brought up to April 1842, by the Secretary.

The Committee, composed as follows, meet at half-past 10 A.M., on the first Monday of every month.

President:

J. W. Grant, Esq., Keeper of the Export Warehouse.

Members:

Major W. N. Forbes, Mint Master.
Major W. R. Fitzgerald, Superintending Engineer, S. E. Provinces.
Captain J. H. Johnston, Controller of Steam Vessels.
Captain A. Wilson, Superintendent Cossipore Foundry.

Junior Member and Secretary:

Assistant Surgeon, John McClelland, Deputy Apothecary, H. C.

June 1841. PROCEEDINGS of a Meeting of the Coal Committee, held at the Mint, on the 3d June 1841.

Present:—C. W. Smith, Esq., President; Major Forbes and Captain Wilson, Members; and J. McClelland, Secretary.

Doobradgapore Coal. Read a letter from Mr. James Pontet, dated 17th May 1841, announcing the dispatch of 15 maunds of Doobradgapore Coal from beds on the Burmany river. This is a hard, slaty Coal, evidently taken from a superficial bed.

Specific Gravity, 1.4.

Inflammable matter	-	-	-	-	-	-	-	-	-	42
Carbon	-	-	-	-	-	-	-	-	-	38
Ash	-	-	-	-	-	-	-	-	-	20
										100

Forty lbs., tried in the Laboratory, Honourable Company's Dispensary, proved to be a useful second or third rate Coal, and left about 8 lbs. of ashes.

Major Forbes also read a Report of an experiment made at the Mint on the previous day, June 2d, on this Doobradgapore Coal, a copy of which he promised early to send to the secretary.

Burdwan. 2. Read a letter from Mr. James Erskine, stating the difficulties and oppositions experienced by him in sending Coal at present down the Damooda.

Assam. 3. A Report from Mr. Landers on the Coal beds of Upper Assam was received; but as a map referred to in the Report had not yet reached the Committee, the reading of the Report was postponed.

Captain Johnston's trials of Coals. 4. Read a copy of a memorandum drawn up by Captain Johnston for the Marine Board, dated 10th May 1841, detailing the results of certain experiments, conducted by himself, for the trial of different Coals. Captain Johnston found eight maunds of Coal supplied by Mr. Homfray from a new mine, the locality of which he keeps secret, to keep up steam well for 55 minutes, while Coal from Dearee on the Soan, supplied by Mr. Ravenshaw, would not keep up steam. Three maunds of Moulmein Coal were next tried, but though it burnt briskly, the quantity was too small to allow of an accurate experiment. Equal parts of Cherra and Dearee Coal were then mixed, and found to keep up steam well, as also a sample, consisting of 5½ maunds, of Mr. Erskine's Adji Coal.

5. Captain Johnston remarks that two principal objects were to be attained by the above experiments. First, to try the quality of Mr. Erskine's Coal, with the view to ascertain whether that gentleman would be warranted in working his mines; and, secondly, whether Mr. Ravenshaw's Dearee Coal, mixed with Cherra Coal, would be an economical fuel.

The

The quantity tried of Mr. Erskine's Coal, Captain Johnston thinks, was too small, and therefore the experiment, though promising, was unsatisfactory. With regard to the mixed Coal, although it kept steam well up, Captain Johnston thinks it would not be economical, and therefore recommends the Dearee mines to be discontinued.

6. The above memorandum seems to have been addressed to the Marine Board, and to detail experiments proposed in the first paragraph of the Proceedings of the Committee, 8th February 1841, with a view of submitting to decisive experiments the fitness for purposes of steam navigation of a mixture of Cherra Ponji and Dearee Coal. The Committee think, that as the Government have gone to considerable expense in regard to Palamow and Dearee Coals, and as the Revenue and local officers have interested themselves greatly in the pursuit, and that upon principle it is always desirable, as well as satisfactory, to parties sending samples of Coal, that the experiments should be made by the Committee collectively; they are not, therefore, prepared altogether to discontinue the Dearee mines, or their researches, for a still better Coal, in a quarter so advantageously situated to supply the Dinapore station, and for the reason above assigned, determine to submit the mixed Coal to another experiment before the Committee, conformably to their resolution in the first paragraph of their proceedings for February last.

Remarks of the Committee.

7. A specimen of pipeclay, from the vicinity of Singmaree, in the Caribari Hills, also a white silicious and a yellow ferruginous sandy clay from the same vicinity, together with a few inferior specimens of iron ore and shale, resembling that of the Coal formation, were received from Captain Jenkins, as having been collected by Mr. Hudson.

Minerals from Caribari Hills.

8. From Lieutenant Ouchterlony nine specimens of copper, and two of lead, and one of tin ore, washed and unwashed.

Minerals from Nellore.

9. From Mr. Wilkinson the following specimens, referred to in his Report, which was read at the last meeting, were received. Soda, impure carbonate; various iron ores, as red and yellow ironstones, and ochres, gold dust, compact grey manganese ore, steatite, pipeclay, &c.

Minerals from Nagpore.

At a Meeting of the Coal Committee, held at the Honourable Company's Dispensary, on July 1841.
5th July 1841,

Present:—C. W. Smith, Esq., President; Major Forbes and Captain Johnston, Members; and J. McClelland, Assistant Surgeon, Secretary.

Read a letter from Mr. Hollings, of Mongheir, to Mr. Dent, Collector of Bhaugulpore, stating his knowledge of the existence of Coal a little beyond the borders of the Bhaugulpore district, and which may be conveyed to the village of Surygurra, on the banks of the Ganges, 20 miles above Mongheir, at six annas per maund, and offering, before communicating further, to become agent for the supply of this Coal for the Gangetic steamers. Mr. Dent states that Mr. Hollings would be willing to give every aid in pointing out the situation of the Coal to an agent appointed by the Government, and should the Coal turn out well, Mr. Dent thinks Mr. Hollings would deserve well of the Government.

Resolved, That Mr. Dent be informed that it will at first be requisite that the Committee be supplied with from 100 to 300 maunds of the Coal in question, when, if it prove good, and the field new and valuable, the Committee will recommend Mr. Hollings' claims to the favourable consideration of the Government; but full particulars must first be communicated to the Committee on the subject.

2. Read a letter from Captain Jenkins, forwarding Reports from Mr. A. H. Landers, Special Assistant to the Commissioner, for working Coal mines in Assam.

3. A specimen of Coal from Jaipore was presented from the Assam Company, with a note expressing the desire of the Directors that the Committee would favour them with an opinion as to its value. The Secretary was requested to examine the specimen and afford the necessary information.

Assam Coal.

The following are the results of the examination of this specimen of Jaipore Coal:—

Specific Gravity, 1.03.										
Volatile matter	-	-	-	-	-	-	-	-	-	48
Carbon	-	-	-	-	-	-	-	-	-	46.2
Ash	-	-	-	-	-	-	-	-	-	5.8
TOTAL										100.0

This is a superior description of Coal, and if procurable from a large bed, capable of being worked with facility, might be profitably delivered at Dinapore and the other Gangetic depôts.

Doobradgepore Coal. 4. Read a Report from Major Forbes, dated 2d July 1841, alluded to in paragraph 1st Proceedings, June 1841, on the quality of the Coal found by Mr. Pontet, near Doobradgepore. The experiment was made by Mr. Gilbert, and the result is that 4 maunds 24 seers of Rajmehal Coal is only equal to 3 maunds 5 seers of Burdwan Coal. The sample was evidently surface Coal.

Akyab. 5. Read a letter from Lieutenant Phayre, stating that his search for Coal in Akyab district has proved unsuccessful.

6. Read a letter from Captain Bogle, the Commissioner of Arrakan, who with reference to the resolution in the second paragraph of the Proceedings of the Committee, 5th April 1841, has entertained a Mr. H. Adams to superintend the raising of Coal at Kaung-dying, at a salary of 100 rupees per mensem. Resolved, that the employment of Mr. Adams be recommended to the approval of Government, as a temporary arrangement.

On the importance of thin seams of Coal.

7. A letter from the Government, in the General Department, dated 16th June, was laid before the Committee, together with its enclosure from Mr. Richard Boodle, dated Radstock, 12th September 1840, accompanied with sample of Coal on which the Government require information from the Committee as to whether similar seams of Coal, when favourably placed, might not be worked with equal advantages in India.

The Coal is considered as good as any in the kingdom, and supplies the surrounding country with fuel for steam as well as for domestic purposes, for lime-burning and forges, and yet the thickest bed is only 2 feet 2 inches; and the average thickness of seven different veins only 1 foot 7 inches; each vein would form a size which in India has hitherto been thought too small to work. The Secretary was requested to state the particulars regarding such beds of Coal as have hitherto been thought too small to be worked in India, for the information of the Government.

The following is a copy of Mr. Boodle's remarks:—

Radstock, 12 September 1840, near Bath.

Sir,—In compliance with the request of my friend, Reverend William Hockin, of Phillack, near Penzance, I herewith forward specimens of the different veins of Coal in the parish. The rest of the pits in this neighbourhood, such as those of Timsbury, Paulton, Midsummer Norton, Kilmersdon, Writhlington, &c., have Coal of nearly the same quality, and from nearly similar veins. I believe there is no better Coal in the kingdom for household purposes. The prices are for all haud 8 *d.* per cent., for rubble, 6 *d.*, and for half-and-half, 7 *d.* The rubble is usually good with the haud, but contains some small as well as haud, but not more than is useful in every family; I have not used any but rubble for the last 20 years; besides this, we have what is called small Coal, sold at 3 *d.* per cent., and is inferior to the other in quality, in consequence of containing some portion of dirt or chippings of the cliff, which is mixed with it by the miners in getting the Coal. This is chiefly used for burning lime, but I believe is not used for steam engines. A considerable quantity of this rubble is sent up by canal to Reading, and used in steam engines. In the neighbourhood at Vobster, about six miles off, there are pits of Coal of inferior quality as to household purposes, as I believe very little of it is large, but the small Coal is particularly clean, and of superior utility for smith's work, which is proved by the fact, that in all the smith's shops in our own Coal works, they use the Vobster small Coal instead of their own.

The thickness and specific gravity of our veins are as follows:—

	Thickness.	Specific Gravity.
	<i>Ft. in.</i>	
Great vein - - - - -	1 10	1·269
Top little vein - - - - -	1 4	1·298
Sliving vein - - - - -	—	—
Little vein under the sliving - - - - -	1 2	1·288
Bottom little vein - - - - -	1 0	1·301
Top Bull vein - - - - -	2 2	1·237
Bottom Bull vein - - - - -	2 0	1·307
	6)	7·700
Average - - - - -	1 7	1·283

or 80 lbs. to the cubic foot.

August 1841.

I have not been able to procure any of the Sliving vein, as none is worked at this time; it burns with a brilliant flame, and consumes rapidly; therefore when they are landing it, I tell my servant to avoid it.

Our chief market is the surrounding country and Wiltshire, by land carriage and by the canal

canal to Reading and Berkshire, chiefly for household purposes, and much of the rubble for engines; and this is of equal quality, and indeed is the same Coal as the haud, only more broken in the getting.

If I can be of any service to you in procuring any other specimens, or gaining further information, I shall be most happy to do so.

I remain, &c.
(signed) *Richard Boodle.*

At the Meeting of the Coal Committee, held on the 9th August 1841,

Present:—C. W. Smith, Esq., President; Major Forbes, Captain Johnston, Captain August 1841.
Wilson, and Mr. McClelland.

READ a letter from Mr. Erskine, stating, that having no ground to land his Coal on, it would enable him to get over one of the difficulties of first opening mines on his side of the Burdwan Coal field, if the Coal could be received from his boats on its arrival. Major Forbes and Captain Johnston thought that Mr. Erskine's Coal may be received to a certain extent, according as he can send it down.

2. Read a letter from Captain Jenkins, suggesting the employment of a common Coal- Assam.
miner in Assam, and he thinks amongst European soldiers Northumberland or Welsh Coal-
miners might be found, who, on the pay of an overseer in the Barrack Department, would
be content to work hard and superintend coolies at Coal pits. Captain Wilson remarked
that he knows several deserving men in the Artillery who have been brought up to
mining, and who, if temporarily transferred in the manner proposed by Captain Jenkins,
would be very useful in the way he suggests. The Committee agree as to the importance
of such an arrangement if it could be conveniently effected, particularly as some dis-
appointment has attended their attempts to obtain by private arrangements the services of
miners.

3. Report of Captain Tremenheere, Executive Engineer on the Tenasserim Coal field, Tenasserim.
received from Government for the purpose of being placed on the records of the Com-
mittee, together with papers from the Governor of Prince of Wales' Island, connected
with the quality of the Tenasserim Coal furnished for the use of steam-vessels in the
Straits for the same purpose; Captain Tremenheere describes the locality of the Coal field
and the navigation of the great Tenasserim. The Coal bed which has been worked is six
feet in thickness, and appears on the bank of a stream now known as the Coal Nullah.
The bed of Coal is covered at this spot merely by a few feet of shale and dips, at an angle
of 24 to 29 degrees. There are several small, unworkable seams of Coal, alternating with
clay, below this to a depth of 18 feet. The mine was opened from the outcrop, and con-
sequently whatever water it contained necessarily lay in the workings, which no machinery,
however perfect, could keep dry, the working being the lowest portion of the pit. The
Committee regrets that it had not been consulted in the case of the Tenasserim Coal mine,
or kept informed of the nature and progress of these works by the officer in charge, or the
local authorities on the coast.

4. The communications from Singapore on the subject of the Mergui Coal are to the Mergui Coal.
effect that 620 tons of that Coal supplied to the Straits has been repeatedly discovered to
evince signs of spontaneous combustion, owing, as would appear from samples since fur-
nished to the Committee by the Marine Board, to the large proportion of pyrites it
contains.

5. Read a letter from A. J. M. Mills, Esq., Commissioner of Cuttack, acknowledging Cuttack Coal.
the receipt of specimens of coal forwarded to him as a guide in transmitting future samples
of Cuttack Coal to Calcutta for trial, that which is referred to in the Proceedings of the
Committee, 3d May 1841, having proved very inferior. The cause of this disappointment
is referred by Mr. Beetson to the heat of the jungles in March last, when the Coal was
obtained, and to the necessity of entrusting the raising and dispatch of the sample to
natives.

Mr. Mills assures the Committee, on the authority of Mr. Beetson, that Coal, of the
best quality, is abundant at Talcher and Hingolee, and that the Coal field is above
30 miles in extent, covered with their stunted jungle, and composed of various kinds of
sandstone and slate.

6. Read a letter from Captain Jenkins, Commissioner of Assam, enclosing a Report
from Mr. Landers on the salt springs near the Naga villages of Junkoo. Some beds of
Coal appear to have also been met with by Mr. Landers in the Naga Hills, but not in
situations favourable for transport.

PROCEEDINGS of the Coal Committee, 6th September 1841,

September 1841.

Present :—C. W. Smith, Esq., President; Major Forbes, Captain Wilson, and Assistant Surgeon J. McClelland.

Bhuttecana.

READ a letter from T. T. Metcalfe, Esq., Commissioner of Delhi, in reply to the Committee's circular of 24th March last, enclosing a letter from S. G. Smith, Esq., Officiating Superintendent of Bhuttecana, stating that an inferior iron ore, derived from mines within two miles of Ferozepore in that district, is used in the manufacture of iron for agricultural implements.

About 10 maunds of the ore reduced to fragments of one and a half tola weight is mixed with 11 maunds of charcoal and exposed to heat for 21 hours, yielding from one and a half to two maunds of iron.

Ferozepore.

A better iron is produced from a mine at the village of Caloonce, five coss from Ferozepore, in the Ulwur jurisdiction, the ore of which yields, by a similar process, six seers per maund. It has been reported to Mr. Smith, that hot springs impregnated with sulphur occur in Sanah, and that sulphur is a product of that vicinity.

Nerbudda.

2. Read a letter from Dr. Spilsbury, surgeon to the Governor General's Agent, Nerbudda Territories, accompanying specimens of the rocks, &c., of the Coal beds situated in the Nerbudda river, between Lemata and Felwaree Ghats.

Jubbulpore.

The bed of Coal in this situation is only approachable towards the end of the hot weather when the river is lowest, at other times the site is inundated, but there are other situations in the vicinity from which Coal is now obtained by the inhabitants of Jubbulpore at any season. A sketch of these localities, exhibiting the peculiarities of the place, accompanies Dr. Spilsbury's letter.

Chittagong.

3. Read a letter from H. Ricketts, Esq., Commissioner of Revenue, Chittagong, enclosing a communication from Mr. Sconce, Collector of Chittagong, stating that specimens of a coal-like substance, which burns to ashes, emitting a bituminous smell, were some time since found in the bed of a nullah, flowing from the east face of the Seetakoond Hill, and which joins the Holdah, a large river that runs into the Kurnodoolie river, five miles above the town.

The secretary was desired to thank Mr. Sconce for this interesting information, as well as to request specimens of the mineral in question which Mr. Sconce proposed to forward. Mr. Sconce also mentions that the tribes inhabiting the hills east of Chittagong, derive their salt from the brine springs. Mr. Sconce was desirous of being informed how the existence of salt springs effected the prospect of finding Coal in their vicinity.

The secretary was desired to communicate with Mr. Sconce on this subject, and explain that the saliferous marls which contain salt springs occur in Europe, resting on the Coal formation, and that as far as we yet know, the same relative position between the Salt and Coal formations holds good in India. No limestone has hitherto been found at Chittagong, much to the disadvantage of the district.

4. Read a letter from Messrs. Gillanders, Arbuthnot and Co., accompanying a sample of Kennel Coal, imported from the Clyde, which is said to be of very superior quality, and which they think may be useful for comparison with other Coals, at the same time expressing a wish to be supplied with a copy of the Committee's Report on the quality of the same, which was ordered to be furnished.

Mergui Coal.

5. Read a letter from C. B. Greenlaw, Esq., Secretary to the Marine Board, transmitting the copy of a letter from Captain James Ramsay, Deputy Assistant Commissary General, on the spontaneous combustion of Mergui Coal, at Singapore, together with a sample of the Coal in question after incipient combustion had taken place, and requesting, in case no portion of Mergui Coal has been already analysed, that the specimens now sent may be examined, and the result communicated for the information of the Board.

The Committee observe on this subject that the experimental working of Mergui Coal has not been carried on under its direction or advice. In reply, the secretary was, however, directed to inform the Marine Board, that the tendency to spontaneous ignition in the Coal in question, appears to be owing to the presence of pyrites, a common ingredient in certain seams of Coal in most Coal fields. That the yellow shining substance may always be detected on the surface of the fracture. Specimens presenting such appearance are known to colliers as Brassy Coal, are generally of local occurrence, and should always, when they are found, be rejected at the pit. Pyrites often abounds most at the partings between the alternate layers of shale and Coal; and from samples of the Mergui Coal which came under the experiments of the Committee, it would appear probable that several seams of thin Coal and thin bituminous shale, closely resembling Coal in appearance, were worked as one thick seam of Coal, and the pyritous parting shale and Coal thus mixed together.

Chota Nagpore
Superior Coal and
other valuable
minerals.

6. Read a letter from Major J. R. Ouseley, the Governor General's Agent, Chota Nagpore, in reply to the Committee's letter of the 25th March, stating that in making the new road, he has found an immense field of Coal, about nine or ten miles south of Hazaree Baug, from which specimens will shortly be sent, some of which Major Ouseley thinks will be

be found equal to the Hosingabad Coal, pronounced at Bombay to be far superior to any Scotch or English hitherto known.

Major Ouseley states that he has also found Coal in great quantities in the Behor river, as well as close below the table land of Mynpok Surgooja, and in the Hustoo river, still more to the westward at Koorba, near Ruttonpore, in Chutteesgurh, of a very valuable kind, and laid open by the river to a vast extent. In the Behor river these extensive beds of Coal which lie in the direction of the direct route from Calcutta to Bombay, are applied to no use whatever by the natives, who are ignorant even of its combustible qualities.

An iron ore of fine quality, of which very good steel is made by the natives, also occurs in the same direction. Major Ouseley thinks, that in the hands of skilful people, the washing for gold in the sands of the Mahanuddee, might be turned to very profitable account. Gold is also found in the Brahmeny River between Midnapore and Sumbulpore. Diamonds of much value are occasionally found by the gold-washers, particularly in the Ehee river, which is supposed to be the source of diamonds in this quarter.

The secretary was directed to enter into communication with Major Ouseley, as to the best means of bringing the minerals referred to into useful operation.

7. Specimens of a superior description of red chalk or reddle were received from Captain Jenkins, as having been found by Mr. Bedford in the vicinity of Caribari Coal.

A Meeting of the Coal Committee was held on Monday, the 4th of October 1841, October 1841.

Present:—C. W. Smith, Esq., President; Major Forbes, Captain Johnston, and Captain Wilson, Members; Assistant Surgeon, J. M'Clelland, Junior Member and Secretary; and Captain Bogle, Commissioner of Arracan, Visitor.

The reply of the Government* to the proposition contained in the 3d paragraph of the Proceedings of the Committee for August 1841 having been read, the Committee came to the following resolutions with regard to the employment of miners.

The Committee refer particularly to two Coals on the Island of Ramree, Kaeng Dyng, and Hoong, respecting the quality of which they have already reported favourably, the one as being the best sample of Coal hitherto met with in India, and the other a good serviceable Coal; while both appear to be most favourably placed for transport, near navigable creeks but a few miles from the coast.

Captain Bogle, who attended the Committee, stated his desire for a practical working miner in the first instance, and if, after a fair trial on a small scale, the Coals were found to answer, measures could then be had recourse to for putting the establishment on an improved footing, according to the extent to which it might be necessary to extend the operations, to guard against the chances of sickness and the consequent loss of another season. It was suggested that two miners should be sent to Arrakan, provided with all the necessary implements for working the Keang Dyng and Hoong Coal beds, so as to arrive at their post by the 15th proximo.

Recommendations
of the Committee
relative to Arrakan
Coals.

2. The Committee recommend in detail the adoption of similar measures with regard to Assam, with a view to ascertain the expense at which the best Assam Coal could be furnished to the nearest accessible stations along the course of the Berhampooter to Bengal, according to the 8th and 9th paragraphs of the Proceedings of the Committee for January 1841. The Committee in this, as in the case of Arrakan, recommend that two miners should be selected for the duty, so as to guard against the loss of time which the sickness of one might occasion, as also that they should be in Assam as early in November next as possible. Assam.

3. With reference to the letter of Mr. Mills, the Commissioner of Cuttack, dated 4th of August 1841, and the 6th paragraph of the Proceedings of the Committee for August 1841, the Committee recommend that two miners be appointed as in the case of Arrakan and Assam, for the purpose of opening Coal mines at Talcher and Hingolee, as well for that of ascertaining satisfactorily the quality of the Coal of those districts, as well as the expense at which it may be carried down the Bramenee river to Hunsua. Cuttack.

4. The Committee attach great importance to beds of Coal which have been brought to notice in various situations at the foot of the Rajmehal Hills, and particularly to those situated at Doobradgepore on the Burmanee Nullah, west of Moorshedabad. Regarding this Coal Mr. Pontet has declared that nothing more can be done until practical aid be afforded in working it. Rajmehal.

The Committee, therefore, recommend that two miners, furnished with the necessary implements, be appointed with the view of opening a mine in the most desirable situation, and should the result prove satisfactory that Captain Smyth should then be directed to afford information as to the state of the Birrmany river, and the extent to which it is navigable during the year.

5. The

* Letter of the Secretary to the Government of Bengal, General Department, Marine Steam, No. 902, dated Fort William, 15 September 1841.

Recommendations
relative to Cherra
and Soan Coals.

5. The Committee conceive it to be one of its first objects to ascertain the existence of good Coal in as many different directions, where it may become useful, as possible; and after obtaining as much information as the local authorities on the spot can afford, to recommend that practical persons may be deputed at the smallest possible expense, in order to place the fact of the existence and workability of good beds beyond a doubt. To follow out these views to the requisite extent, the Committee would also recommend that two miners be placed at the disposal of the authorities in the Kasyah Hills, for the purpose of trying the workability of the Byrung Ponjee, and other beds in that vicinity, as well as under the Commissioner of Patna, with the view of fixing upon some point where the beds long known to exist on the Soan river, or its branches, might be worked with advantage. It was, therefore, proposed and unanimously agreed to embody the above views and recommendations in a letter to the Government.

Potters' Clay.

6. Read a letter from Mr. Thomason to Major Forbes, dated Agra, 21st March 1841, enclosing a specimen of clay from Bundlecund, said to be that used by Dr. Jeffreys, of Futtyghur, for firebricks and pottery, together with two specimens of a green glass manufactured at Agra. The clay appears to be of a very fine magnesian quality, and from this peculiarity as well as its compact structure, is doubtless well adapted for firebricks and crucibles.

With regard to the clay used by Dr. Jeffreys, for the manufacture of soda water bottles, the Committee consider a knowledge of its situation would be highly useful, and the secretary was therefore directed to address Mr. Thomason on this subject, with a view of obtaining, if possible, a few maunds of the clay in question, together with such information as may be available regarding the uses to which it is now applied at Futtyghur.

7. Read a letter from Mr. James Erskine to Major Forbes, in which it is stated that when searching for Coal a few years since, in the eastern parts of Sheerghur, his workmen reported that at a short distance below the surface they came to a hard rock which required stone cutters to penetrate. Below this, about 25 yards, a quicksand was reached, from which water entered faster than their means enabled them to pump it out. In other cases, after several yards of superficial soil and clay had been penetrated, they came to a very soft sandstone succeeded by something like pipeclay in different layers of various degrees of whiteness and fineness, some as white as English chalk, of which specimens are stated to be forwarded. Mr. Erskine expresses a wish to obtain boring rods, 30 or 40 feet in length, for which he would gladly pay, in order to extend these inquiries. Mr. Erskine also states that 20,000 maunds of Adji Coal have been delivered by him at Cutwa, during the present rains, and only 5,000 maunds of what he had raised with the intention of dispatching by this channel, remained to be forwarded at the date of his letter.

It was stated by Major Forbes, Captains Johnston and Wilson, that several boat loads of Damoda Coal, lately received from Mr. Erskine, had turned out of a superior quality, after trials of samples of 300 maunds each in the Mint, Cossipore, and Steam Department.

Adji River.

8. Read a letter from G. Boscawen, Esq., to the Secretary of the Committee, dated 30th September 1841, offering suggestions for improving the navigation of the Adji, by means of three or four sluice gates at situations where the river is sufficiently narrow to admit of their construction. Major Forbes remarked that the great breadth of the stream and the velocity and body of water which passes down it during the rains, would render Mr. Boscawen's plan impracticable, or, at least, more expensive than a canal holding six feet of water formed in a direction nearly parallel to the stream.

November 1841.

A Meeting of the Coal Committee was held on the 8th November 1841,

Present:—Major Forbes, Captain Johnston, Captain Wilson, J. McClelland, Secretary.

Iron ores.

Read a letter from the Government, No. 977, dated 13 October 1841, requesting information as to the experiments made in smelting iron ores at the Mint or the Cossipore Foundry. Major Forbes informed the Committee that arrangements are now in progress which will enable him to complete the new furnace and render it available for the experiments on iron ore.

Captain Wilson submitted to the Committee a memorandum detailing the following experiment on Tavoy iron ore at the Cossipore Foundry: 26 cwt. of the ore, broken into small pieces, was put into the coaking oven, with a like quantity of English Coal, on the 7th April, at half-past 2 p.m., and taken out 9 a.m. on the 10th. A strong sulphureous smell came from the roasted ore.

Experiment on the
reduction of Tavoy
Red Ironstone.

The 20 cwt. of ore and 20 cwt. Coal yielded 32 cwt., united with coke and roasted ore. Sixteen hundred weight of this, with 5 cwt. of limestone as a flux, was put into the cupola, and subjected to the blast for three hours and a half; a good deal of slag ran off at first, but the outlies being small soon got clogged up.

The cupola being tapped, no metal ran from it, but on being opened, a mass of iron mixed

mixed with scoria was found at the bottom of the furnace, weighing 2 cwt. 3 qrs. This metal, when cold, yielded readily to the hammer and file, but when heated in a forge, and subjected to the hammer, crumbled to pieces.

No further experiment was tried, as the cupola was found to have been considerably injured by the above experiment, and being of small capacity, was unfit for the purpose.

Cossipore, 6 November 1841. (signed) *A. Wilson*, Captain,
Officiating Superintendent of Foundry.

2. Read a letter from the Government forwarding a Report from Captain G. B. Tremenheere, Executive Engineer, Tenasserim Division, on the tin grounds and manganese beds of the Mergui Province. Tin is said to have been formerly worked in the Mergui Province to considerable extent, and is chiefly found, Captain Tremenheere states, in the beds and banks of streams issuing from primitive districts. The principal tin streams are on the little Tenasserim. Captain Tremenheere found that two men accustomed to the operation of washing collected 25,406 grains of per-oxide of tin, equal to 2 lbs. 963·232 grains of pure tin in half a day. The price of labour is six annas per *diem*, and the price of tin is 4*a.* 4*p.* per lb. at Mergui. Stream tin.

3. The existence of black oxide of manganese, Captain Tremenheere states, was brought to his notice in the bed of the great Tenasserim, near the mouth of the Therabuen stream, by Mr. T. A. Corbin, Assistant to the Commissioner, and a specimen of the same mineral from the Khuggoo river was also brought to Captain Tremenheere by a Kureen. The localities in which these minerals were found are all laid down upon a map which accompanied Captain Tremenheere's Report. Black oxide of manganese.

4. It is stated that the price of labour is high in the Tenasserim Provinces, a drawback which will however correct itself, the price of provisions being low. The specimens of minerals which accompanied Captain Tremenheere's Report not having reached the Committee, they cannot form an opinion of their value. The small quantity of black oxide of manganese, used in India with chloride of lime as a disinfecting agent, is imported from Europe at the invoice cost of 2*d.* per lb. Should the Mergui article answer as a substitute, it will be unnecessary longer to import this mineral from Europe; it is also used in the manufacture of glass, a manufacture which is every day becoming more essential in India.

Major Forbes states that about seven years ago a large quantity of the black oxide of manganese was forwarded to Calcutta from Ceylon, and a portion of it was sent to Mr. James Prinsep at the Mint for experiment.

Captain Johnston thinks it desirable that the greatest publicity be given to these papers.

5. Read a letter from J. Hannington, Political Assistant, to Major Ouseley, Agent to the Governor General for Territories, forwarding the following list of specimens:—

- | | | |
|-----|--|--|
| No. | 1. Decomposed felspar, from Purgunnah Pateoom. | |
| „ | 2. Red ochreous earth from ditto. | |
| „ | 3. Ditto, ditto. | |
| „ | 4. Talcoise clay from ditto. | |
| „ | 5. Ditto ditto. | |
| „ | 6. Yellow ochreous earth from ditto. | |
| „ | 7. Inferior iron ore from ditto. | |
| „ | 8. Ditto of better description, ditto. | |
| „ | 9. Very superior iron ore from ditto. | |
| „ | 10. Decomposed felspar clay from ditto. | |
| „ | 11. Red ochreous clay from ditto. | |

Minerals from
Manbhoom Chota
Nagpore.

6. Read a letter from J. Thomason, Esq., stating that the clays referred to in the proceedings of the last meeting, came from near Punnah, in Bundlecund, referring for further information on this subject, as well as the manufacture of glass and pottery ware, to Mr. J. C. Pyle, now at Futtyghur, as well as to Mr. Dodd, Assay Master, Agra, and also to a correspondence on the manufacture of pottery between the Supreme Government and the Government of Agra, which correspondence has since been received by the secretary for publication in the "Calcutta Journal of Natural History." Potters' Clay.

A Meeting of the Coal Committee was held on Monday, the 6th December 1841.

Present:—C. W. Smith, Esq., President; Captain Johnston and Mr. McClelland; Major Forbes was prevented by indisposition from attending.

READ a letter from Major Lister, Political Agent, Kasyah Hills, in reply to the Committee, stating that the Cherra Coal is capable of being delivered in Calcutta by Government agency, at 7*a.* 8*p.* per maund, a price which, considering the superior quality of the Coal, is such as to render it, in the opinion of the Committee, desirable that the mines should still be retained in the possession of the Government. Rate at which
Cherra Coal may be
delivered.

Comparison of Adji and Damooda Coals. 2. Reports from Major Forbes on the trial of Adji and Damooda Coals were submitted to the Committee. Major Forbes found the expenditure of Adji Coal from Mr. Erskine's mine, in a 20-horse power engine, to be 27 maunds 14 seers daily, leaving 24·47 per cent. of ashes; 29 maunds 9 seers of Burdwan Coal were required to keep the engine to the same work during the same period, and this left 25 per cent. of ashes, from which Major Forbes infers that the Adji Coal is the best of the two, and as the Adji Coal may be more cheaply delivered for up-country use, this result is one of undoubted practical importance.

Extent of the Adji beds. 3. On the subject of Adji Coal an interesting memorandum was read from Captain G. Boscawen, who describes the country west of Elambazar, on both sides of Adji river, as one extensive Coal field.

Cherralea Coal Mine. Two hundred maunds of Coal were delivered to the Committee by Captain Boscawen for trial; this sample was raised by himself from a mine, the property of Mr. C. Hollings, which is situated at a place called Cherralea, about a quarter of a mile from the west or left bank of the Adji river, about 13 miles above Mr. Erskine's mine, and about 80 miles from the entrance to the Adji river at Cutwa.

The mine is situated about 40 feet above the bed of the river on the side of an eminence, and the thickness of the bed of Coal is about six feet, and only 13 feet from the surface, covered merely by a bed of clay and "hard rocky stone." Captain Boscawen laid the Coal bare, having removed the superincumbent clay and stone for an area of several yards, and having raised the Coal, amounting to about 5,000 maunds, he then carried an excavation downwards to a further depth of 23 feet, or about 40 feet from the surface, and found several thin seams of Coal about one and a half to two inches thick, alternate with beds of shale and sandstone. A sketch of Captain Boscawen's plan of working the mine is herewith attached.

Mahuddunugger Mine. At Mahuddunugger, in an east-north-east direction, on the opposite or north-eastern bank of the Adji, and about three-quarters of a mile from the stream, Captain Boscawen states there is a bed of Coal 13½ feet thick, with only six feet of hard clay on the surface. In the vicinity of this mine Captain Boscawen states that large quantities of iron ores occur; this is melted by the natives and manufactured on the spot into all manner of mining implements, which Captain Boscawen found to be of better quality than any procurable in the Calcutta Bazaar.

Boats of 200 maunds can ascend in the rains as high as Elambazar, and make six or seven trips in the season, and if a road were constructed from Elambazar for about 15 and 20 miles, and rendered fit for hackeries, this important Coal district would thus be thrown open. It was ordered by the Committee that about 20 maunds of Captain Boscawen's sample of Coal should be tried in the Laboratory of the Honourable Company's Dispensary, and the remaining 180 maunds divided equally between the Mint and Cossipore Foundry for trial, and reports on the result made to the next meeting.

Borneo Coal. 4. Two samples of Coal from the Island of Borneo, together with a letter from Government in the Political Department, enclosing extracts of correspondence from the Governor of the Eastern Settlements on the subject, and requesting a Report from the Committee as to the quality of each sample. The Coals are stated by Mr. Bonham to exist on two small islands in the Borneo river called Pulo Chirring and Pulo Keng Arrang. The first of these consists of about half a maund of pure good coal.

		Specific Gravity, 1·22.							
Pulo Chirring Coal.	Volatile matter	-	-	-	-	-	-	-	64
	Carbon	-	-	-	-	-	-	-	32·5
	Ash	-	-	-	-	-	-	-	3·5
									100

This Coal is admirably adapted for steam purposes. It appears from the letter of Mr. Bonham that Pulo Chirring is an island within six miles of the town of Borneo, of three miles in circumference, situated in a large navigable river, easy of access, and free from danger. The Coal is found on the beach, the ebbing and flowing of the tide having removed the superincumbent bed of clay, leaving the Coal exposed at low water; it is also supposed to extend into the island, where it may be obtained by merely removing the superincumbent earth.

The Coal has been tried in large quantity on board the "Diana" steamer, and Mr. Bonham remarks that the engineer of that vessel reported very favourably of its quality.

Pulo Keng Coal. The second sample from Pulo Keng is not good Coal, but consists chiefly of the slates and shale of the Coal formation, with thin layers of Coal forming slaty layers in each specimen. One of slaty fragments of Coal from the mass of shale afforded the following result:—

		Specific Gravity, 1·39.							
Pulo Keng Coal.	Volatile matter	-	-	-	-	-	-	-	43
	Carbon	-	-	-	-	-	-	-	30·5
	Ash	-	-	-	-	-	-	-	26·5
									100

Although

Although this sample would not answer for fuel, yet there can be no question whatever of the existence of good Coal at the place from whence it was derived. Mr. Bonham refers to a small work published at New York in 1839, by Mr. Tradescant Say, and Mr. Dicken, giving an account of a voyage of the American brig "Himmaleh," in 1837, and to Mr. Brooke, a gentleman belonging to the Royal Yacht Club, for further information regarding these Coals, which, from their situation, may become of the utmost importance.

5. Read a letter from Government, accompanying specimen of tin ore forwarded to the Committee for their Report. The specimens are from four localities described in Captain Tremenheere's Report.

The first locality near the Coal mine affords stream-tin by washing the sands of the Thangdon river, which empties itself into the great Tenasserim. The specimen forwarded by Captain Tremenheere is a blackish grey ore, consisting of fine and rather large-grained angular particles of peroxide of tin, not quite free from magnetic iron ore and sand, but still a good ore. Tenasserim Tin Ores.

Its value will entirely depend on the labour required to obtain it in large quantity by washing. Captain Tremenheere states that a Shan obtained 19 ounces of the ore in an hour.

The second locality from which six specimens are furnished is on the Thabawlick, a tributary of the Thakiet, which falls into the little Tenasserim, 11 miles from Tenasserim town. Here Captain Tremenheere states, paragraph 8, in his Report, that there is some uncertainty in the results obtained by digging and washing the sand, but that there is more certain results from looking for deposits of tin ore on the sand, and washing it out wherever it occurs. Five specimens of tin ore are furnished by Captain Tremenheere, which have been obtained in this manner. They are all alike; fine, dusty, or sandy peroxide of tin, more or less free from sand, according to the care bestowed in washing them. The sixth specimen presents the crystals of peroxide of tin adhering to nodules of the granitic matrix. Captain Tremenheere found that two men employed in this way obtained sufficient ore for 5lbs. 3oz. of pure tin (value *R.* 1. 8. 4.), at an expense of 12 annas. Captain Tremenheere does not, however, state to what extent tin may be collected from the surface of the sands.

This point can only be settled by more extensive trials, which, as they would be attended with little or no expense, might be the more conveniently made.

Four other tributaries of the little Tenasserim have also been represented to produce tin. These streams were not visited by Captain Tremenheere, but a specimen, No. 9, consisting of larger crystals of the ore, was obtained in a similar manner from one of them, the Khamaung river.

It would appear, from the number of pits that have been formed in the beds of these streams, that the former operations of the Burmese have been confined to washing the alluvial sands. There is nothing to show that mining operations for the extraction of the tin ore from the rock has ever been resorted to in this locality. Captain Tremenheere had not time to visit the hilly district at the sources of these streams, with a view of ascertaining the extent to which tin there occurs in the rock.

At Kahun, a hill on the right bank of the great Tenasserim river, Captain Tremenheere found peroxide of tin in a decomposed granitic vein, about 3 feet wide, and it is here that the results might, in the opinion of the Committee, become most important, under the management of an experienced miner, if such a person be procurable here. On the importance of this vein, and the prospects it holds out of being worked with advantage, the Committee refer with confidence to paras. 18, 19, of Captain Tremenheere's Report.

6. A letter was submitted from G. F. Franco, Esq., Commissioner of Meerut, in reply to the Committee's circular of 24th March last, enclosing such information as he has been able to collect from the local officers of his division. From the Seharunpore district it is reported that no coal or iron occurs, and a small quantity of gold dust is obtained by washing the sands of some of the hill torrents, and that glass is manufactured at Rampoor from the sands found in the bed of the canal. Mr. Tonnochy, the Deputy Collector of Boolundshahur, reports the existence of kunkur large enough to be used for building and paving, and when burnt affords an excellent mortar, and Mr. Tonnochy recommends its use likewise as a manure. Chalk is also mentioned by Mr. Tonnochy to exist, but from his description it appears to be rather a magnesian clay. Carbonate of soda, nitre, and muriate of soda also exist; and Mr. Tonnochy's remarks on these subjects are considered by the Committee very interesting, and have, therefore, been transferred for publication. Meerut.

A Meeting of the Coal Committee held on the 11th January 1842.

January 1842.

Present:—C. W. Smith, Esq., President; Major Forbes, Captain Johnston, and Captain Wilson, Members; Assistant Surgeon J. McClelland, Secretary.

READ a letter from Captain Jenkins, Agent to the Governor General of North Eastern Frontier, accompanying a specimen of specular iron ore, which he received from Major Davidson, of Goalpara, said to have been found on the Garrow frontier. Major Davidson states, that he has seen much richer specimens than the one in question, and that he understands Superior Iron Ore.

stands it is to be had in great abundance at the foot of the Garrow Hills, and all over the plains; the Garrow who brought the specimen proposed, if necessary, to supply boat-loads of it. Major Davidson adds, that he submitted specimens of this ore to Captain Fisher, who pronounced it to be superior to any iron ore he had ever seen.

The Committee also entertain a very favourable opinion of the value of this ore, and at the suggestion of Major Forbes recommend that Captain Jenkins adopt the necessary measures for obtaining a sample, consisting of 300 or 400 maunds, as it would appear that several experiments are necessary, and that less than 100 maunds is not sufficient for a satisfactory trial.

2. Major Forbes informed the Committee that the fan blast for pig iron meltings will be ready in a few days, and before the next meeting Major Forbes hopes that the old cylindrical blast will be made available for the new furnace which has been erected at the Mint for experiments on native ores agreeably to the recommendations of the Committee. When the new furnace shall have been heated two or three times, and used with a load of pig iron, it will then be ready for the experiments with the ores, which Major Forbes reports have been so long delayed in consequence of the pressure of other works.

Cheralea Coal. 3. Received a Report of experiment from Major Forbes on the quality of 203 maunds of Adji Coal from Mr. Hollings' mine, referred to in the third paragraph of the proceedings of last month, the result of which is, that 28 maunds of this Coal is equal to 25 maunds of the best Burdwan.

Doobradgepore Coal. 4. An intimation having been received of the arrival of a sample of Coal, consisting of 130 maunds from Mr. Pontet, for trial, it was ordered by the Committee that 50 maunds should be delivered to the Mint and Cossipore Foundry and 30 maunds to the Dispensary for trial; the results of which would be required at the next meeting.

February 1842.

At a Meeting of the Committee held on Monday, 7th February 1842,

Present:—C. W. Smith, Esq., President; Major Forbes, and J. McClelland, Junior Member and Secretary.

1. WITH regard to the sample of Coal, consisting of 133 maunds, referred to in the fourth paragraph of the Proceedings of the Committee for January 1842, the following reports have been received as to its quality.

Major Forbes states in a Report made to the Committee, under date 20th January 1842, that this sample appears to be greatly inferior in quality to that formerly sent down by Mr. Pontet to the Mint, and that it would not keep up steam.

Doobradgepore Coal. Captain Wilson reports that the Coal is of a dull brownish colour, with thin bright patches or layers, and that it is evidently a crop of surface Coal, and that 20½ maunds are required to do the work of 12 maunds of Burdwan Coal, and that it keeps up steam with difficulty. Copies of these Reports are annexed. Hence from the trials that have been made of this sample it appears to be a surface Coal, evidently from the first bed approached on sinking below the surface instead of going down to a better quality of bed, which might doubtless be found in the same locality by any one practised in working Coal. Resolved, that the result of the experiments, together with the observations respecting the Coal, be communicated to Mr. Pontet.

2. Major Forbes informed the Committee that, having now got the new fan blast in operation at the Mint, he will soon be able to commence the experiments on the reduction of country ores.

March 1842.

At a Meeting of the Coal Committee, held 7th March 1842,

Present:—C. W. Smith, Esq., President; Captain Johnston and Captain Wilson, Members; J. McClelland, Assistant Surgeon, Junior Member and Secretary.

Caribari Coals. READ a letter from Major Jenkins, Commissioner of Assam, dated 19th February 1842 enclosing copy of a letter from Mr. James Bedford, Assistant Revenue Surveyor, together with a map of the several sites in which Coal has been discovered by him in the Caribari Hills. And informing the Committee that Mr. Bedford is now working the Coal experimentally, of which specimens have been dispatched by Dawk Bangy to the Committee.

Salkoora. The information contained in Mr. Bedford's letter is highly satisfactory. It relates to Coal in three distinct places in the Garrow Mehaul Gundooparah, namely, Miramparah, Champageree, and Salkoora. The first of these places is marked "Coal bed discovered 1st March 1841," north of Horigong, on the map, page 71, Proc. Com. 1841. The Balajora river, leading from Horigong to this Coal, Mr. Bedford states, will at no season be navigable, owing to waterfalls within two miles of the Coal, but the road direct to Potumaree,

Potumaree, only five miles distant, is good, and from Potumaree the navigation is always open for boats of 400 to 500 maunds. The Salkoora bed is about three miles west of Mirampara, and is still more conveniently situated, being only three miles north of Potumaree, with a perfectly level road the whole way. Mr. Bedford, however, states, that should the Acasee Nuddie and other small streams prove navigable during the rains, there will only be a few yards of land carriage from the Coal bed at Salkoora to depôts either at Jagrachur, or on any other place on the Bramaputree. The Salkoora bed, discovered by Mr. Bedford on the 7th of January last, will therefore afford the most accessible locality for Coal mines hitherto known, provided the quality of the Coal should prove favourable. On this last point the Committee must reserve its opinion till the arrival of the specimens, the dispatch of which is announced in the letter of Major Jenkins, above alluded to.

See Map Proceeding of the Committee, 1841, page 55.

With regard to the Coal beds to the east and south of Horigong on the Bunassee river, Mr. Bedford states that he has not yet been able to collect further information than that previously furnished. (*Vide Proc. Com.* page 71, 1841.)

2. Read a letter from Major Jenkins, dated 31st January 1842, affording the following information relative to the Coal mine opened by Mr. Landers and referred to in the concluding part of the 1st paragraph of the Proceedings of the Committee, 7th February 1842. The mine is situated between two hills, one of which is called Namsang. Coal of superior quality is found extensively under both hills to the north, and on the banks of the river, but Mr. Landers cannot describe the spot more particularly. He has however, 100 maunds of Coal ready to forward to Seebisagur on the Bramaputra, and Major Jenkins states that Mr. Landers in thus employing the Tablong Nagas (a rude people with whom we have heretofore had little intercourse) is doing much good, and hopes to effect a contract with them for the supply of this Coal to the mouth of the Deekho river in Upper Assam.

Namsang Coal.

N.B. This is from the vicinity of the Suffry Coal, which proved on trial at the Mint the best ever found in India.

3. Read a letter from Mr. Sconce, announcing the dispatch of specimens of anthracite found at Chittagong, and the existence of brown Coal in that district. From the specimens which accompanied Mr. Sconce's letter, the Committee hope that further inquiries on the part of Mr. Sconce will lead to the discovery of good Coal at Chittagong.

At a Meeting of the Coal Committee, held on Monday, the 4th April 1842,

April 1842.

Present:—C. W. Smith, Esq., President; Major Forbes, Captain Johnston, J. McClelland, Assistant Surgeon, Junior Member and Secretary.

A LETTER was read from Major Lister, enclosing a contingent bill for 21,003 rupees, being the cost of delivering 43,790 maunds of Cherra Coal to Dacca, Calcutta, and Dinapore, and requesting the Committee to obtain the sanction of the Government to the payment of the same. The Committee observe that the delivery of this Coal at the places above stated amounts to no more than an average rate of 7 *a.* 8 *p.* per maund, and that 3,810 maunds of Cherra Coal, delivered at Dinapore, cost only 8 *a.* 7 *p.* per maund, a rate which they anticipate will be found to be considerably below that which is paid for the supply of an inferior article from other Coal mines, notwithstanding the heavy charge on this Coal of 3 *a.* 11 *p.* per maund for its delivery into boats.

Results of extensive deliveries of Cherra Coal.

The secretary was directed to transfer the Contingent Bill in question to Captain Johnston for payment, and to convey the thanks of the Committee to Major Lister for having afforded so good an example of the importance of this Coal, and established the rates at which it may be delivered.

2. Read a letter from Captain Guthrie (Engineers) forwarding a specimen of Coal from Bickrampore in Cachar, found in a small watercourse on the side of a hill about 300 feet above the plain of Cachar, and half a mile distant from the Arang river, a branch of the Soorma, navigable for 600-maunds boats for four months in the year, and for dinghies for six months. The beds from which the specimen were found have not yet been traced.

Bickrampore, Cachar.

The following is the result of analysis of this Coal:—

Specific Gravity, 1.3.										
Inflammable matter	-	-	-	-	-	-	-	-	-	64.8
Carbon	-	-	-	-	-	-	-	-	-	32.2
Ash	-	-	-	-	-	-	-	-	-	2.

Bickrampore Coal.

100

REPORT RELATING TO THE

Considering that Coal in this situation would have all the advantages of the Cherra Coal without the expensive portorage, the secretary is directed to express the thanks of the Committee to Captain Guthrie, and to recommend further inquiries.

Caribari Coal.

3. With regard to the discoveries of Coal by Mr. James Bedford, referred to in the first paragraph of the proceedings of the last meeting, the secretary announced the arrival of the specimens referred to, and submits the following remarks on them. The Caribari Hills present the most convenient situation in which good workable Coals have heretofore been found in India; about five years ago Mr. Cheap, the Collector of Mymensing, presented to Mr. Cracroft, then member of the Coal Committee, a specimen of Coal said to have been found at Chilmaree. It subsequently appeared that Mr. Cheap's specimen came from the Garrow Hills on the opposite side of the river from Chilmaree, and that the late Mr. Scott was aware of the existence of Coal in those hills. It was understood however that the Coal beds were situated several days' journey in the interior of mountains.

Thus our information continued until 1841, when Mr. James Bedford, who was employed as revenue surveyor, reported the existence of Coal in three different quarters in the Caribari Hills, within a distance of from three to five miles of water carriage over a good country for roads.

The following are the characters of the specimens he has supplied:—

Salkoora Coal.

Salkoora.—This is a dull brown earthy Coal, situated only three miles from Putumaree and the Kalo river, which is navigable to this point for large boats.

Specific Gravity, 1·3 to 1·4.

Inflammable matter	-	-	-	-	-	-	-	-	-	70
Carbon	-	-	-	-	-	-	-	-	-	25·4
Ash	-	-	-	-	-	-	-	-	-	4·6
										100

Caribari.

This Coal burns freely, with a bright flame, and is admirably adapted for steam. The bed in which it occurs is near the surface, and from two to three feet thick.

Mirampara* or Balajora Coal.

Mirampara or Balajora.—This Coal is situated five miles distant from Putumaree, with good road. The size and peculiarities of the bed, as well as of the Coal, differ but little from the last.

Specific Gravity, 1·2.

Inflammable matter	-	-	-	-	-	-	-	-	-	64
Carbon	-	-	-	-	-	-	-	-	-	26
Ash	-	-	-	-	-	-	-	-	-	10
										100

Specimen from the Bunassee river.

This sample burns with a bright flame, and is well adapted for steam. This bed is situated on the Balajora river, a tributary (not navigable) of the Kalo.

A third specimen has been also forwarded by Mr. Bedford from the bed of the Bunassee river, another tributary of the Kalo, which has been examined with following results, although the original bed from which the specimen has been derived has not yet been found.

Specific Gravity, 1·4

Inflammable matter	-	-	-	-	-	-	-	-	-	50
Carbon	-	-	-	-	-	-	-	-	-	40·6
Ash	-	-	-	-	-	-	-	-	-	9·4
										100

Its qualities as a fuel are like those of the foregoing.

The value of Mr. Bedford's information is enhanced by the annexed map, on which the situation of the different beds of Coal in the Caribari Hills is laid down. The existence of iron ore and useful clays has also been pointed out in this vicinity by Mr. Bedford. The secretary will be pleased to communicate the high sense which the Committee entertain of Mr. Bedford's exertions and their satisfactory result.

Gudada river.

4. Read a letter from Major Jenkins, the Commissioner of Assam, presenting a specimen of Coal from the Gudada river, which falls into the Bramaputra, opposite to Goalparah.

The

This Coal consists of a single waterworn and rounded specimen found by Mr. Bedford. It is supposed that the bed from which it was derived, is situated somewhere about Purbut Juor, to which place the Gudada is navigable for boats of 100 to 200 maunds.

The following is the result of analysis of this Coal:—

Specific Gravity, 1.4.							
Inflammable matter	-	-	-	-	-	-	57.4
Carbon	-	-	-	-	-	-	24.6
Ash	-	-	-	-	-	-	18.
							100

This is heavy Coal, ignites with difficulty, and burns without flame.

5. The secretary was directed to record an application for employment from a person named Laurence Fleming, who has been brought up to the business of working Coal mines, and would, in the opinion of the Committee, from his experience, prove a useful man in any of our Coal districts, where valuable beds are neglected for want of practical aid.

6. The President intimated to the Committee his intended departure for Europe, and requested that this communication should be entered on the proceedings.

TABLE of INDIAN COALS analysed in the Laboratory of the Honourable Company's Dispensary, from June 1841 to April 1842, in continuation of the Table, page 56, in the Reports of the Committee for 1841.

	LOCALITY.	QUALITY.	Specific Gravity.	Composition in 100 parts.			From whom received.
				Volatile Matter.	Carbon.	Earthy and Ferruginous Matter.	
84	Jaipore, Upper Assam	Superior - -	1.3	48.	46.2	5.8	Mr. F. R. Hampton, 8th July 1841.
85	Pulo Chermin, Borneo	Very superior -	1.34	64.	32.5	3.5	Marine Board, 8th Nov. 1841.
86	Pulo Keog, Arreng, Borneo.	Inferior - -	1.39	43.	30½	26½	Marine Board, 8th Nov. 1841.
87	Bikrampore, Cachar -	Superior - -	1.3	64.8	33.2	2.	Captain Guthrie, Engineers, 7th March 1842.
88	Gudala River, Dhubary	Inferior - -	1.4	57.4	24.6	18	Discovered by Mr. J. Bedford, Assistant Revenue Surveyor, 1st February 1842, received from Major Jenkins.
89	Bunarosee Caribari Hills.	Brown coal burns freely.	1.4	50.	40.6	9.4	Ditto, March 1842.
90	Mirampara, or Balajora Caribari Hills.	Ditto - - -	1.2	64.	26.	10	Ditto, March 1842.
91	Salkora, Caribari Hills	Good brown coal -	1.3 to 1.4	70.	25.4	4.6	Ditto, March 1842.

J. M. Clelland, Assistant Surgeon,
Secretary Coal Committee.

APPENDIX.

EXTRACT of a LETTER from Major *Jenkins*, Commissioner of Assam, to the Secretary of the Coal Committee, under date 19 February 1842.

April 1842.

I HAVE the honour to forward a copy of a letter from Mr. James Bedford, Assistant Revenue Surveyor, No. 69, of — January, to the address of Major Davidson, transmitting a map of the several sites in which Coal has been discovered by him in the Caribari Hills, with sections of the beds opened.

Mr. Bedford is now working the Coal at Salkoora and Mirampara or Balajora.

Mr. Bedford's Report
on the Caribari
Coals.

"I have the honour to forward map of the Caribari Coal Districts, North of Kalo river, comprising the three localities, 'Mirampara' (or Balajora), 'Champagerree,' and 'Salkoora,' situated in the Garrow Mehaul 'Gundooparah.'"

2. As the Coal of Miramparah and Salkoora appears of the best quality, I have commenced raising 300 maunds from these beds. The vein in both these places is, however, only two to three feet in thickness.

3. I have to remark also that the Balajora will at no time of the year be navigable, owing to waterfalls at Z. on the map.

4. The road from Miramparah to Pateemarree having fewer ascents than that to Harigong, the Coal raised is conveyed by land to Pateemarree (five miles), whereby the distance is somewhat increased, nine miles of shallow navigation is avoided.

5. The Salkoora bed appears the best located, as the road is level to Pateemarree Haut (three miles distant), from which place Coal can be transported by water to a depôt either at Jagrachur or Mohyndergunge; and should the streams prove navigable in the rains for canoes, there will be only a few hundred yards of land conveyance; and Coal can also be conveyed to Singheemarhi, by the Acasee Nuddie.

6. The country east of Harigong and Doomeeganee is covered with such dense jungle, that I am sorry to inform you I have not succeeded in finding the actual Coal beds, though the Coal found in the stream of Bunarosse river appears of a better kind and more brilliant colour than any in Caribari; the Coal found in the stream of Kalo River, is similar to the Mirampara and Salkoora Coal. I have no doubt, however, of receiving information in the course of another year from the Garrows.

7. The Coal found at Champagerree is very impure, but the situation, although inferior to Salkoora, is superior to that of Mirampora, owing to the road being nearly level to Pateemaree, four miles distant.

8. Globular stones, containing iron ore, are also found in the neighbourhood of Champagerree and Salkoora.

9. The hills about Domalgeree, on banks of Kalo river, are composed of pure pipeclay, and also of a white and variegated kind of clay, much impregnated with sand, but all three varieties are also found in different parts of Caribari, the best located being at Mohyndergunge, near the Burhampooter, specimens of which I have taken the liberty of sending, in case they may be deemed of any utility.

(signed) *James Bedford*,
Assistant Revenue Surveyor.

REPORT of a COMMITTEE for the Investigation of the COAL and MINERAL RESOURCES of *India*, for May 1845, by the Secretary.

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GENERAL PROCEEDINGS, the 28th December 1836.

THE growing importance of the line of iron steamers established for communication between Calcutta and Allahabad renders it essential to consider again the means of providing Coal for their use. Resolution.

At present, the mines of Burdwan present the only resource available for the entire demand of this Presidency, and their produce reaches Calcutta by an uncertain and difficult navigation down the Damoodur, a mountain torrent which, for more than half the year, is entirely closed. During that period the Coal remains in depôts at Ampta, whence it is forwarded into the Hoogley river in different craft from that in which it was brought to Ampta as required. The depôts along the Ganges are now uniformly supplied from this source, and are hence subject to all the uncertainty of the navigation of the Damoodur, and in case the demand for Coal at the Presidency should be more active at any time than was expected the depôts at Ampta are exhausted, and the whole supply of the capital and of the interior is at a stand until the Damoodur is again filled on the setting in of the rainy season.

This difficulty actually occurred in the past season, and great disappointment was accordingly experienced in the upper stations of the Ganges in particular, which did not receive the supplies for their depôts till long after they were required.

Such accidents will be occurring constantly as the inevitable consequence of the entire supply of Coal being drawn as at present from one spot. The Government, however, has knowledge of other mines in various parts of the territory of this Presidency more conveniently situated than the Burdwan mines for the purposes of steam navigation, and the Governor of Bengal cannot believe that means may not be found of bringing these resources also into play. The subject has heretofore attracted the attention of Government, and individuals have from time to time been deputed to search for Coal in different quarters, and their reports have been recorded, showing their inquiries to have been attended with various success. When these inquiries were ordered, the subject had not the same importance as it now possesses, under the assurance of success to the project of navigating the Ganges extensively with iron steamers of small draught, and the results of the several inquiries have never been combined for the definite purpose of showing where the endeavour to bring the Coal resources of the interior into use can be prosecuted with most chance of ultimate success.

Mr. Surgeon Wm.
Banister.
Capt. J. H. John-
ston.
Captain W. N.
Forbes.
James Prinsep,
Esq.
Captain H. B.
Henderson.

Preparatory to adopting any definite measures with this object in view, the Governor of Bengal resolves, that the gentlemen named in the margin shall be appointed a Committee, specifically to consider all the information on the subject now collected at the Presidency, and to recommend what further examinations or surveys shall be ordered for the purpose, enabling Government to decide as to the best means of procuring Coal applicable to the wants of steam navigation in the interior. The inquiries of the Committee will embrace as well as the locality of the different mines of Coal explored, the descriptions of the mineral, and whether it is found alone or with iron, lead, of copper, or other useful metals in the vicinity of the mines, and likewise by what routes and at what expense in their improvement or construction it will be possible to bring the Coal to the banks of navigable rivers.

True copy.

(signed) *H. T. Prinsep,*
Secretary to Government.

LIST OF COMMITTEE FROM COMMENCEMENT.

PRESIDENTS:		
C. W. Smith, Esq., c. s.	- -	Member of the Sudder Board of Revenue, and Provisional Member of Council. Date of appointment, 17th April 1839. Date returned to Europe, 4th May 1842.
J. W. Grant, Esq., c. s.	- -	Keeper of the Export Warehouse, and Member of the Marine Board. Date of appointment, 10th June 1842.
MEMBERS:		
James Prinsep, Esq.	- - -	Assay Master. Date of appointment, 28th December 1836. Returned to Europe, October 1838.
Lieut. Col. Forbes, Engineers	- - -	Mint Master. Date of appointment, 28th December 1836.
Major Henderson	- - -	Deputy Auditor General. Date of appointment, 28th December 1836. Returned, April 1839.
Captain J. H. Johnston	- - -	Controller of Steam Vessels. Date of appointment, 28th December 1836.
W. Bannister, Esq.	- - -	Madras Medical Service. Date of appointment, 28th December 1836. Returned to Madras, February 1837.
J. McClelland, Esq.	- - -	Bengal Medical Service, Junior Member and Secretary. Date of appointment, 24th March 1837.
*W. Cracroft, Esq., c. s.	- - -	Judge of the Sudder Dewany Adawlut. Date of appointment, 10th May 1837. Returned to Europe, 1839.
Lieut. Col. Presgrave	- - -	Superintendent, Cossipore Foundry. Date of appointment, 17th April 1839. Proceeded to the Cape, 7th December 1840.
Captain A. Wilson	- - -	Superintendent, Cossipore Foundry. Date of appointment, 7th December 1840.
Major W. R. FitzGerald, Engineers	- - -	Superintendent Engineer of the South Eastern Provinces. Date of appointment, 10th June 1842. Deceased, November 1844.
Thomas Cargill, Esq.	- - -	Date of appointment, 16th April 1845.

* Mr. Cracroft acted as President at the request of the members, though he stood appointed merely as member.

I.—INTRODUCTION.

1. AGREEABLY with the preceding resolution, Dr. Bannister, acting as Secretary of the Committee, had just time to collect and place in the hands of the members such documents as were available in the public offices bearing on the proposed inquiry before he was recalled to Madras, to which Presidency he belonged.

In 1838 the Committee lost the services of Mr. James Prinsep.

In 1839 the Committee were likewise deprived of the services of Mr. Cracroft and Major Henderson. These vacancies were afterwards filled by C. W. Smith, Esq., as president, and Colonel Presgrave.

On the retirement of the former in 1842, and the death of Colonel Presgrave, J. W. Grant, Esq., succeeded as president, and the late Major W. R. FitzGerald as member, whose death shortly after took place.

2. The first minute in the Committee was written by Captain Forbes, 4th May 1837. It directed that the secretary should draw up the first Report, consisting of an historical and topographical as well as geological account of all that was known up to that period of the existence of Coal and Iron in India. It further directed that such information should be conveyed in a popular form, with a view to ultimate publication.

This was countersigned by Captain Johnston and Mr. J. Prinsep, and directed to be recorded for the guidance of the new secretary, who was referred to the papers in the Committee box, as well as to several reports in public offices for his materials.

3. Captain Henderson, instead of subscribing to the above, remarked, that if the papers in the Committee box were to be taken as a sample of the practical information to be found in public offices, they would have to rely more on the experience of their secretary, and the information to be elicited in correspondence with the authorities located where Coal is known to exist, than on any materials already in possession of Government, particularly as no previous inquiry had ever been entered on with the specific object now in view, except by the late Mr. William Jones. The results of whose proceedings were already before the public.

4. Captain Henderson then enumerated the following localities where Coal was known to exist, but regarding which we had little information, with the exception of what was published by Mr. Jones regarding Burdwan.

1. Burdwan.
2. Cherra Ponji and Laur.
3. Hurrah and Bagelpore.
4. Mcotee Jarma, near Sukreegullee, and Rajmehal.
5. Palamow, and on the Coile river.
6. Bidgeghur.
7. Vicinity of Hazareebag and the Benares road.
8. (Assam) under the Naga Hills, Dysung Nuddee and vicinity, worked by Mr. Scott.
9. (Assam) on the Namroop river.
10. (Assam) the bank of the Jomuna.
11. (Assam) the Noa Dihing and its affluent the Dupha Panee.
12. The Coal formation supposed by Captain Jenkins to extend to the western extremity of the Curribari Hills, near the great bend of the Barrampooter.

5. The first Report, conformably with the plan laid down by the members in the minute of Captain Forbes above referred to, was submitted to Lord Auckland

18th October 1837. It was soon after ordered to be printed to the extent of 250 copies and distributed.

Three years and a half afterwards, 14th April 1841, the subsequent proceedings of the Committee having come under the observation of the Governor General, his Lordship caused the following memorandum in his own hand to be conveyed to the president of the Committee through the private secretary, Mr. Colvin.

“These Reports are satisfactory, and much that is useful is apparently in progress and promising well; I shall presently hope for such a Report as may give a good summary of all that has been done, and as may be sent home and published here. It would, I think, be much to the credit of the Committee.”

A second, more copious Report was accordingly prepared by the secretary, containing an abstract of the monthly proceedings of the Committee, with all the results attained up to April 1841. It was ordered at once to be printed and distributed to the extent of 250 copies.

In April 1842 a continuation of the proceedings up to that date was also printed and distributed amongst the mercantile houses of Calcutta.

But it was not until the present time that such a summary as the Governor General called for, could be completed in a manner at all becoming the nature and importance of the subject. If the delay that has taken place be thought excessive, it ought to be remembered, as some excuse for the Committee, that its inquiries relate to great practical questions upon which we had no previously existing experience in India to guide us.

	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
6. The total outlay on account of the Committee from its institution, January 1837 to January 1845, being a period of eight years, has been Co.'s <i>Rs.</i> - - - - -	19,617	6	0
Of which sum the following items stand on the credit side:—			
	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
To Books and office furniture - - - - -	528	2	8
„ Mining tools - - - - -	886	1	6
„ Blast furnace, erected at the Mint - - - - -	1,945	10	-
„ Adji ironstone, sent to the Mint - - - - -	396	7	-
„ 500 maunds of limestone, sent to the Mint - - - - -	250	-	-
„ 6,906 maunds of Coal, delivered to different public establishments - - - - -	3,202	11	4
Deduct - - - - -	7,209	-	6
7. Leaving a total expenditure of - - - - -	12,408	5	6
Which sum - - - - -	4,616	10	8
was devoted to 21 months and five days' Secretary's salary, as follows:—			
To Secretary's salary from 25th March to 15th December, 8 months and 20 days, at 100 rupees per mensem - - - - -	866	10	8
„ Secretary's salary from 15th December 1837 to 15th December 1838, being 1 year, at 300 rupees per mensem - - - - -	3,600	-	-
„ Secretary's salary from 15th December 1838 to 1st February 1839, being 1 month and 15 days, at 100 rupees per mensem - - - - -	150	-	-
Deduct - - - - -	4,616	10	8
Carried forward - - - <i>Rs.</i>	7,791	10	10

	<i>Rs.</i>	<i>a.</i>	<i>p.</i>	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
Brought forward - - - - -				7,791	10	10
8. Of this balance - - - - -	3,631	5	2			
have been expended in mineral surveys, as follows:—						
To Lieut. Don, for travelling charges, proceeding to examine the Coal at Sukree Gully - - - - -	83	5	9			
„ George Osborne, Esq., for travelling charges, proceeding to examine the supposed Coal at Bidgeghur - - - - -	240	-	-			
„ Mr. Tonkin, a Coal miner, employed in Arrakan 3½ months, at 100 rupees per mensem - - - - -	350	-	-			
„ Capt. Bogle, Commissioner of Arrakan, for expenses incurred in searching for Coal - - - - -	721	9	3			
„ Mr. L. Fleming, a Coal miner, employed at Rajmehal 2 months, at 50 rupees per mensem, 100; at Curribari, 10 months and 22 days, at 70 rupees per mensem, <i>Rs.</i> 748. 12. - - - - -	848	12	-			
„ Mr. Sweetland, to enable him to produce samples of Curribari Coal, as proposed by himself, on the assurance of his personal knowledge of its value - - - - -	1,387	10	2			
Deduct - - - - -				3,631	5	2
Balance - - - - -				4,160	5	8
9. To Postage - - - - - <i>Rs.</i> 298 6 -						
„ Freight and banghy charges „ 47 9 -						
345 15 -						
„ Printing extra copies of first Report - 161 10 -						
„ Ditto 4 cancelled pages, 2d Report, 1841 10 10 8						
Deduct - - - - -				518	3	8
Total expense of Committee for petty charges, stationery, and establishment, from January 1837 to January 1845 - - - - - <i>Rs.</i>				3,642	2	-

10. In addition to the charge of *Rs.* 3,631. 5. 2. in the above account for inquiries regarding Coal, the expense attending the temporary employment of Messrs, Homfray and Landers might also be included, although their bills were not submitted to the Committee for audit. There is nothing on the records of the Committee to show that Mr. Homfray's deputation to Palamow emanated from it, except the following observation in the letter of the Committee to Lord Auckland, on submitting the first Report of its proceedings, 18th October 1837. "With your Lordship's concurrence, our first measure was to depute a professional miner, Mr. Homfray, to survey and report on the Palamow Coal beds, &c."

The employment of Mr. Homfray would, therefore, seem to have taken place before any regular proceedings were entered upon. I mention this particularly, as it has been since alleged that his interests in Burdwan mines were opposed to the successful object of his mission.

11. The appointment of Mr. Landers has tended to show that practical experience acquired in English Coal mines, when removed to circumstances so totally different in India, may fail to answer the desired expectation.

12. With regard to the miners, B. Tonkin and L. Fleming, who were employed with a view of supplying the demand for practical aid, which was supposed to be alone required in order to open Coal mines, Tonkin lost his health before entering on his duty, and was forced to return to England; Fleming proved of some use to Mr. Erskine in opening his mines on the Adji.

Where all the necessary previous information is obtained, and nothing remains but to commence operations, such men are useful; but in India, where the geology of the country is unknown, and the districts in which Coal occurs are unsurveyed, men of superior attainments and zeal appeared to be essential, in order to promote effectively the objects of this Committee.

13. Hence, in order to give these objects a specific and practical character, as well as to place the inquiry on a sound footing, consistent with its importance to the general interests of the country, the Committee ventured to recommend a geological survey of the Coal formation of India; or, at least, that this question should be referred to the highest scientific authorities in England.

This recommendation, we believe, has gone home, approved by the Government of Bengal; and whatever the result may be, the public interests must profit by the reference.

NOTES.

May 1837.

I HAVE collected from the Government offices all the papers on record respecting Coal, and they are contained in two bundles now circulated. The large bundle was received from Mr. Mangles, and the small one from Mr. Prinsep, and to prevent confusion, gentlemen will be good enough to keep them separate.

Each gentleman will have the kindness to forward the box to the next upon the list, and the last will be good enough to send it to me. After the papers have been circulated, perhaps it will be better to call a meeting.

(signed) *W. Bannister.*

18 January 1837.

To Capt. J. H. Johnston.
 „ Capt. W. N. Forbes.
 „ James Prinsep, Esq.
 „ Capt. B. H. Henderson.

Original Minutes,
 regulating and
 fixing the duties
 of the Secretary.

Buchanan's Reports, Southerland's on the Rajmehal and Bhaugulpore Hills, and many other Reports of a general nature, are amongst the records of Government, and ought to be read and abstracted, in so far as they relate to Coal and Iron, for the Committee's Report; and I would suggest the expediency of the secretary making an official application for those reports, in the name of the Committee. Buchanan's Reports, I have ascertained, are in the office of the Secretary to Government, in the General Department, and Southerland's, in the office of the Secretary to the Government of Bengal; and both will readily be made over to us, or our secretary. When such application has been sanctioned, the Reports of Pemberton, Jenkins, Wilcox, and other officers, on Assam, Manipore, &c., and generally all the Reports in the possession of Government, containing matters respecting Coal and Iron, or other minerals, ought also to be similarly obtained and abstracted. The first Report of the Coal and Iron Committee should contain an historical and topographical, as well as mineralogical account of all that is known, or can, through its means, be ascertained, on the subject of the minerals of India: this, as much as possible in a popular form, with a view to its ultimate publication, and as a means of attracting Indian or other capital to the speculation of working mines in the localities indicated. If the members of the Committee approve of this suggestion, they perhaps will have the goodness to correct and sign this memorandum, as a guide to the exertions of the secretary.

Mint, 6 May 1837.

(signed) *W. N. Forbes.*

I entirely concur in Capt. Forbes' suggestions, on which our secretary had better act at once.

(signed) *J. Prinsep.*

I believe the suggested measure will be productive of great good.

(signed) *J. H. Johnston.*

These

These Reports, and any others which can be discovered in the Government offices, will be of use, certainly, in preparing an historical or other account of the discoveries, and may possibly serve to direct attention to new and likely situations in which to prosecute further inquiry. But, if we take the correspondence and Reports now circulated in this box, as a sample of the practical information to be derived from any existing records of Government, we may conclude that little useful or practical benefit will follow the task of going through the papers which the offices have still to furnish us with.

Major Henderson's Minute.

The fact seems to be that no previous inquiry has ever had the precise practical object in view (viz., that of working and supply) which the Government have now taken up, if we except Jones' inquiry; and it strikes me that our new secretary, whose services I am glad have been secured to us, may at once, in addition to the proposed collection of former researches, place himself in communication with the authorities and persons connected with, or in the vicinity of, the places where Coal has been discovered, and endeavour to obtain such matter-of-fact information regarding the whole of them, as may determine the Government where to direct their aid and attention, and may assist speculators in coming forward to work the places themselves.

(signed) *H. B. Henderson.*

REPORTS of the Committee that have been printed from time to time since May 1837.

1. REPORTS of a Committee for investigating the Coal and Mineral Resources of India; 8vo., G. H. Huttman, Bengal Military Orphan Press, 1838.

2. Reports and Abstracts of the Proceedings of a Committee for the Investigation of the Coal and Mineral Resources of India, brought up to May 1841, by the Secretary; G. H. Huttman, Bengal Military Orphan Press, 1841.

3. Abstract of the Proceedings of a Committee for the investigation of the Coal and Mineral Resources of India, brought up to April 1842; G. H. Huttman, Bengal Military Orphan Press, 1842.

These being now out of print, a revised and incorporated copy of the whole should be printed, together with the latest information on the subject now submitted in the present Report, May 1845.

II.—LEVELS OF INDIAN COAL FIELDS.

14. No barometrical or other measurements, with a view to obtain the relative levels and accessibility of the Coal districts of British India, have as yet been made. Improved means of transport, whether by land or water carriage, will mainly depend on such information.

15. The face of the country rises gradually from the Hoogley towards Burdwan, which is proved by the fact noticed by the late Mr. Jones, that at Omptah, 22 miles west of Calcutta, the tides in the Damooda, derived from the estuary of the Hoogley, rise only 10 inches during the highest springs in June, ebbing and flowing only half an hour. In Calcutta, on the other hand, the same distance from the sea as Omptah, there is a difference of 17 feet during the same springs, between high and low water. Hence we infer that the rise of the country westward of Calcutta, for a distance of 22 miles to Omptah, is about nine inches per mile. Beyond this the country is known to rise more rapidly for a distance of 60 or 80 miles to the Coal mines, which accounts for those violent floods which render the navigation of the Damooda above Omptah so difficult.

16. It may be supposed that the general rise of the face of the country from Omptah to the Coal mines, a distance of 80 miles, is about three feet four inches per mile, so far as we can venture to judge from the little we know of the peculiar difficulties of the navigation of the corresponding portions of the Damooda, and Adji rivers.

Thus the elevation of the Burdwan Coal district may be supposed to be about 300 feet above the sea. But it may be suggested, as a very important practical question, whether the best description of Coal is reasonably to be expected in

the Burdwan and Adji Coal fields, without either advancing further into the hills than the situation of the present mines, or sinking to a proportionately greater depth.—See paragraph 26.

17. With regard to the Orissa district, in which the Coal fields of Talcher and Hingolie are situated, no particular mention is made of the existence of any very formidable rapids, in the accounts we have of the Bramini river.

This river is said to be navigable for 300-maund boats during six months of the year, from the coast at Hunsooa, to within 23 miles of the Coal district, the whole distance being about 120 miles.

It may, therefore, be supposed that the Coal districts of Talcher and Hingolie, are about 150 to 250 feet above the sea.

18. Again we may suppose, from the only information we have on the subject, that the Rajmehal Coal beds, situated at Doobradgepore, within 10 miles of water carriage in the rains (by means of the Burmany Nulla to Moorsshedabad), are not more elevated than the Adji and Burdwan beds. The adjoining Coal beds to the north of Doobradgepore, at the pass of Patchwarry, on the Bansli river, may be a little higher.

19. The valley of Palamow contains Coal at two distinct levels, to the first of which the Coile river is partially navigable with some slight difficulty. The lower beds of Palamow Coal may therefore be supposed, in regard to levels, to bear the same relation to the Ganges at Dinapore, as the Burdwan district bears to the Hoogley at Calcutta. The second, or upper Coal field of Palamow valley is some hundreds of feet higher, cut off from the lower Coal field by an intervening ridge 500 feet high, but no exact measurements have been made. From all we know of this last Coal field, we should suppose the height to be about 500 or 600 feet above the level of the sea.

20. With regard to the Coals at Sohagepore and Singrowlie, these beds being situated above the falls of the Sone, water carriage to any great extent is out of the question. But their distance from the Ganges at Chunar, being such as to enable the country people, without roads, to bring in Coal for sale at eight or ten annas per maund to Chunar and Mirzapore, it deserves to be considered whether the supply might not be much improved on the higher parts of the Ganges from these sources.

21. East of the Ganges, circumstances as regards the general levels of the country are different, as well as the quality of the Coal itself, which is almost invariably superior to any of the beds on the western side, except Hazareebaugh, Sohagepore and the Nerbudda Coals, as accounted for para. 26.

The Coal from the eastern districts generally belongs to what is called mountain Coal, the disruptive forces to which the strata in this direction have been subject, having brought up to the surface the main Coal, without the trouble of sinking for it.

22. The chief beds extend along the south side of Assam, at intervals from the Garrow Hills to the farthest extremity of the valley; and from the former point southward, along the eastern boundary of Sylhet to Chittagong. The Coal formation throughout this course, skirts the base of the lower ranges of hills, more or less elevated from the plains, but rarely appearing near the summit of the higher mountains except at Cherra Ponji.

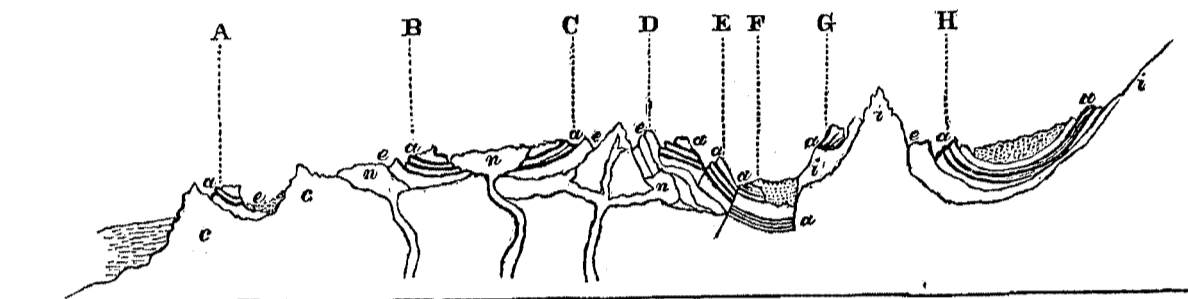
23. In Assam, as far as we are acquainted with the circumstances of the various beds, they would seem to be from 200 to 300 feet above the adjacent portions of the Barrampooter, from which they are distant generally from 40 to 60 miles by navigable tributaries.

24. The nearer situation of the Cherra Coal to the Presidency, has directed attention chiefly to it, notwithstanding its great elevation above the plains, and the consequent expense and difficulty of its delivery. Indications have been found at more accessible heights in the same vicinity, but the requisite intelligence has not yet been brought to bear on their examination, in order to determine their real value.

25. On both sides of the Ganges the Coal measures are associated with sandstone, shale, and sometimes limestone, disposed along the flanks of hills and mountain

mountains, the central masses of which are granite, presenting outbursts at intervals, forming more or less prominent elevations. One of these elevations on the western side, at the head of the Burdwan Coal field, is Purrisnath, which rises, it is supposed, to 5,000 feet, while the adjoining country consists of low table land.

On the eastern side the elevations are higher, and form continuous ridges, affording delightful climates suited to the cultivation of European productions. For the better understanding of these observations, we beg to refer to the annexed sketch, exhibiting a general section of Coal districts from Cutch to Assam.



a, a, and c, Coal Formation—c, c, and c, Primitive Rocks—n, n, and c, Basaltic and Trap Rocks—e, e, Sandstone Formation.
 A, Cutch—B, Nerbudda—C, Sohagepore—D, Singrowlee—E, Ramghur—F, Burdwan—G, Cherra Ponji—H, Assam.

26. There is no fact better established than that the quality of Coal in India depends on the degree of disturbance to which the adjoining strata, with which it is associated, have been exposed. This is exactly what we should expect, from the circumstances of the best beds of Coal being the lowest in the series; and as in all hills and mountains the lower rocks are raised to the higher altitudes, so the lower beds of Coal are those which are projected upwards to the surface.* Hence it is due to the greater disturbance of the strata generally beyond the Ganges, that we find the Coal of our eastern districts superior to that of the districts on the western side of Bengal. The main or lower beds are, in the eastern districts, upheaved (as in the case of Cherra and Assam Coals) to the surface, where they are found as *Mountain Coal*. In the Burdwan, Rajmehal, and other low western Coal districts, the main beds of good Coal may be supposed to lie at a greater depth below the surface than has yet been reached in Coal mines of this country. But in the central table lands and hilly districts to the westward, such as Hazareebaugh, Sohagepore and Nerbudda, where the degree of local disturbance of adjoining strata corresponds with the eastern districts of Sylhet and Assam, the main Coal is brought to the surface. Hence it is that the Hazareebaugh and Nerbudda Coals, correspond with those of Assam and Cherra Ponji in point of quality, and are of the most superior description.

27. It may be superfluous to notice in this place the intermediate plains between the eastern and western Coal districts of Bengal, further than relates merely to the navigability of rivers.

The gradual rise of the country westward of Calcutta, renders the navigation of the rivers in that direction as they approach the Burdwan district, difficult, and of short duration, during the height of the rains. On the eastern side of Calcutta, on the contrary, there is a gradual depression, extending perhaps in diminished proportion to that portion of the Sunderbunds marked "Morass" on Arrowsmith's Map, a little to the west of Culnah. This admits of the general influx of tides throughout the Sunderbunds; which, together with the great rivers of the eastern parts of Bengal, affords an uninterrupted facility for inland navigation at any season, and consequent ready means for the delivery of Coal from that quarter to all parts of India.

Temporary

* Mr. Murchison observes that limestone is more prevalent in the lower beds of the Coal formation in Wales, than in the upper or newer beds. All our best Coals in Assam and the Khasyah Hills are likewise associated with limestone; while on the other hand no limestone has yet been found associated with, or in the vicinity of, Burdwan or Rajmehal Coals.

Temporary difficulties might in the first instance be felt in obtaining boats at Sylhet, on any sudden emergency, beyond a certain extent of tonnage, but these would diminish as the demand for tonnage in the district became steady, and the carriage of Coal offered a certain and profitable employment for boats.

28. The following Tabular Statement affords the result of our information as to nature and extent of the indications of Coal throughout India. It will be seen from it, that the position of 67 beds is already ascertained, affording an aggregate thickness of 466 feet of Coal.

29. A comparison of this Table with the list of sites in which Coal was supposed to exist on the Continent of India, as enumerated p. 7, Reports of the Committee 1838, will show to what extent our information on this subject has been extended since the publication of our first Report.

There is still, however, unlimited room for further improvement, for it is the nature of the inquiry to expand in magnitude and practical importance in proportion as we approach and enter into it.

ABSTRACT of COAL known in India 1 May 1845.

PROVINCE.	DISTRICT.	FIELD.	LOCALITY.	B E D.
Tenasserim Provinces	Mergue	Little Tenasserim	Thian Khan River	a, 6 feet. b, 6 feet.
		Great Tenasserim	a, 20 miles above Tenasserim town b, above the falls	a, 6 feet. Size not stated.
	Moulmein	Leueha River	Forty miles from the coast	Size not stated.
		Tavoy River	Not stated	Not traced.
Cuttack (Orissa)	Gopalpershad	Talchergurh	Balajora Nulla, half a mile from the fort.	1 foot 6 inches.
		Hingolee	Singra Nulla	15 feet.
Bengal	Damooda	Singharun River	A mile from the junction of the Damooda.	7 feet.
		Barracara	Burmury village	8 or 9 feet.
		Rane Gunge	Seven miles above Singharun Nulla	9 feet.
		China Coory	Five miles above Rane Gunge	7 feet.
	Adji River	Churalya	Five miles below the confluence of the Barracara River.	7 feet.
		Churalya	Quarter of a mile from the south bank of the Adji.	6 feet.
	Rajmehal	Mobeednuggur	North bank of Adji, quarter of a mile from the river.	13½ feet.
		Mammudpore	Two coss south of Seedpore Ghat	Size not stated.
		Banshi River	Patchwary Pass	In sandstone.
	Rangurh	Braminy Nullah	Doobradgepore village	Numerous beds not described.
			Hurra	At Teer Mohun
		Mootee Jurma	Near the waterfall	Not traced.
Bullea		In the Suncharie, a tributary of the Habaroo River.	3 feet.	
Augballa		On the right side of the Benares New Road, near the 187 milestone.	Not stated.	
Behar	Upper Palamow	Village of Palamow	Coyle River, 50 miles from the conflux of the Sone.	3 feet 9 inches.
	Middle Palamow	Singra Village	a, Junction of the Amanath and Coyle River.	a, 13 inches. b, 4 feet 7 inches.
		Gorassan Nulla	b, Above Mirall village	6 feet.
	Lower Palamow	Rajhara	Five miles beyond the village of Chapari	a, 13 inches. b, 3 feet 9 inches.
Lower Assam	Now Gong	Sadabah River		a, 9 inches. b, 6 feet.
		Jomoon River	North bank, a little above the falls	a, 1 foot 6 inches. b, 2½ feet.
	Mouas River	Dephoo Nudjee, eight miles above the falls.	Drifted	Not traced.
		Bijnee Doar	Hills on the left bank, at the exit of the stream from the Bootan Mountains.	Not described.
	Kurribari	Bonarossee River	Garow Mehals (Drift)	Not traced.
		Tezpore	Jelluadce River	a, Kooreapara Doar, 16 miles from the Burrampooter (Drift).
	Belserees River	Booroolce River	b, Booregoomee Doar, 16 miles from the Burrampooter (Drift).	Not traced.
			Near the village of Dymamorah, ditto	Not traced.
	Dikrae River, a tributary, ditto	Dikrae River, a tributary, ditto	ditto	Not traced.
			b, Booroolce Main Branch	Not traced.

ABSTRACT of Coal known in India 1 May 1854.—continued.

PROVINCE.	DISTRICT.	FIELD.	LOCALITY.	BED.	
Sylhet	Garrow Hills	Doorgapore	Undefined	Two beds, native testimony. Not traced.	
		Khasyah Hills	a, Lour	a, Patli River	9 inches.
	b, Disung River		b, Near Susung	2 feet.	
	c, Between Panatic and Bunsikorah.		c, Top of second range of hills	Not traced.	
	d, Cheila		Undescribed	7 feet 6 inches.	
	e, Cherra		a, At Cherragow	a, At Cherragow	6 feet.
			b, At Barachara	b, At Barachara	1 to 3 feet.
			a, Byrungponji	a, Byrungponji	1 to 3 feet.
			b, Cheila	b, Cheila	4½ feet.
		c, Mustuk	c, Mustuk	28 feet.	
a, On the left of the Road, entering Cantonments from Mosmye.		a, On the left of the Road, entering Cantonments from Mosmye.	2 feet.		
b, Facing Cantonments	b, Facing Cantonments	17 feet.			
c, Opposite declivity	c, Opposite declivity	12 feet.			
d, Serrareem	d, Serrareem	Not traced.			
Cachar	Bikrampore	A small watercourse on the side of a hill, half mile distant from the Arung River.		Conjectural.	
		Tipperah Hills	Arpeen	Near the bed of a small stream, a sandstone rock, from which petroleum flows.	
Arracan	Bolonga Islands	Augne Keong	West coast of Augne Keong	a, 5 feet interrupted. b, 1 foot 6 inches. c, Very small.	
		Penee Keong	a, South extremity of Penee Keong b, West coast of Penee Keong	1 foot interrupted. A thin seam.	
	Ramree Island	a, Kyuk Phyu	On two small islands in front of the harbour.	Irregular broken bed.	
		b, Hong Valley	In the harbour, subject to the tides a, South-western extremity	Irregular broken bed. a, 3 inches. b, 20 inches. c, 15 inches.	
	Sandoway	c, Koeng Dyeng a, Kingtelle b, Sandoway Town	b, South-eastern extremity	8 inches.	
			c, North-western side	a, 20 inches. b, 8 inches.	
			West coast of Ramree Island	Masses of coal detached. 6 inches bed.	
	Muggee or Paget Island.	Chaduba Island	a, On the beach	Numerous detached pieces.	
			b, Sandstone hills, a mile from the town	18 inches. Not traced.	
	Central Districts	Ruttenpore	Hutsoo River	On low hills, at the south side	A thin seam.
Manpore			Near the Fort of Koorba	200 yards thick.	
Surgooja		Raher River	Sixteen miles south of Chergurh	3 feet.	
		Kotah	Seven miles east of Burra	Many yards. 6 inches.	
Nerbudda Valley	Sohagepore	Sukhuwan	Mouzah	b, 1 foot 2 inches. 1 foot.	
		Keyverji River	Sewallah Mookhe River	Not described.	
	Sukur River	Johilla River	Near Seetamadhi	Not described.	
		Gurrawara	Near Palee	Not described. a, 20 feet. b, 40 feet. c, 25½ feet.	
Baitool	Shawpore	a, Mardanpore	b, At the junction of the Hard with the Sukur Rivers.	a, 1 foot. b, 2 feet. c, 4 feet. 6 feet.	
		b, Boragurh	a, Mardanpore	1 foot 9 inches. 1 foot.	
	Bhoorna River	Eight miles south of Bhoorda	Several beds from 9 inches to two feet.		
	Nerbudda River	a, Lemata Ghat b, Four hundred yards below Lemata Ghat.	12 feet. 6 feet.		
Guzerat	Cutch	Jubbulpore	At a depth of 70 feet	Undescribed.	
		Near Bhoj	a, In the bed of the Trumboo River b, Drojapore	Several thin seams. 20 inches.	
Upper Assam	Dhunsiri	-	Number River, on the west bank of the Dhunsiri.	Not traced.	
			On a line between Deoza and Cham-bakotee.	Not described.	
	Dikoo River	Namsang	Namsang Purbut	6 feet. 6 feet.	
	Suffry River	Upper Suffry	a, Tyroo Ghat	Not described.	
			b, West Tyroo	Not described.	
	Lower Suffry	Bed of Suffry River		a, 18 feet. b, 37 feet. c, 36 feet. 8 feet.	
		Disung River	Boorhath	a, Rising ground near the bed of the river, about a mile from the village.	6 feet.
	b, Quarter of a mile from the river, on an elevation of 50 or 60 feet.				
Boree Dihing River	Jeypore	a, Gheerphong	a, 9 feet. b, 2 feet. c, 2 feet.		
		b, One mile south of Geerphong	Several beds, size not stated.		
	Namroop	c, Three miles or four from Old Beesa	20 feet.		

A S S A M.

Assam.

32. THE Coal districts of Assam, though more or less continuous, particularly along the southern side of the valley for 350 miles, may be conveniently divided into Upper and Lower, corresponding with the division of the province.

33. Bishenath, situated 170 miles from Bengal, being taken as the limit between Upper and Lower Assam, we have indications of six Coal fields above, and three below.

34. Major Jenkins in enclosing to Mr. Maddock the last discoveries of Coal in Assam, 26th February, and 14th March 1842, urges the expediency of appointing at once a well-qualified person to examine all the Coal beds known to exist in that province.

35. In reply, Major Jenkins was informed that the Governor General proposed to avail himself of the first opportunity of appointing an officer of experience and the necessary acquirements, to conduct a survey of the Coal deposits near the banks of the navigable rivers in Assam, where the best Coal is to be found in situations affording the greatest facilities for its removal by water to the Presidency. In forwarding this correspondence to the Committee, its opinion was invited.

36. A survey of the Coal beds in Lower Assam and Sylhet was accordingly recommended with the above view by the Committee.

LOWER

NOTES.

EXTRACT of a Letter from Major *F. Jenkins* to Government, 26th February 1842.

THAT his Lordship may judge of the expediency of appointing at once a well qualified person to examine all the beds of Coal known in Assam, I will briefly mention the beds yet discovered or supposed to exist.

Namroop and Namsang river falling into the Booree Dehing above Jaipoor, little is known to me of the beds in either stream, but I think the quality of the Coal is nearly the same, and Major Forbes reported on some, sent down by Lieutenant Bigge from the Namroop river, that it was the best for certain purposes of any discovered in India.

At Jaipoor there are three beds, two directly on the gorge of the hills through which the river flows. One of these the Assam Company are working, and the stratum, as far as exposed when I visited it, was six feet thick of very fair Coal, and containing apparently much less sulphur than in the first small stratum overlying that now working.

Half way to Borhaut from Jaipoor is the bed worked by Captain Hannay and Mr. Landers above adverted to. I imagine this coal is similar to that of Jaipoor and Borhaut.

At Borhaut, directly in the bed of the Disung on both sides, is a deep stratum of Coal that has not yet been worked, but the locality seems very favourable.

In the Suffery, is the Coal worked by Mr. Bruce under the late Mr. Scott's directions, and it was said to be very good. In the Disang is the bed now working by Mr. Landers.

In the Dhunsiri, Coal has been traced in several places, but we know nothing of the beds.

In the Junnoona there is a Coal bed connected with a limestone perfectly identical with the limestone of Cherra, and there is therefore fair grounds for supposing the Coal may be of the same quality.

The last bed known on the south bank is that lately discovered by Mr. James Bedford on the Caribari estate, under the Garrow Hills, of which the Coal as far as yet opened appears inferior and earthy; but as the situation is extremely favourable, it may be worth while to go on with the operations here to some extent, in the hope of coming upon a richer stratum below. This Coal is besides connected with beds of iron ore and pottery clays that seem likely to be of much value.

On the north bank several traces of Coal have been met with from time to time, but from our recent occupation of the Doars it now seems certain that Coal will be found under the northern hills in the same manner as we have found it abounding under the southern hills, for I have lately had samples of Coal from the Gadada river, falling into the Berhampootur at Doubry, which were sent me by Mr. Bedford, and small samples from Mr. C. K. Hudson and Captain Mathie, of Coal found in the Monas and Bijnee Doar; and lastly, Lieutenant Scott showed me at Tezapore both good Coal and limestone from Koreaparah Doar, of which he would have made a personal examination, but he was driven in by a slight attack of fever.

EXTRACT of a Letter from the Government to Major *Jenkins*, 14th March 1842.

I HAVE the honour to acknowledge the receipt of your Despatch, dated the 26th ultimo, No. 29, submitting your opinion upon Lieutenant Colonel Garstin's proposal for expending a sum of 1,000 rupees in obtaining specimens of Coal in Assam, and in reply, to inform you that the Governor
General

LOWER ASSAM.

Lower Assam.

IN this part of the province indications of Coal are less decided than in the Upper Assam, but being nearer to Bengal, they are on that account more important.

37. *Durrumpore*.—Beds of Coal are found in the valley of Durrumpore at the fall of the Jumoona, a confluent of the Kopili river, about 90 miles from Gowahatti, 60 miles of which is an open navigation for the greater part of the year, the remainder is navigable in the rains to the Coal beds.

38. A bed of Coal $2\frac{1}{2}$ feet in thickness is intersected by a little nullah half a mile above the falls of the Jumoona, at a distance of 80 or 100 yards from that stream.

39. A second bed occurs in this locality, the particulars of which are not yet known, but a sample of the Coal transmitted to the Committee in April 1844, proved on analysis to be one of the purest and finest Coals hitherto met with anywhere; also at a distance of eight miles above the falls, a small bed of $2\frac{1}{2}$ feet in thickness, has recently been found in a tributary of the Jumoona called Dephoo Nuddee, by Messrs. Wood and J. W. Masters. The quality of the sample furnished from this last bed is not however good.

40. *Kopili River*.—In the bed of Kopili river, 24 miles above the confluence of the Jumoona, near a place called Serga, at a distance of 10 or 20 miles to the south west of the preceding Coal, drifting specimens have been found in the sands, thereby indicating the existence of beds of Coal more or less extensive towards the head of this stream.

41. *Monas River*.—(Bonash.)—At the Bijnee Dooar, on the north side of the valley, 45 miles from the confluence of the Monas with the Burrampooter at Goalpara, and 260 miles from Bauleah on the Ganges, several thin beds of Coal were observed by Mr. C. K. Hudson, in hills on the left bank of the Monas, at
its

NOTES—continued.

General in Council proposes to avail himself of the first opportunity of appointing an officer of experience, and the necessary acquirements to conduct a survey of the Coal deposits near the banks of the navigable rivers of Assam, with a view to determining where the best Coal is to be found in situations affording the greatest facilities for its removal by water to the Presidency.

EXTRACT of a Letter from Major *Jenkins* to the Committee, 1st December 1837.

I HAVE the honour to forward a copy of a letter No. 26, of the 25th instant, from my assistant, Lieutenant Vetch, in charge of the Durrung division, communicating the discovery of traces of Coal in three of the rivers flowing from the Bootan range through that division into the Burrampooter.

Lieutenant Vetch has not yet been able to visit the places in which the Coal has been found, but he proposes taking the earliest opportunity of doing so, and I trust his further researches will lead to the discovery of Coal *in situ*.

These discoveries of Coal on the north bank of the Burrampooter, and over a tract of country 50 miles in length, appear to me to add greatly to the importance of the previous discoveries of Coal on the south bank of the river; for I conceive it may be presumed that we have by no means yet obtained a knowledge of the full extent of the Coal beds in Assam, and that it is not improbable they are co-extensive on both sides of the valley, and will be found very nearly throughout its whole length.

The original sketch alluded to by Lieutenant Vetch I have the honour to annex hereto, and the specimens will be forwarded by dawk banghy.

From Lieutenant *Vetch* to Major *Jenkins*, 25th November 1837.

I BEG to send you, for presentation to the Government Coal Committee, specimens of Coal which I have discovered in the channels of the Ghellundee, Belseeree and Bhooroolee rivers.

The expectation entertained in my note to you, from having found the same lignites in the Ghellundee of Koorecapara as in the Bhooroolee of Chardooar, with courses about 50 miles apart, but taking their rise from the same chain of mountains that the seam from which they were washed extended along the frontier, is greatly increased by the discovery of the same lignite in the Belseeree, which is central.

Lower Assam.

its exit from Bootan, along with limestone. The place is in all respects favourable for water carriage. The size and circumstances of the beds are not described. But, with the exception of Kurribari, this is the most convenient situation in which Coal has been hitherto found in Assam.

42. *Kurribari Hills*.—Detached specimen of good Coal have been found in the beds of the Bonarasee river, a tributary of the Kalo, in the Kurribari Hills.

43. Drifted fragments have also been found on the north side of Assam in the sands of Jelluadee, and Dhunsiri, in the Kooreapara, and Booreegoomee Doars, 16 miles from the Burrampooter; also on the Belseeree river near the village of Dyamorah, 14 miles from the Burrampooter; and lastly, on the Booroolee and its tributary the Dikrau river, 17 miles from the Burrampooter, a little above Tezpore.

ABSTRACT OF COAL IN LOWER ASSAM.

Province.	District.	Field.	Locality.	Beds.
Lower Assam -	Nowgong -	Jumona River	At the Falls - -	2½ feet 2d bed not described.
		Kopili River -	Drifted - - -	Not traced.
	Monas -	Bijnee Doar -	Hills on the left bank at the foot of the Bootan Mountains.	Not described.
	Kurribari -	Bonarasee River	Garrow Mehals -	Not traced.

Upper Assam.

UPPER ASSAM.

44. In Upper Assam we have six Coal districts as follows :

- I. The Dhunseeree, 30 miles above Bishenath.
- II. The Dikhoo, 80 miles above Bishenath.
- III. Suffry, 80 miles above Bishenath
- IV. Disung, or Boorhath, 90 miles above Bishenath.
- V. Boree Dihing, or Jeypore, 100 miles above Bishenath.
- VI. Namroop, or Beesa, 180 miles above Bishenath.

45. In these six fields 10 beds of Coal have already been observed, and their size respectively ascertained; which altogether amounts to an aggregate thickness of 159 feet. This is probably not a third of the contents of these great Coal-fields.

46. Abundance

NOTES—continued.

I particularly beg to bring to notice the specimen marked A, found in the bed of the Belseeree, which seems to be good Coal, and to burn freely. The lignite is difficult to ignite, but when once on fire gives out a very powerful heat, and is very enduring.

As soon as I can spare time, I propose visiting the beds of these and other intermediate streams flowing into the Burrampooter, as far up their course as it is possible to proceed, with the hope of coming upon the main seam.

In the accompanying box, the specimens marked A and a, are coal and lignite found in the Belseeree river running through Chardoar, and found in greater abundance than in the other rivers. That marked B, is from the Ghellundee running through Koreahparrah; the same kind is also found in the Dunseeree (and I sent you a specimen of it some time ago), C is from the Bhooroolee and also Dekraee, which falls into the former.

I have also put up into the box two rather curious specimens, one of the ash of the Coal A, in which there appears to be osseous remains, and the other of lignite C, in which a knot in the wood can be distinctly seen, while a formation of iron ore has filled a crack in the same specimen.

I have information which leads me to expect the lignite in the whole of the rivers between Dunseeree, west, and Booroolee, east.

I have the pleasure to annex a rough outline of the rivers in this district, marking the places where the Coal was found, with letters to correspond with those on the specimens.

Copy

46. Abundance of clay ironstone occurs with the Coal of Assam, and is a important feature in the resources of the provinces especially demanding attention, particularly as it is the very kind of ore from which the bulk of cast-iron is made in England.

Upper Assam.

47. Thus, should the Coal of Upper Assam be available at present for no other purpose, it may at once be employed in the reduction of the iron ores which occur with it; and where both coal and ore are found together, attended with an easy water carriage to all parts of India, the result may without difficulty be made of the highest degree of importance.

48. The

NOTES—continued.

COPY of a Letter from Captain *Jenkins* to Captain *Henderson*, Member of the Coal Committee, 23d March 1837.

I HAVE just had the pleasure to receive your letter of the 11th, and, as it is a holiday to-day, I will proceed immediately to give you all the information in my power regarding the Assam Coal-fields, though I may premise that what I have to say, is more to point out the sites in which Coal has been found, than to give any description of the extent of the beds, or any details that I could hope would turn to any useful account in the present state of our information.

The first bed of Coal that appears to have been brought to notice was that worked by Mr. Scott with a view to supply the steamer intended to ply on the Burrampooter as alluded to by you. In describing its position, I must refer you to Wilcox's Map of the Eastern Frontier. The next river in that map above Rungpore, on the south bank of the Burrampooter, is the river called Disung Nuddee, and you will observe two small streams running into it from the Naga Hills; the name of the most westerly is the Suffry. The bed of coal worked by Mr. Scott is on the banks of this little nullah close under the Naga Hills; Mr. Scott employed Mr. Bruce (the Tea Plantation superintendent) to raise Coal, and Mr. Bruce sent down a few thousand maunds to Mr. Scott, but what became of the Coal I do not know, except that a small quantity was lying at the ghaut at Gowhatti when I first came to Assam. It seemed to be very fair Coal. Mr. Bruce's Report, or some account of his proceedings, will be found, I think, in the Reports on Assam, by Pemberton and myself. He found the Suffry navigable with difficulty, from the rocks which obstructed the channel of the stream, but he was of opinion, that the obstructions were readily removable. Mr. Bruce had to encounter some difficulties also from the want of population, but he had overcome these in great measure, and was in the way to provide any supply that might have been required when the experiment was closed. The Coal lay in a thick stratum close to the surface, and I think Mr. Bruce found the bed easy to work. In the immediate vicinity were iron mines, worked by the Nagas; from my recollection of the account given of these mines, the iron they yielded was a nodular iron ore imbedded in clay; and from the circumstance of the ore lying on the brink of a small declivity, there was every facility for working it. I speak now from imperfect recollection, but I will request Mr. Bruce to favour me for the Committee with an account more to be depended upon. At the source nearly of the Disung Nuddee is the old fort of Boorhath, between which and the fort of Jypore are valuable brine springs, though now made little of; they are worked by the Nagas in a very rude way indeed, some account of which you will also find in an Appendix to Pemberton's and my Reports. Mr. Bruce's elder brother had taken a farm of these brine springs, and was providing himself with the necessary iron boilers when he died, and the undertaking was abandoned.

The next bed of Coal that was brought to light is situated on both banks of the Jumoona river which falls into the branch of the Burrampooter, called the Kullung, and that rejoins the great river eight or ten miles above this. The Coal is found about half-way between "Deezooa" and the "Dissaro rivers," and little more is known of it, than that it is abundant and associated with precisely the same limestone as that of Sylhet. This Coal is good and similar to that of Cherra Ponjie. Of the extent of this field nothing is exactly known, but having lately had a specimen of very fine Coal sent me, which was picked up in the bed of the Deyong, just where it is incorrectly called "Koppelce" by Wilcox, there are grounds for supposing that between the Deyong and Jumoona there is a very extensive field of Coal, and there are some reasons for believing that it is not confined to the doab of these two rivers. The lime being known to extend to the Kopili which fall into the Deyong at the places marked Dyung, but which ought to be read Dyung Mookh; the Deyong or Dyung there losing its name at its junction with the Kopili, although the former is the larger river. The further indications which denote the probable extension of this Coal field are brine springs under the Naga Hills, at a place called Sunkur, facing the centre of the doab of the Jumoona and Dyong, and which brine springs continue to the north down the western branch of the Dhunsiri river, and are connected with lime and hot spring, while in the eastern branch of the Dhunsiri (the Dyong or Dheong) are beds of sulphurous alum slates, or rocks related nearly to the Coal strata. At a junction of these two streams of the Dhunsiri at Naga haut ("Naga pate") and for a considerable distance inland on the right bank of this river, there are iron clay ores worked, of which some account was lately given by Mr. Rae, the missionary. The Dhunsiri, Jumoona, and Dyong are small streams, but they are navigable half the year for boats of the province (canoes), and bring down large volumes of water equal to any boats in the rains. Of the intermediate country along the hills between the Dhunsiri and the Disung, I have no information, but it appears to me probable that the same formation extends throughout.

For in the late expedition of Major White, Lieutenant Bigge, Mr. Griffith, and Captain Hannay to the Patkaye Hills, in the direction of the Namroop river, they brought to light an extensive bed of Coal and several petroleum and brine springs of the Coal. I have sent samples to James

Upper Assam.

48. The manufacture of iron, if once introduced in Upper Assam, would tend greatly to settle this part of the frontier, and might draw into habits of industry the restless and uncivilised races who inhabit the districts adjoining, who appear, from the following instance, to be quite capable of improvement by such means, and upon whom the occupation afforded by working coal mines in the Khasyah Hills, as well as in Assam, has already produced some good effect.

49. Major Jenkins, in addressing the Committee on the subject of the Dikhoo Coal beds (observes, 100 maunds are ready to be forwarded to Seesagur, and remarks (alluding to the person engaged in this duty), "he is employing the Tablong Nagas, a rude people, with whom we have had very little intercourse, is doing much good, and hopes to effect a contract with them for the supply of Coal to the mouth of the Dikhoo river.*

* See Proceedings 7th March 1842, para. 2.

No. I.—*Dhunseeree.*

50. Coal has been found in two situations on this river, which joins the Burrampooter 30 miles above Bishenath, but we are not informed of any particulars or circumstances connected with the beds.

51. The first situation at which detached fragments of good quality were found was,

NOTES—*continued.*

Prinsep, and I believe Lieutenant Bigge has done the same to Gordon, with a full account of what they discovered. I will call upon White and Bigge officially to give further details than I am able to furnish; I think I heard that one of the stratum of Coal observed by these gents was 15 feet thick. The Booree Diding is also a navigable river.

By turning to Wilcox's account of his journey to Borkhamti, in the "Asiatic Researches," you will find that he met with Coal in the Noa Diding and its affluent the Dupha Pancee. From a consideration of all the circumstances before enumerated, I think there is reason for supposing that a very extensive coal field, or series of fields associated with other valuable minerals, extends from the Singpho Hills east, along the Naga Hills south, all the south side of the valley to the hills of Cachar, and I cannot help thinking that the same formation somewhere in the Jynteah country crosses the hills and is connected with the formation of Cherra Ponjie, and the lime and Coal of Pundua and Laour. It is certain that from Chilmari along the Caribari Hills and the Garrow and Kassiah Hills to Gowhattee, that on the northern face of these hills none but granitic formations will be found; but at the western extremity of the Caribari Hills the formation changes to laterite, and further on there is alum slate; and from some part of that neighbourhood, I once saw in Calcutta, specimens of numerous fossil remains, from which circumstance, and also from a common report, that Mr. Scott had Coal brought him from some spot in the Caribari Hills, I am led to believe that the whole of the south of the Garrow Hills from Pundua will be found to be of the same formation, and that Coal may possibly be found close upon the great bend of the Burrampooter, than which a more desirable site for a Coal bed could scarcely be imagined for the supply of steamers coming through the Sunderbunds, and for the general demands of the eastern part of Bengal.

On the whole, I think it highly desirable that we should at least try to know what actually does exist, and I should recommend your Committee to endeavour to prevail on Government to appoint a well-qualified person to survey all the south of the Garrow Hills from Chilmari to Cherra Ponjie, and from thence to cross through Jynteah to the Cachar Hills, and fall down the Kopoli; and, after examining all the country on the banks of the Dyong and Jumoona, to proceed to the Dhunsiri, and thence upwards under the hills all the way to Sadiya. Much might be done in one season if he is at his starting post early; and I should recommend his being at Cherra by the 1st October at latest; he could then immediately and safely proceed to examine all the ground above the ghats as far as Laour or Soosung, and by the 1st of November he would be able to descend and examine the lower hills round the Chilmari; from thence he should return again to Cherra, and keep on the high ground until he falls in with the bed of the Kopoli, which, in about 92° 30' E. Long., he will fall in with, running nearly S. and N. to Dyong Mookh. By taking this course he will, I think, undoubtedly ascertain whether the Coal formations cross the hills or not.

I have said nothing of the geology of the north bank of the Burrampooter, for in fact I know nothing of it; and the country is nearly inaccessible from the misrule of the Bhooteahs, and the rudeness of Duphlas and Abors who inhabit the lower northern hills; but there is nothing in the state of the south bank that will prevent a full examination of all the border hills, except that our *protégé* Poorunduz Sing has a feud with the Nagas, but they would not molest any English gentlemen, accompanied by half a dozen of our sepoy, and whose pursuits were peaceful.

I think I have given you all the information I recollect, but if anything else occurs to me I shall not fail to address you again. I am exceedingly anxious to know what mineral resources we do possess in this province; and as I trust to get assistance from your Committee in prevailing on Government to send us a competent geologist to report on what we have already got imperfect traces of, I shall not be backward in laying before the Committee all the information in my power to induce them to second my application.

EXTRACT

was in the bed of a small stream called Nambar, which falls into the Dhunseeree from the west, at a distance of about 30 miles from the confluence of that river with the Burrampooter.

52. The second locality in which specimens were found in the vicinity of this river is stated to be in a line between Dezooa and Chumakotee, where the mineral is said to occur in large quantities.

53. In communicating specimens from these sites to the Committee, Major Jenkins observes that they confirm previous indications of the existence of extensive beds on the banks of the Dhunseeree, which is a large and more manageable river than either the Dihing or Disung, on which valuable beds of Coal also occur.

ABSTRACT of COAL on the Dhunseeree.

Province.	Field.	Localities.	Beds.
Upper Assam	Dhunseeree	Nambar - - - - - On a line between Dezooa and Chambakote.	One not traced. Two not described.

No. II.—*Dikhoo*.

54. This Coal is situated on the Dikhoo river, 80 miles above Bishenath, and 35 miles from the confluence of the Dikhoo river with the Burrampooter. Two beds of Coal have here been observed on the western bank of the river, a little above the rapids.

55. In the Namsong Hill, a bed of very superior Coal occurs, six feet in thickness. It was first opened by the Government, and subsequently worked to some extent by the Assam Company, for the use of their own steamer, the commander of which certifies to its being the finest Coal he ever used.

56. The second bed occurs in another hill bearing a short distance south of the Namsong. In order to make the thing clear, the relative situation of these hills, and the circumstances of the Coal, are exhibited in the annexed figure, as we understand the case to be from imperfect descriptions. The size of these beds is not expressly stated, but they are supposed to be each about six feet.



57. Other

NOTES—continued.

EXTRACT of a Letter from Lieutenant *Brodie*, 9th May 1837, to Captain *Jenkins*.

PIECES of Coal of good quality were picked up by myself in the bed of the Nambua, a small stream running into the Dhunseeree from the west; near the place where Coal was found in the Nambua is a rock of limestone, which extends across the river.

EXTRACT of a Note from Captain *Jenkins*, 12th September 1839.

I SEND you a lump of Coal from a new site near the Dhunsiri, which I shall be obliged by your giving me an opinion of. It has been found, I understand, in large quantity, and near the banks of the above river, in a line between Dezooa and Chamakote of the Nagas, not far from the tract of tea lately found to exist in that quarter.

Upper Assam.

57. Other beds are stated to exist on the eastern bank of the river, but particulars are not stated.

ABSTRACT of COAL on the Dikhoo.

Province.	District.	Locality.	Beds.
Upper Assam - -	Dikhoo - - -	Namsang - - -	6 feet. 6 feet.

SUFFRY and DISUNG.

58. The Disung river enters the Burrampooter near the mouth of the Dikhoo, but takes a more oblique course along the foot of the lower range of Naga Hills. On one of its branches, the Suffry, a tributary falling into the Disung, at a distance of about 30 miles from the confluence of the main river with the Burrampooter, Coal has been found at several points, as well as on the main branch of the Disung itself, at Boorhath, about 20 miles above the confluence of the Suffry.

No. III.—*Suffry.*

59. The Suffry river extends in a south-westerly direction for a distance of 18 miles towards the Diko Coal fields, and in this course intersects several large beds of Coal.

60. *Lower Suffry beds.*—At a distance probably of six or seven miles from the confluence of the Suffry with the Disung river, several beds of Coal, no less than eight, were observed by Mr. Bruce to intersect the stream and the banks of this river.

NOTES—*continued.*

From Captain *Rogers*, Hon. Secretary to Assam Company, 25th January 1845, to Secretary of the Coal Committee.

THE trial made by the Assam Company of the Coal mines in Assam was limited to about 1,000 maunds. The mine was originally opened by the Government at the foot of the Namsang Hills, which abound with Coal of the finest quality. It is now probable, from the rapid success of our tea manufacture, that a steamer may soon be employed by us in Assam, when the Coal will be found most important.

From Mr. *Smith*, Commander of the Assam Company's Steamer, to Captain *Rogers*, Hon. Secretary of the Assam Company, 24th January 1845.

I HAVE great pleasure in informing you, that the Coal I received at the Diko river was the best I ever had on board a steamer, generating steam quicker without clinker, and far superior to any Coal in Calcutta.

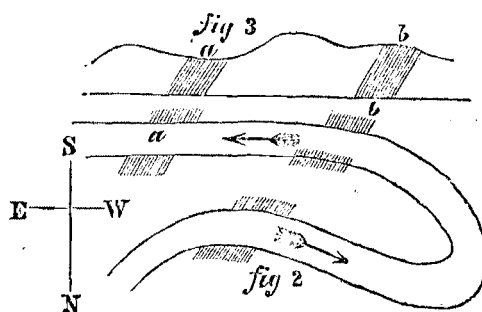
EXTRACT of a Letter from Mr. *A. H. Landers*, Special Assistant to the Commissioner.

"THE upper strata of Coal is six feet high, clay forming the roof. The bed dips at an angle of 40 degrees, and buries itself so as to prevent me from tracing it above 100 yards. I am certain it could be worked at a trifling expense."

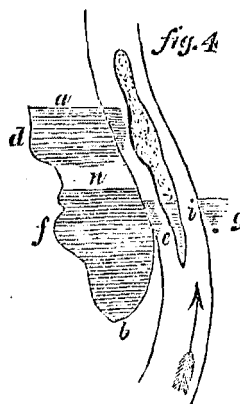
Limestone, Mr. Landers had reason to believe, occurs under the Coal. Another bed of Coal was pointed out to Mr. Landers on the very top of Namsang Purbut, bearing south, but size and distance are not mentioned.

Letter

river. The annexed figures are reduced from a drawing by Mr. Bruce of one situation in which the bed of the river, Fig. 2, is intersected in three places by great seams of Coal, which are also seen rising up into the bank, Fig. 3. The bed, *a*, is said to be 12 cubits or 18 feet in thickness, and the bed, *b*, is 25 cubits or 37 feet 6 inches. Mr. Bruce raised a quantity of Coal here from these beds at their projecting points; but, having been acted upon by the water, he did not think it of such good quality as the following.



61. Half a day's journey further up the river, or probably three or four miles at the utmost, the navigation is very difficult. Mr. Bruce came to a bed of Coal 24 cubits or 36 feet thick, or rather, as would seem from his drawing, two beds separated from each other by a thin band of "stones," shale. Figure 4 is copied from Mr. Bruce's drawing of the out-crop of Coal; *d*, *c*, and *f*, *e*, seem to be two distinct beds running in the direction of north-east, appearing both on the island, *i*, and opposite bank; 5,000 maunds were raised from this out-crop in 1828, and a boat-load sent to Calcutta for trial; this was pronounced by Captain Forbes to be equal to English Coal, and superior to any native Coal of this country which he had seen.



62. The first beds, Figs. 2, 3, are situated at, or but a short distance above the rapids. From this to the last described bed, Fig. 4, the stream is obstructed with stones, trees, and ledges of rock, over which the water falls, as Mr. Bruce describes, with a loud noise; nevertheless, Mr. Bruce managed to get boats up to the Coal beds,

NOTES—continued.

Letter from Captain *Jenkins* to Captain *H. B. Henderson*, No. 167, 4th May 1837.

In continuation of my letters of the 6th and 25th ultimo, I have now the honour to forward a copy of a letter of the 20th ultimo, from Mr. C. A. Bruce, regarding the Coal beds worked by him under the directions of the late D. Scott, Esq., Governor General's Agent, on the banks of the Suffry, a small stream which falls into the Disung Nuddee.

From the observations of Mr. Bruce, there appear to be several strata of Coal in this direction, and some considerably lower down the stream than where he commenced operations, and though he considered that further down to be of inferior quality to what he worked, yet I should think there was little doubt but good Coal would have been found below in the deeper strata.

Mr. Bruce alludes to having heard of Coal being found in the Dikho, and also in a river below Dhergong (Dhemsiri?), and to the very numerous position in which petroleum springs have been discovered under the Naga Hills.

My preceding letters have given information of the existence of deep beds of Coal in the Booree Dihing, and Coal was found by Captain Wilcox in two or three places in the Noa Dihing; Coal has likewise been found in Lower Assam in the streams of the Jummona, Dyong, and Kopili, so that I conceive we have every ground for supposing that a very extensive Coal formation borders the Naga Hills along the whole southern frontier of Assam, as far west as the Jynteah country.

I was in great hopes that I should have been able to avail myself of the presence of Mr. Assistant Surgeon McClelland when on his late deputation to Assam, to have some of these beds examined by him, but unfortunately the season did not admit of it, and the information I have it therefore in my power to submit is gleaned from the hurried or imperfect inspections and accounts of unscientific observers; but if the Committee are, with myself, convinced that there lies along the southern hill of this valley a series of carboniferous formations unequalled in extent by any yet discovered in India, and, as we have every reason to believe, containing some beds of Coal of excellent quality, the Committee will, I trust, consider the further examination of the tract of country in question a matter of sufficient importance to induce them to recommend the subject to the notice of Government. I do not imagine that the Coal is likely to be brought into use for the special purpose which I believe the Committee has principally in view, the supply of the Government steam vessels and boats; yet from its superior quality may be made available for other public wants, which cannot now be met except from foreign or as distant sources. But should the Coal fields of Assam be of no present service for use in Calcutta or the west of India, the full development of our abundant resources in this invaluable mineral may be the occasion of the establishment of local manufactures

Upper Assam.

beds, and to bring away several thousand maunds by this means. The river is described as very tortuous, so that the distance for which a road would be required would not be great. Hills containing clay-iron are worked for that ore, and Mr. Bruce's letter contains drawings of the method used by the natives of the place for obtaining it, which we need not copy, as this is merely by sinking wells to a depth of 10 to 40 feet into the summits of the "iron hills," and raising the ore up by means of a bamboo (for they have no rope) with a hook at the end, to which a wicker basket is attached. From the summit of the iron hills, the ore being in the form of round boulders, is rolled down the hill, and collected and worked on the spot, or conveyed in canoes to the forge. The only demand at present for iron in this quarter is the manufacture of *daws*, axes, and spears. The vicinity was, at the period referred to, a dense forest.

63. *Tyoo Ghat*.—At Tyoo Ghat, a distance probably of seven or eight miles higher up to the Suffry, Coal of superior description has also been found to occur with clay-iron stone. Specimens of both the Coal and the ore have been transmitted to the Committee: for the result of analysis of the former, see No. 62 in the Table of Analytical Results of Indian Coal. The size and circumstances of the beds in this locality are not described.

64. *West*

NOTES—continued.

manufactures, or of its conversion to use in the Eastern Provinces, and the production of results highly beneficial to the trade and commerce of Bengal. I consider it, however, quite necessary to advert to the many purposes to which our extensive deposits of Coal may be turned to productive account; but I would beg to draw the Committee's attention to the intimate connexion of our Coal beds with other minerals of the highest value, iron and salt, and the probable inducements of the known co-existence of these with Coal in the same localities, to draw European capital and skill to a province which appears only to want these stimuli to be as valuable to the state as any of the same extent.

Letter from Mr. C. A. Bruce to Captain Jenkins, 20th April 1837.

I HAVE the pleasure to acquaint you, for the information of the Coal and Iron Committee, that I was deputed by the late D. Scott, in 1823, to examine the Suffry river, where the Coal had been seen in its bed, and to extract the Coal if possible. I found a vein of Coal in the bank on which I commenced work, but as it dipped inland I was obliged to work that which was on the river, and to be able to do so I was obliged to drive stakes and to build a bank all round the vein, and to keep people constantly bailing the water out whilst digging the Coal. On the upper surface, right over the Coal, I found an immense number of trees, and amongst them many walnuts.

With about 100 men I got about 50 maunds of Coal per day, but the lower I got, and further out into the river, I found the difficulty greater in keeping the pits clear of water, for when we left off work in the evening the pits filled, and we had to throw all the water out with bamboo baskets before we commenced operations again.

I got two natives to blast the Coal, thinking by that means to get it out faster, but I suppose there must have been too much water, for we could dig the Coal out much faster with our pickaxes than they could blast it. The vein was rather a large one, I should say it was 32 cubits in breadth, all solid Coal. I might have dug six to eight cubits deep into it, and got out from 4,000 to 5,000 maunds of Coal, but am not certain, as I did not keep duplicates of my plans and work which were sent to Mr. Scott and Colonel Cooper. I, however, have three plans of the pit by me, which I had sent to Mr. Bruce, and copies of which I have the pleasure of enclosing for the Committee; from them they will at once see the nature of the work, size, &c., &c., of the pits. Over at Stoney Island I met with the same vein, but did not work there, in not being able to keep the water out on account of the stones. On the opposite side of the Suffry from our pit there was another vein, high upon the bank, but not more than two or three cubits square of it could be seen. It was set deep in stones about the size of a man's clenched hand.

Half a day's journey lower down, I saw another vein running right across the river, and a little lower down I saw two others high up in the bank. I dug a lot of it out, but it did not appear to me to be so good as the one I was working; the outside was rotten Coal, which had been worked on by the water in the Suffry, but the difficulty is in getting it down from my pit to the nearest navigable river; there lies a small range of hills on the route; the pass would have to be cut and widened to permit hackeries to get along. The river, again, is one of the most dangerous I ever met. I had to go up in the height of the rains in canoes, and suppose I was the first person that ever did so; after I had got up two or three rapids the current came down with such force, that I was obliged to send about 20 men on ahead with coir rope, to lash one end to a bamboo and float it down to the boats, make fast to one, and the people ahead would pull her up; thus each one was drawn up in succession. The noise of the water rushing over stones and past the rocks was so great that we could hardly hear one another when standing together. In going down I lost four boats, on account of the short turnings in the river and the rapidity of the current.

Could the Coal lower down be worked, there would be less difficulty, as it is not so far in the rapids;

64. *West Tyroo*.—Other beds have been observed west of Tyroo Ghat, and approaching towards the Dikhoo; but, like the last, particulars as to extent are wanting.

Upper Assam.

65. Several beds of inferior Coal are also said to be intersected by the Suffry in the lower part of its course, not far from its junction with the Disung, regarding which we have no particulars.

ABSTRACT of COAL on the Suffry.

Province.	District.	Field.	Locality.	Beds.
Upper Assam -	Suffry River -	Upper Suffry	Tyroo Ghat - - West Tyroo - -	Not described. Not described.
		Lower Suffry -	Intersected by the stream.	a. 18 feet. b. 37 feet 6 inches. c. 36 feet. Several others not specified. <hr/> 91 feet.

No. IV.—*Boorhath*.

66. The Coal beds at Boorhath occur on the Disung river, 20 miles above the confluence of the Suffry. Large boats may ascend in the rains for the Coal.

67. The first bed occurs about a mile from the village of Boorhath, at the commencement of rising ground, adjoining the channel of the stream. The bed of Coal is visible for 100 yards in length to a thickness of eight feet above the water and the gravel of the stream.

68. The second bed is about a quarter of a mile distant from the river, at an elevation of about 50 or 60 feet, and is exposed to an extent of 200 yards in length on the bank of a little watercourse.

The quality of both these Coals appeared to Major Jenkins to be very superior, an opinion which has been confirmed by analysis of specimens sent to the Committee. (See No. 72, Table of Analytical Results of Indian Coals.)

ABSTRACT

NOTES—*continued*.

rapids; a few rocks blasted in the cold season would make the passage much safer, and by placing large boats at the end of the rapids, canoes lightly loaded, might empty their cargoes into them, and again return the same day for another; but they should be manned with Doooms only.

I met with no less than eight different veins of Coal in going down; there may be more.

About half a day's journey from the pit, I worked there on small hills that have very good iron in them. I went and visited one; and as I happened to send a drawing of it to Mr. Bruce, and will copy and send it. The iron is smelted close to the hill, worked up into daws (knives), and sold to the Nagas for cotton, goats, spears, &c., &c. In the Suffry I met with some oil springs. I found it oozing out of the bank into the river; it was rather of a brownish colour. I also met with it not far from the Coal pit; this was of a greenish colour; samples I sent to Mr. Scott and Colonel Cooper.

My brother, many years ago, told me that Coal was seen in some river below Dergong, but the people were afraid to work it as it was so unhealthy. The Committee know of the Coal lately discovered in Naum Cheek Panney, it is said to be in the Now Dehing, but I never saw it, and if discovered it would be too far amongst the rapids to be of any use to us. I have been informed that Coal was in the Deeko river, and strongly suspect that it is.

After adverting in detail to the Boorhath and Jeypoor beds, Captain Jenkins remarks that although no other traces of Coal have yet been discovered in the immediate vicinity, it is impossible not to see from what has already been brought to light, the general uniformity of the whole tract, as belonging to the Coal formation which comprises all the small ranges of Naga Hills, for 100 miles in this direction. We may hereafter, Captain Jenkins adds, find beds extending far lower down towards the great navigable channel of the Burrampooter, and therefore offering some advantages in regard to transport. But as those advantages would be counterbalanced by greater difficulty of drainage, it seems to him that we are not likely in all Upper Assam, to find two points where Coal could, upon the whole, be worked with more advantage than Boorhath and Jeypore. The two streams, which traverse these districts respectively, the Boree Dihing and Disung, are the largest rivers on the south bank, and most fitted for navigation.

Upper Assam.

ABSTRACT of COAL at Boorhath.

Province.	District.	Field.	Locality.	Beds.
Upper Assam	Disung	Boorhath	1. Rising ground near the bed of the river, a mile from the river.	8 feet.
			2. A quarter of a mile from the river on an elevation of 50 or 60 feet.	6 feet.

No. V.—*Jeypore.*

69. The Coal beds at Jeypore are situated near Geeraphong, a small village, $1\frac{1}{2}$ to $2\frac{1}{2}$ miles from the old fort of Jeypore, on the east bank of the Boree Dihung river, at a distance of 40 miles from its confluence with the Burrampooter, and 100 miles above Bishenath. The beds appear to be large, numerous, and of various quality, and the Coal may be raised and delivered on the bank of the Burrampooter at $1\frac{1}{2}$ anna per maund. We find it difficult to distinguish the several beds, for want of a more discriminating account of the size and quality of each than we possess at present.

70. On the declivity of a low chain hills, two or three miles in length, extended in S.W. direction, a nine-foot bed of Coal occurs, alternating with a soft white sandstone containing "masses" of iron ore, and two smaller beds of Coal, one above and the other below the nine-foot bed.

71. A third bed, 11 feet in thickness, is mentioned as intersected by a ravine or watercourse a little beyond the nine-foot bed.

72. Somewhat better than a mile to the south of the last-mentioned bed, there are several others "trending in a direction of 350 degrees, the line of dip being 280 degrees, and dipping at an angle of 45 degrees into the hillock." Thus we might venture, perhaps, to represent these details as in the annexed figure.



73. In

NOTES—continued.

EXTRACT of a Letter from Captain *Hannay* to Captain *Jenkins*, Commissioner of Assam, 15th September 1838.

I ONLY worked the Coal to the extent of 15 yards in length and six feet in depth, and although I found a good deal of slaty substance, much impregnated with pyrites, on which pickaxes struck fire, still I did not come upon rocks, and to all appearance the vein of Coal may extend many yards further down.

The breadth of the vein, including partings, is about nine feet. Examining the beds of two watercourses which pass over the vein of Coal, I found several beds of sandstone of the description called by miners white post; it is soft and easily broken, and was intermixed with large masses of iron ore and softened sandstone. There were also two small veins of Coal, though several feet higher than the larger vein, evidently appeared to belong to the same bed, having the same dip and bearing.

In another place a quarter of a mile distant, where Captain Hannay observed greyish coloured soft shaly sandstone, strongly impregnated with petroleum, of which it affords several springs, the surface is covered with fragments of Coal. These lead to a watercourse which intersects a bed of Coal 11 feet in thickness, which Captain Hannay supposed to be a continuation of the one he opened; proceeding down the watercourse in a southerly direction, about six furlongs distant, several beds of Coal appear, dipping into the centre of the hillocks. (See Report Committee 1841, p. 4, 5.)

EXTRACT

73. In addition to the soft red and white sandstone, the other rocks in the vicinity are described as a greenish coloured soft slaty sandstone, strongly impregnated with petroleum.

Upper Assam.

74. Regarding the quality of the Coal sent to Calcutta in 1838, from the first of these beds marked *a*, Fig. 2, 40 maunds were only equal to 32 of Burdwan. From the inferiority of the Coal itself, as well as from the nature of the shale and sandstone above described, we might venture to infer that the bed from which the sample is derived is superficial Coal, and that some of the other beds, *c*, or *h*, which do not appear to have been tried, might have afforded better results. Different beds, as may be understood from the foregoing figure, may be variously thrown up from below, so that the lower beds (*c*, *h*,) which always constitute the best Coal, may by the displacement to which Coal beds have been subjected, be as frequently found at the surface, in open day, as newer beds of which originally occupied a more superficial place.

ABSTRACT of COAL at Jeypore.

Province.	District.	Field.	Locality.	Bed.
Upper Assam -	Boree Dihing River.	Jeypore - -	Geerophong -	9 feet. Other 11 feet. Numerous other beds, particulars not specified.

No. VI.—*Namroop*.

75. *Namroop* Coal is situated near *Beesa*, 21 miles from the confluence of the *Noa Dihing* with the *Burrampooter*, 10 miles above *Suddyah*, thus supplying the highest navigable point of the latter river.

76. The only bed as yet observed is situated three or four miles south of the *Beesa*, on the bank of the *Namroop* river, a tributary of the *Boree Dihing*, about seven miles above the confluence of these streams, and $2\frac{1}{2}$ miles above the village of *Namroop*. The bed of Coal is 20 feet thick, forming a precipice overhanging the stream.* The quality of the Coal is of the most superior description.

ABSTRACT

NOTES—continued.

EXTRACT of a Letter from Captain *Jenkins*, Commissioner of Assam, 19th February 1838.

“CAPTAIN HANNAY was not aware of the existence of *Boorhath* Coal, the superior facilities of transport offered by which would otherwise have induced him to work it in preference to *Jeypore* Coal. But he could not so well have superintended the labourers,” &c.

* This Coal was first observed by the late Captain *Bigge* and Mr. *Griffith*, in April 1837, a fuller description of it will be found in Mr. *Griffith*'s journal now under publication. The bank in which the Coal occurs is 30 feet high, consisting of Coal chiefly reposing on an absorbent slate clay, easily acted upon and softened by the stream. The adjacent country is composed of low hills 200 to 300 feet high, abounding in springs of petroleum and naphtha, which prevent the growth of the larger vegetation. The *Boree Dihing* at the confluence of the *Namroop* is said to be as large as the *Tweed* at *Kelso*.

The *Singphos* are altogether ignorant of the nature and uses of Coal, and, Captain *Bigge* remarked, were greatly surprised to see large lumps of it burst into a brilliant flame as soon as ignited.

Upper Assam.

ABSTRACT of COAL on the Namroop.

Province.	District.	Field.	Locality.	Bed.
Upper Assam	Beesa	Namroop	2 miles from Beesa	20 feet.

On the Carriage of Upper Assam Coal to Bengal.

77. To give the Upper Assam Coals a fair trial in the N. W parts of Bengal, advantage should be taken of such facilities as the place affords for building boats from the useless forests on the spot. The late Captain Bigge suggested a plan similar to that followed on the Damooda of building boats, and he considered that if adopted in Assam it would tend greatly to diminish the expense of carriage.

78. We may here advert to paragraph 1, Proc. Committee, 11th January 1841, by which it appears that 500-maunds boats may be built at 80 to 150 rupees each. We may also refer to another opinion, paragraph 5, Proc. Committee 6th January 1841, as to the period a boat will last, which with slight repairs is stated to be 10 years. Let us assign 10 rupees per annum for repairs, and 120 rupees for the cost of the boat.

	<i>Rs. a. p.</i>
Hence, in 10 years the boat would cost - - - -	220 - -
For a mangy at five rupees per mensem, and seven boatmen at four rupees each per mensem, for 10 years -	3,960 - -
Insurance at 3 per cent. on each trip, two trips per annum for 10 years - - - - -	250 12 10
Cost of 10,000 maunds of Coal at Dikhoo Mouth, on the Barrampooter, at two annas per maund, as per result already ascertained on the Boree Dihing - - -	625 - -
Cost of 10,000 maunds on delivery - - - -	<u>5,055 12 10</u>

79. Thus, allowing a boat to make two trips a year between the line of depôts on the Ganges and Upper Assam, Coal might be delivered for a little more than eight annas per maund, each boat delivering 1,000 maunds annually; 200 boats would be requisite to meet the present expenditure.

80. Such boats might be disposed in fleets of 20 or 30, with a clahie to each fleet. A steamer might be employed, if necessary, to assist the boats and facilitate their progress.

81. The quality of Suffry Coal is already known to be most superior, that of Dikhoo is certified by the commander of the Assam steamer to be the best Coal he ever had to do with. Thus, although it might cost more, its use would be less expensive than an inferior article.

82. But the beds of Bijnee Doar, and Jumoonia in Lower Assam, particularly the former, should first be looked to, as more completely within reach of Bengal.

ABSTRACT of COAL in *Upper Assam.*

Province.	District.	Field.	Locality.	Beds.	
Upper Assam	Dunseeree River	- - -	Number - - - - - On a line between Deoza and Chambakotee.	One not traced, Two not described.	
	Dikhoo River	Namsang	Namsang Purbut - - -	{ 6 feet. 6 feet.	
	Suffry River	Upper Suffry	Tyroo Ghát - - - - -	Not described.	
			West Tyroo - - - - -	Not described.	
	Disung	Boorhath	Bed of Suffry River - - -	a, 18 feet. b, 37 feet 6 inches. c, 36 feet.	
			Rising ground near the bed of the river, about a mile from the village.	8 feet.	
	Boree Dihing	Jeypore	Quarter of a mile from the river, on an elevation of 50 or 60 feet.	6 feet?	
			Geerophong	{ 1 9 feet. 2 2 feet? 3 2 feet? 4 11 feet?	
				One mile south of Geerophong	Several beds, size not specified.
				Namroop	Three miles from the Noa Dihing
TOTAL Thickness - - - - -				157 feet 6 inches.	

KURRIBARI BROWN COAL.

83. Kurribari is a low hilly tract situated at the great flexure of the Burrampooter, where it emerges from Assam. The hills apparently 30 to 50 feet high, consist of soft sandstone and beds of clay intersected by ravines. They are thickly wooded and overran with jungle. The face of the country continues pretty much the same for a distance of 10 miles into the interior, when the levels begin to rise more abruptly, and at a distance of 16 or 18 miles, elevations of 1,500 to 2,000 feet occur, forming the lower and outer skirts of the Garrow mountains. The Kalo river rises on the face of the Garrows, and taking a westerly course, enters the Burrampooter opposite to the village of Chilmaree. It is navigable during the rains to Putamaree, a distance of 11 miles from its mouth. Thin beds of a dull earthy Coal occur in three distinct localities on the north bank of the river.

84. Salkora, three miles inland from Putamaree on the north bank, a bed of Coal 2½ feet thick occurs, alternating with slate-clay, and friable red and white sandstone, covered with boulders and a deposit of earth. The measurements of these beds are not given, but the whole section does not embrace above 20 or 30 feet. The strata here appear to be level. The hills in which the Coal is situated are from 70 to 80 feet high.

This is of a dull brown earthy Coal, see No. 91 in the Table of Analysis. It burns freely with a bright flame, and might answer for steam purposes, although the expenditure would be larger than of ordinary Coal.

85. *Mirampara.*—This is situated three miles eastward of the last described. The same alternation of beds takes place here, with the exception of boulders. The beds in this situation dip 15 degrees to the west. The bed of Coal is somewhat smaller than the last, and of a more earthy nature.

Upper Assam.

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Kurribari Brown
Coal.

86. *Champageree*.—This locality is intermediate between the former two, and about a mile further from Patamaree; the beds here consist of slate-clay, impure earthy coal, boulders, and clay; they dip 25 degrees to the east.

87. These beds appear to belong to one or more small isolated basins of a spurious Coal formation, and are not likely to lead to any important result. The Coal resembles specimens of the brown Coal of Bornholm, and will probably be found to be equivalent to the brown Coal formation. Mr. Sweetland submitted proposals to the Committee for working these beds on the part of Government. Doubtful, however, of their value, the Committee required beforehand to be put in possession of more satisfactory samples than they had seen. These, Mr. Sweetland undertook to supply on certain conditions, which were complied with, but failing in his object the proposal was abandoned, and should never be renewed.

ABSTRACT of *Gundoopara* Brown COAL Formation.

District.	Field.	Locality.	Bed.
Kurribari - - -	Gundoopara - -	Salkoora - - -	2½ feet.
		Mirampara - - -	2 feet.
		Champageree - - -	2 feet.

88. This brown Coal formation is not to be confounded with the indications of bituminous Coal in the same district, afforded by drifted specimens in the bed of the Bonarosee River. See para. 41, Lower Assam.

SYLHET COAL DISTRICTS.

Sylhet Coal
Districts.

89. THESE are five districts or tracts of country on the eastern frontier of Bengal Proper, in which beds of Coal have been found, together with three tracts in which the indications are so strong as to leave little doubt of its existence. These districts are all immediately adjoining Sylhet. Eleven beds of coal have already been discovered in them at various points during the last 30 years. The aggregate thickness of Coal that has been thus ascertained in the Sylhet Coal districts, amounts to 84 feet 11 inches, which is probably not half their contents.

90. With regard to Sylhet Coal generally, its quality being superior, it will on that account always have the preference for sea-going steamers. But for river navigation it would have the advantage of all other Coals for the supply of the Sunderbunds at Kulna, and Commercolly, as well as Bauleah and the lower parts of the Ganges.

91. Carriage from Sylhet to the latter station, or to Calcutta, being considered by boatmen as one and the same, the rates at which Cherra Coal may be delivered at both places would of course be alike. Hence at Bauleah it is obvious this Coal would have a decided advantage over Burdwan for the supply of the upper parts of the Ganges.

No. 1.—*Doorgapore*.

92. The late Commissioner of the N. E. Frontier, Mr. Scott, was aware of the existence of Coal in the Garrow Hills. It has been stated perhaps on his authority that there are two beds in the vicinity of a village called Doorgapore, 20 or 30 miles west of Laour on the corresponding declivity of the same range; a specimen of good Coal from this quarter was presented to the Committee in 1837, but no information has since been obtained on the subject.

ABSTRACT

ABSTRACT of COAL in the *Garrow Hills at Doorgapore.*

Sylhet Coal Districts.

District.	Field.	Localities.	Beds.
Sylhet - - -	Doorgapore - -	Garrow Hills - -	Two, conjectural.

No. II.—*Laour.*

93. Our information of the existence of Coal in Sylhet goes as far back as 1813. Inquiries at that period were chiefly directed to the hills in the neighbourhood of Laur, from the number of drifted pieces of Coal found in the stream.

94. *Patli River.*—Rolled pieces of Coal derived, Mr. Jones supposed, from several sources, are plentifully found in this river. Some of the tributaries entering into it from the mountains bring down abundant fragments, which from their appearance led Mr. Jones to conclude that some came from more distant, and others from sources near to the plains.

95. *Susung.*—A little beyond Seripore or Cheripore, and near Susung, is a small rivulet in which there is a 9-inch bed of Coal.

96. *Second Range of Mountains at Laur.*—On the top of this, the natives who accompanied Messrs. Jones and Stark in 1816, pointed out a bed of coal of good quality two feet thick.

ABSTRACT of COAL on the Hills at *Laour.*

District.	Field.	Locality.	Bed.
Sylhet - - -	Laour - - -	1 <i>Patli River</i> - - -	Not traced.
		2 <i>Near Susung</i> - - -	9 inches.
		3 <i>On the top of the second range of mountains</i> }	2 feet.

No. III.—*Disung River.*

97. In the *Disung* river and its tributaries, Mr. Jones found fragments of common Coal, but in less quantity than in the rivers at *Laour*, so much so, that 15 persons were seven days in collecting one maund without finding the source from whence any of the fragments were introduced.

98. Nevertheless, the fragments were there, an unquestionable proof of the existence of Coal. It would be erroneous to draw any conclusion from the abundance or scarcity of the fragments as to the probable extent of the beds, since large beds might exist apart from rivers or tributary streams, into which fragments could not find their way. Such is the case at *Cherra Ponji*, where no fragments of coal can find their way by natural causes from the mines into the adjacent rivers, which consequently contain no fragments.

ABSTRACT

NOTES.

EXTRACT of a Letter from *D. Scott, Esq.*, to *G. Swinton, Esq.*, Chief Secretary to Government of India, 14th February 1828.

“ IN continuation of the subject of my letter to your address of date 1st instant, I beg to acquaint you for the information of the Right Honourable the Governor General in Council, that I understand that there are beds of Coal in an accessible situation, some miles above *Doorgapore* on the *Sumaseree River* at the *Garrow* village of *Seejook* and *Rewak*, from which places it seems probable that Coals for the use of the steam vessel might be supplied much cheaper on the lower part of the *Burrampooter* than if sent from *Assam*.”

In the Committee's letter to Lord Auckland under date 18th October 1837, it was stated that Mr. Homfray, and Mr. Cracroft had then persons searching for this Coal, but the inquiry came to nothing. See Reports Committee, 1838, p. 5.

Sylhet Coal
Districts.ABSTRACT of COAL on the *Disung*.

District.	Field.	Locality.	Bed.
Sylhet - - -	Disung River - -	Undescribed - - -	Not traced.

No. IV.—*Between Panatich and Bunsikora.*

This locality is not laid down on any map we have seen, but it is somewhere intermediate between Cherra and Laour.

Two beds of Coal are found in this locality.

99. *Barachara*.—This bed was discovered in 1816, when 250 maunds were transmitted to Calcutta for trial and approved of. The quality was found to improve still further, the deeper the bed was penetrated, which induced Mr. Stark, the gentleman to whom the discovery was due, to expect that the quality would eventually equal that of English Coal. The size of this bed is not expressly stated, but it was understood to be about six feet in thickness, and so convenient to water carriage that boats might be loaded at the mine. Mr. Stark experienced some opposition from parties in Sylhet in regard to working this Coal, which together with the success of Mr. Jones in Burdwan, caused it to be abandoned soon after its discovery.

100. Messrs. Inglis & Co., of Chattak, it is said, afterwards expended some four or five thousand rupees on this Coal, which they were obliged to abandon in consequence of its being impregnated with sulphur. This peculiarity does not seem to have been adverted to in the result of the original trials made in Calcutta by the public authorities to whom samples were submitted, nor in the trials made of it by Mr. Jones, a good authority. Admitting it to be the fact, all Coal being more or less subject to this impurity, it is not a sufficient cause for abandoning a bed some parts of which may be quite free from such objection. In the present instance, the objection rests on no definite authority.

101. *Charra Gow*.—This bed, which is seven feet six inches thick, was discovered in 1814 by Mr. Stark, and examined two years after by Mr. Jones, by whom it was abandoned in favour of the Barachara bed, para. 99, which was more convenient to water carriage.

102. The foregoing beds and indications of Coal, 93 to 101, have been neglected since 1816, when inquiries were given up in the Sylhet districts from the difficulties with which they were then beset, the hilly and mountainous tracts containing Coal being in the hands of unconquered tribes, and the demand for Coal being at the time comparatively small; circumstances are now completely altered, and a proper examination of these districts would seem to be imperatively required.

ABSTRACT of COAL between *Panatic* and *Bunsikora*.

District.	Field.	Locality.	Bed.
Sylhet - - - - -	Between Panatic and Bunsikora.	{ Charragow - - - Barachara - - -	7 feet 6 inches. 6 feet.

No. V.—*Cachar and Bihrapore.*

103. A letter from Captain Guthrie, of the Engineers, was entered on the proceedings of the Committee 2d April 1842, from which it appeared that a specimen of Coal had been found in a small watercourse on the side of a hill about 300 feet above the plain of Cachar, and half a mile distant from the Arang river, a branch of the Soorma, navigable for 600-maunds' boats four months in the year, and for dinghies for six months.

104. The

104. The following is the result of analysis of the specimens in question:—

Sylhet Coal
Districts.

Specific gravity	-	-	-	-	-	1.3
Inflammable matter	-	-	-	-	-	64.8
Carbon	-	-	-	-	-	32.2
Ash	-	-	-	-	-	2.0
						100

It is needless to remark on the interest of such a decided indication of the existence of Coal in so favourable a place for water carriage, or upon the urgency and importance of this and other similar indications of Coal in these districts being properly inquired into.

ABSTRACT of COAL in Cachar and Birkampore.

District.	Field.	Locality.	Bed.
Sylhet - - -	Birkampore - - -	A small watercourse on the side of a hill, half a mile distant from the Arang river.	Not traced.

No. VI.—Tipperah Hills.

105. About two miles from the mouth of a small river which descends from the lower Tipperah Hills, petroleum issues from sandstone rocks near the bed of the stream. Mr. Jones sank to the depth of four feet into the rock when he found it become slaty, thus indicating, as he said, the presence of Coal. Others, he observed, can prosecute the search; the place is well known by an adjoining cluster of small sandstone hills, the most remarkable of which is called Arpeen, and has a celebrated Mussulman durga on the top.

ABSTRACT of COAL in the Tipperah Hills.

District.	Field.	Locality.	Bed.
Tipperah Hills -	Arpeen - - -	Near the bed of a small stream, a sandstone rock from which petroleum issues.	Not traced.

No. VII.—Chaila Ponji.

106. This Coal district is situated in the Khasyah Hills, about 12 miles to the west of Cherra Ponji. It is not perhaps distinct from Cherra Ponji, but it belongs to a different native chief.

It is distinguished by three beds of Coal, which have only been made known since the attempts to work the Cherra mines were entered upon, in 1839. They were all brought to notice by the natives employed in the Cherra mines, with a view to shorten the distance to which that Coal has to be carried.

107. *Byrung Bed.*—This bed is about two miles from water carriage. It would appear to extend a distance of two or three miles along the foot of the hills, varying in size from one foot to three, and not affording more on an average than one foot of good Coal. There are, however, discrepancies in our information, regarding the value of this bed, which time and circumstances can alone remove.

Chaila Bed.—This is said to be near the Byrung bed. It varies in thickness from one foot to three, but is said to yield an inferior Coal.

108. *Mustuk Bed.*—This is situated higher on the acclivity of the mountain than either of the two previous beds. It occurs near the village of Mustuk, at

Sylhet Coal
Districts.

an elevation of 1,500 or 2,000 feet. Regarding the size and extent of the bed, there are discrepancies of opinion evincing some doubt; but the quality of the Coal is unexceptionable.

ABSTRACT of COAL at *Chaila*.

District.	Field.	Locality.	Bed.
Khasyah Hills - -	Chaila - - -	{Byrung Ponji - - -	1 to 3 feet.
		{Chaila - - -	1 to 3 feet.
		{Mustuk - - -	4½ feet.

No. VIII.—*Cherra Ponji*.

109. Cherra Ponji is situated on the brow of a table-land composed of horizontal beds of sandstone, raised abruptly to a height of 3,000 or 4,000 feet from the plains of Sylhet. This table-land is capped by small groups of hills rising abruptly from it to an additional height of 200 or 300 feet, affording limestone caverns and bold picturesque scenery.

The precipices of which Coal forms a considerable part, are 30 or 40 feet high, facing the station of Cherra, from which they are not above a mile distant; they consist of coal, limestone, and shale.

110. The annexed Fig. 6 is intended to afford an idea of the general situation of these Coal beds. Above the Coal there are usually a few beds of soft sandstone, loose sharp sand, and clay. These are succeeded by thin beds of shale; the Coal varies in thickness from 2 feet 8 inches to 28 feet. The Coal rests on beds of blackish shale, passing into thin beds of sandstone, followed by a few thin beds of a dull dark coloured gritty limestone; beneath which, a compact dark bluish or blackish grey limestone containing shells occurs.



These rocks, consisting evidently of the lower beds of the Coal formation, repose on horizontal strata of sandstone already alluded to as forming the table-land.

The Coal is exposed in three particular situations at Cherra.

111. First, on the left of the road entering Cantonments, the edge of a bed 28 feet in thickness forms a considerable portion of a precipice (at 1 in the annexed Sketch). This is the nearest bed to the plains, and the one chiefly worked to supply the Coal sent down to the Presidency. It has recently been found by driving galleries into the hill that the Coal becomes thinner, and appears to wedge itself out the further it is pursued underground, so that what appears to be a 28 feet bed at its exposure in the precipice, thins down it is said to seven or eight feet.

112. About a mile from the last mentioned, another bed of Coal presents itself, two feet eight inches in thickness, at No. 2; this is also in a precipice facing Cantonments. This bed has not, we believe, been worked.

113. The third bed (3 in the annexed Sketch) is situated probably about half a mile distant from No. 2, forming an exposure of Coal about 17 feet thick on the opposite declivity.

114. These three exposures of Coal were known at Cherra since 1833. Whether any subsequent discoveries have been made we do not know; nor do we know whether these exposures all belongs to one and the same bed making its appearance in different situations, or to several beds. To determine this point would

would require more geological nicety than has yet been applied to such objects in India.

Sylhet Coal Districts.

115. *Serrareem Bed*.—This Coal, which also belongs to the Cherra Ponji Field, is situated several miles further in the interior of the hills, at about the same elevation. It consists of a large bed of superior Coal, 12 or 15 feet in thickness, but quite inaccessible at present as regards the plains. Its application to purposes of local improvement in the manufacture of iron will be considered in the proper place.

Six or eight native forges burning charcoal are now carried on in the village of Serrareem, which stands on this bed of Coal, and there are probably 200 forges altogether in the vicinity similarly circumstanced, the manufacture of iron being the characteristic employment of the people.

ABSTRACT of COAL at the *Cherra*.

District.	Field.	Locality.	Bed.
Khasyah Hills - - -	Cherra - - - -	1. On the left of the road entering Cantonments, from Mosmye - - -	28 feet.
		2. Facing Cantonments - - -	2 feet 8 inches.
		3. Opposite declivity from the last - - - -	17 feet.
		Serrareem - - - -	12 to 15 feet.

GENERAL ABSTRACT of COAL in the *Sylhet* DISTRICTS.

Province.	District.	Field.	Locality.	Beds.	Average size of each Bed.		
					Feet.	Inches.	
Sylhet	Garrow Hills -	Doorgapore -	Undescribed - - - -	Two beds conjectural			
			Laour - - -	1. Patli River - - - -	Not traced.		
				2. Near Jusung - - - -	9 inches - - -	0	9
	Khasyah Hills	Between Panatick and Bunsikora	3. Top of second range of Hills	2 feet - - - -	2	0	
			Undescribed - - - -	Not traced.			
		Cheila - - -	Charagow - - - -	7 feet 6 inches - -	7	6	
			Barachara - - - -	6 feet ? - - -	6	0	
		Cherra - - -	Byrung Ponji - - - -	Cheila - - - -	1 foot to 3 - - -	1	6
				Cheila - - - -	1 to 3 feet - - -	1	6
				Mustuk - - - -	4½ feet ? - - -	4	6
	Tipperah Hills -	Arpeen - - -	1. On the left of the road entering Cantonment - - -	28 feet - - - -	28	0	
			2. Facing Cantonments - - -	2 feet 8 inches - -	2	8	
			3. Opposite to declivity - - -	17 feet - - - -	17	0	
			Serrareem - - - -	12 to 15 feet - -	13	6	
	Cachar - - -	Bikrampoor -	Near the bed of a small stream, a sandstone rock from which petroleum flows - - -	Not traced.			
A small watercourse on the side of a hill, half a mile distant from the Arang N. - - -			Not traced.				
TOTAL of ascertained Coal, 84 feet 11 inches - -					84	11	

ARRACAN.

Arracan.

THIS Province may be divided into three Coal Districts :

I. The Northern, consisting of indications of Coal between the southern point of Ramree and Akyab.

II. The Central districts, comprising the southern parts of Ramree and adjoining islands.

III. Sandoway, or Southern district.

117. In these districts 11 beds of Coal have been examined, affording an aggregate thickness of 15 feet 8 inches, being an average of one foot five inches for each bed, the largest not exceeding 20 inches. Where these beds are not exposed to the influence of the tides below high-water-mark on the coasts, they are so much inclined, or, in other words, placed in such a vertical position as to render it difficult to work them. In other respects, some of these beds afford superior Coal. But the best Coal yet derived from Arracan has been found in detached masses, imbedded in sand and clay, at Keang Dyeng, on the western coast of Ramree, and on the island of Muggie, as well as a small range of hills at Sandoway, thus unequivocally proving the existence in these vicinities of large beds of coal in this province.

In the northern, as well as southern divisions of the province, the rocks associated with Coal are sandstones and shales.

In the central division, limestone of dark gritty character are described as accompanying these rocks.

I.—Northern District of Arrakan Coast.

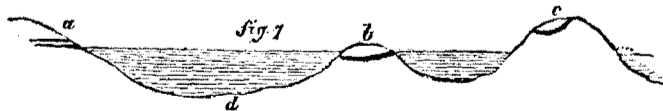
118. *Bolonga Islands*.—These are three islands, each about 20 miles in length, and one mile broad, placed parallel to each other, forming the southern side of the harbour at Akyab. The southern extremities of these islands seem to be composed of sandstone of the Coal formation.

On the western coast of Augne Keong, and about two or three miles from its southern extremity, Coal occurs in three adjoining, but distinct, situations, subject to the tide, the strata dipping S. W. by W. In one place the bed of Coal appeared to be five or six feet thick, in another 18 inches, a third still less.

119. At the southern extremity of the middle island; Coal occurs, also alternating with sandstone, dipping to the east. The indications afforded by the dip in these instances are interesting, as tending to establish the existence of a small submarine Coal basin at this place.

120. *Kyuk Phyu*.—At the harbour of Kyuk Phyu coal is found in three situations; namely, in the harbour itself at *a*. Fig. 7, where it is subject to the influence of the tides, and on two small islands (*b. c.*) in front of the harbour.

The submerged ridge (*d.*) between the islands and the main land is composed of sandstone, and is left dry at low water. The quality of the Coal is good, but the situation and extent of the only bed yet observed is such as to render it scarcely worth working. The annexed figure exhibits the circumstances under which this Coal occurs, as we understand them from very imperfect descriptions.



ABSTRACT

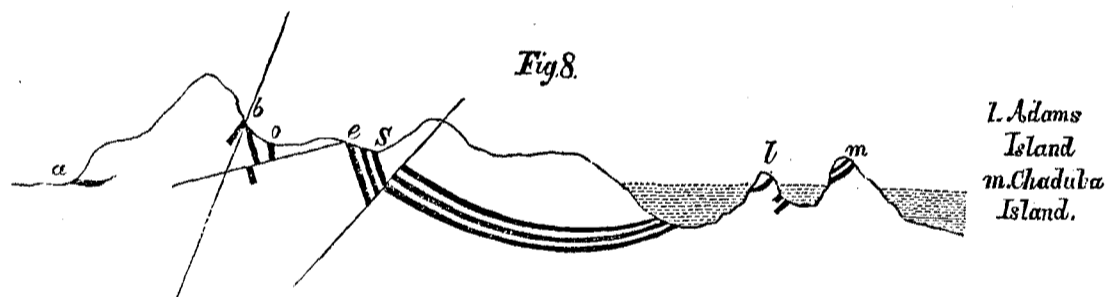
ABSTRACT of COAL at *Arracan* (Northern).

District.	Field.	Locality.	Beds.
Arracan - -	Bolonga Island -	Western coast of Augne Keong - - -	{ 5 feet interrupted bed. 1 foot 6 inches interrupted, very small. 1 foot interrupted.
		Southern front of Penee Keong.	
		Western coast of Penee Keong.	Thin bed.
Ramree - -	Kyouk Phyu -	On two small islands in front of the harbour.	Irregular broken bed.
		On the mainland - -	Irregular broken bed.

II.—*Central Districts of Arracan Coast.*

121. *Hoong*.—Coal occurs at Hoong, about six miles south of the town of Ramree, close to a navigable creek falling into the Sandoway Channel. The beds of Coal that have been observed here are numerous, but the largest does not exceed 20 inches in thickness; and the strata are inclined to a very high angle, so as to render them inconvenient to work.

The following are the particulars of these beds:—Three thin beds, of 3 inches, 20 inches, and 15 inches respectively, dipping 75° to the south, at the south-western extremity of the Valley of Hoong. The third or 15-inch bed is said to be cut off by a *fault* from the two first mentioned, and to appear at a distance of 20 yards from them, causing a local irregularity of dip, as represented at *e* in the following sketch:—



122. On the northern side of the valley, skirting the range of hills in that direction, there are two small beds, at a distance of 2½ to 3½ miles from the first. One of these, 20 inches thick, occurs at *b*, broken by a *fault*, and dipping, it is said, 80° west, in one side of the fault, and 85° E. N. E. in the other; the second bed in this direction, *a*, is only eight inches, three quarters of a mile from which, in an easterly direction along the skirts of the hills, faults are observed with detached fragments of coal imbedded in sand and clay.

123. *Koeng Dyeng*.—On the opposite side of the Adjeekah Hills, at a spot marked *a* (fig. 8), Coal of very superior quality was found and despatched to Calcutta; but on examination of the place, a detached broken mass of Coal, and one bed only a few inches thick, were found lying near the surface, beneath projecting ledges of sandstone. We have no further observation as to the nature and peculiarities of the rocks in this vicinity.

ADJOINING ISLANDS, South of *Ramree*.

124. On the islands immediately adjoining the southern coast of Ramree (*l, m*, fig. 8), Coal has been found, chiefly in detached broken beds, which may probably be connected with the bed at Hoong, as represented in foregoing fig.

Arracan.

ABSTRACT OF COAL in the Central District of Arracan.

District.	Field.	Locality.	Bed.	
Ramree Island	Hoong Valley	South-western extremity	3 inches.	
		South-eastern extremity	20 inches.	
		North-western side	15 inches.	
	Koeng Dyeng	Western coast		8 inches.
				20 inches.
	Chaduba	On low hills at the south side of the island	8 inches.	Masses of Coal detached.
	Adam's Island	Not described		A thin seam.
Paget Island or Muggie Island	Not described		Not traced.	
			Detached masses of coal- imbedded sand.	

III.—Sandoway,

NOTES.

REPORT from Lieut. *Hutchinson*, dated 15 May 1842.

Arracan, from lat. $18^{\circ} 10'$ to $20^{\circ} 10'$ north (beyond which I have not had an opportunity of examining), presents one great continuous field of transition or secondary rocks, varied only by the frequent occurrence of dykes of igneous origin and points of volcanic action, either extinct or in present activity. The strata, consisting of coal-bearing sandstones, shales, and fossiliferous limestones, appear to form the true carboniferous group; but it must remain matter of conjecture of what rock the basin in which these strata were deposited consists. The highest mountains on Ramree Island, as well as those as far to the eastward of the provinces as it has been practicable to examine, consist entirely of the upheaved Coal measures, nor do the many mud volcanoes in present action throw any light upon the subject—the rejected matter consisting wholly of blue mud and the broken-up members of the same formation, with the addition only of some small broken masses of quartz rock.

Sandstones constitute the most prominent members of the formation; they are of all varieties, from very fine-grained to conglomerates; colour, yellow, grey, blue, and red, to all degrees of hardness, generally containing plates of mica, and from it obtaining a thin foliated structure.

Sandstones of a brick-red colour are only largely developed in the neighbourhood of Sandoway, where they appear to be only the equivalents to the yellower rocks of Ramree and farther northward, the clay formations and coal seams in connexion with each being precisely the same. Some of the more thickly stratified have planes of slaty cleavage, by which the rock is divided into thin plates, at an angle, generally, of about 60° with the planes of stratification. In places where the rocks are exposed to the action of the sea, a curious contorted structure, quite independent of stratification, appears, closely resembling the hard-twisted fibres of some woods, after the softer parts have been worn away by long exposure to the weather, and hardly to be accounted for as a simple ripple-mark.

Indurated clays are the next in point of magnitude, and occur interstratified with the sandstones in an endless variety of proportions, the alternating strata sometimes not exceeding an inch or two in thickness, although repeated throughout a thickness of several yards. They also vary much in induration and structure, having, in some cases, a flinty hardness, but for the most part composing a soft blue shale, with sometimes a slaty, and at others a massive conchoidal structure. The sands and clays frequently alternate with little or no admixture of the two, but more generally a sort of gradual transition is observed. Excepting a few small detached veins of calcareous spar running amongst the sandstones and shales, an argillaceous limestone (containing shells) about the neighbourhoods of "Kaendying" and Hoong is the only calcareous formation which can confidently be stated as a member of these Coal measures. There are some detached masses of highly crystalline grey or white limestone found on the southern end of Ramree Island, but it is difficult to say to what age it belongs, and no further connexion with the Coal measures can be traced than the circumstance of its resting upon their edges. In only one spot (a hill on the coast, S. E. of Ramree) have I met with anything resembling ironstone, which is a sort of flinty iron clay; but this appears to be an isolated mass, and not interstratified with the other rocks; indeed, it has more the appearance of having risen through them. The disturbing focus since the deposition of the strata have apparently been very violent, and acting, both when they were still in a soft and flexible state, contorting and, in many instances, doubling them back upon themselves again, after they had obtained a considerable degree of hardness, by which the strata are broken and thrown up at an inclination generally exceeding 40° , and not unfrequently into a vertical position. The general direction of the ridges is from N.N.W. to S.S.E. (coinciding with the great features of the country throughout this part of India). Coal seams have been found on a band following this general line of bearing from the coast below Sandoway, passing through Ramree Island to the Bolonga hills, near to "Akyah."

"Sandoway."—In three localities Coal is found: First, at Keitallee, in N. lat. $18^{\circ} 13'$, a seam of Coal, six inches in thickness, appears on the shore below high-water mark. The super and sub-strata are thin sandstones, shales, and underclay, reared up at an angle of 42° , contorted, broken, and in the utmost confusion. The seam of Coal does not extend above 40 yards in length, and is totally useless for practical purposes. It is very similar in quality to the Morgui lignite. No other

III.—Sandoway, or Southern Districts of Arracan.

Arracan.

125. *Kingtellie*.—About 18 miles south of Sandoway, a thin bed of Coal occurs, not above six inches in thickness. This bed appears on the shore above high-water mark. The adjoining strata, consisting of sandstone and shale, are raised at an angle of 42, contorted and broken; the seam of Coal extends about 40 yards. It is not stated in what direction the strata dip.

126. *Town*

NOTES—continued.

other Coal has been found, nor did I succeed in tracing this seam to any other spot in the neighbourhood.

Second. About a mile from the town of Sandoway, at the foot of a small range of hills, there are some seams of sandstone containing lumps of Coal, some of which weigh several pounds. After examining the hills in the neighbourhood, without discovering any indication of other coal-seams, three pits were opened on a spot where a quantity of Coal had been collected at the surface, or a foot below it, in loose detached lumps. At three feet below the surface a nearly horizontal seam of sand, nine inches thick, with imbedded lumps of Coal, was reached; then three feet of sandstone, and another similar coal-seam; 2 feet more sandstone, and then a tough blue shale, after penetrating through some depth of which the work was discontinued.

Third. Eighteen miles north from Sandoway (at "Coo") on a hill-side, a coal-seam crops out; it is about 18 inches in thickness, and, from its appearance and associated rocks, there is little doubt of its being the same which appears as one of the Hoong seams, which will be described in its proper place. Specimens of Coal were forwarded from the island of Muggea. Some lumps, I hear, weighed upwards of a maund, from which it might be hoped that a strong Coal-bed would be found here; but on examining the spot from which it was obtained, I found the seam of sand, with imbedded lumps of Coal, as at Sandoway. Similar seams appear at the southern point of Ramree Island, and again at the northern extremity, passing through the Cap and Saddle Islands. I also found a seam much resembling it in the Adjeekah hills: a thin seam of Coal crops out amongst some low hills on the south side of Cheduba, which I have no hesitation in identifying as one of the seams appearing at Hoong.

A large quantity of Coal had been sent as a specimen from "Kaendyng." It was obtained on the eastern side of a small detached range of hills, at a spot about 50 feet above the plain at their foot. The face of the sandstone rock had fallen in upon the excavation from which the Coal had been worked, and it was not until a large quantity of rubbish had been removed that a seam, a few inches thick, of broken coal mixed with clay, was uncovered. The seam is covered by a coarse soft sandstone, which slips down in large irregular-shaped fragments, and has much the appearance of having been in some way shaken throughout. It contains frequent crystals of iron pyrites.

The native authority, who superintended the collection of the Coal, declares that it was found accumulated on this spot in the same detached lumps, nearly the whole of which he sent into Ramree. A spring of water and other circumstances show plainly the existence of a fault passing through the spot, and I can only account for the appearance of the Coal by supposing it to be part of a seam broken up and thrown into its present place by a rupture and movement of the containing rocks; no regular seam has been discovered in the neighbourhood.

"The Bolongas:" minute seams of Coal appear upon "Peney Kyoung" and the small island at its southern extremity.

Upon "Augrey Kyoung," a seam, about 18 inches in thickness, is exposed at the southern extremity of the island; in this seam the shapes of the trees are in a great measure retained. The Coal breaks up in slabs across the fibre of the wood, the trees parting from each other so as to show their original shape and girth, the seam dips towards the sea (S.W.) at an angle of 53°, and is below high-water mark. Its enclosing rocks coincide in a great measure with those connected with the Coal at Kingtellie. Were this even a thicker seam, it would be useless for practical purposes, from the peculiarity of its position and dip. No other seams have been found on this island.

"Hoong:" the edges of the upheaved strata here assume a general direction at right angles to the usual N. N. W. line, the hill-ranges running in nearly an east and west direction. The plains of Hoong are bounded on the north by one of these ranges, extending eastward from the foot of the Adjeekah hills, through a distance of six miles to the seashore; on the south are interrupted ranges running nearly parallel to, and at a distance of a mile or mile and a half from, the former for two miles, after which they diverge towards the south-east. The upper end of the valley is closed by ranges running nearly north and south.

Three distinct seams of Coal appear at the western or upper extremity, one of which is a dirty seam three or four inches in thickness. The second is a regular clean coal-seam 20 inches in thickness. These two lie conformably, with 80 feet of coarse sandstone between them. They dip 75° southward, and can be traced some hundred feet through the hill to the westward. It was from the thicker of these seams that a large specimen was sent to Calcutta under the denomination of "Hoong Coal." They are cut off on the east by a fault running N. N. W. and S. S. E., on the opposite side of which, and 40 feet northward on the line of dislocation, a third seam crops up to the day. This seam is 15 inches in thickness, and dips unconformably to the other seams, 60° towards E. S. E. Its enclosing rocks are also different, being thin-bedded sandstones and slate clays; one mile further eastward we find a thin seam of foul coal, and a quarter of a mile further a seam eight inches in thickness; and advancing another half-mile we have more foul coal, from which spot following the northern range we have minute veins and other indications of Coal nearly to the seaside. Returning to the point first started from, and following the hill on the other side of the valley, we have at a distance of 1½ miles underclay, containing minute bits of Coal; one mile further there is a seam of Coal cut by a fault, and dipping in two different directions, the one being 80° west and the other 85° E. N. E.; the seam on one side is 20, and that on the other eight inches in thickness; the rocks resemble those of the third seam at the upper end of the valley. Three quarters of a mile further eastward a collection of underclay, containing detached pieces of

Arracan.

126. *Town of Sandoway*.—In a small range of hills, about a mile from the town of Sandoway, detached pieces of Coal occur imbedded in sandstone. Three feet below the surface a bed of sand occurs, nine inches thick, with numerous fragments of Coal. Three feet of sandstone follows, and beneath this a similar bed of sandstone with fragments of Coal again occurs. This is succeeded with blue shale, which has not been penetrated.

127. *Coo Hill*.—About 18 miles north of Sandoway, on the same coast, a bed of Coal 18 inches thick occurs on the side of a hill; and on a small island opposite this situation, called Muggie, detached masses of Coal occur imbedded in sand, the same as at Sandoway.

No observations have been made as to the dip of adjacent strata, so as to enable us to afford a diagram of the indications of Coal in the Sandoway district.

ABSTRACT of COAL at *Sandoway*.

District.	Field.	Locality.	Bed.
Sandoway -	Kingtellie - - -	On the beach - - -	6 inches.
	Town of Sandoway -	{ Sandstone hills in the } vicinity.	Not traced.
	Coo Hill - - -	18 miles north of Sandoway	18 inches.
	Muggie Island - -	- - - - -	Not traced.

NOTES—*continued*.

Coal, occurred. It proved to be six feet in length, three in breadth by $2\frac{1}{2}$ in depth, being in the upper part of a fault passing through yellow sandstone, the rest of which appeared to be filled up with a blue mixture of sand and clay. The frequent occurrence of thin coal-seams on either side of the valley would point out this spot as the field for any further experiments which might be determined upon. None of the seams at present known are of sufficient thickness to be turned to practical use. The great complexity of the dislocations amongst the hills render it impracticable to ascertain the relative connexion of the seams to each other, or to obtain anything like a probable section through the measures by a mere surface survey; although the great dip of all the rocks would appear to offer great facilities for doing so, the plains being covered with a deep soil with but few deep watercourses. Sections can only be obtained by ascending the hill torrents, and here the examination is subject to constant interruption, and complicated by a repetition of strata so exactly alike, that I am unable to furnish anything like a complete section of the measures. I suppose that the coal-bearing strata which appear about Hoong occupy a total thickness of about 1,000 feet; the rocks composing the hills on either side certainly exceed 3,000 feet in thickness. It is probable that the rocks towards the centre of the valley are more regular, and it is possible that they may contain thick beds of Coal; but it appears probable that if such beds do exist, they are either at an impracticable depth, or that they would have appeared cropping out amongst the hills. A set of borings would ascertain this point, but as means must be provided for putting down the rods to a depth of at least 500 to 600 feet, I should not feel justified, under all circumstances, in recommending an experiment of the sort being made. It has been my chief aim to examine the whole of the coal-seams which a surface survey might bring to light, and be able to report upon them by the close of the fine season. Finding the seams which appear at the surface of no use for mining operations, I have moved over the ground as rapidly as possible, paying but little attention to matters not immediately aiding in forming a right estimate of what practical advantages might arise from pitting or boring experiments, nor do I here remark upon the few other subjects of scientific interest which have fallen under observation.

The southern end of Ramree Island in particular has been minutely examined, with a view to ascertaining the whole thickness and contents of the strata, and the relative position of the already known Coal-beds. The chart will show the confused state of the strata, and (remembering that the hills are covered with an all but impenetrable jungle) the difficulties under which such an inquiry must be made. The dip of the strata being about 50° from the coast, through the Adjeeka hills, for a distance of three miles, gives a thickness of 3,500 yards of alternating sandstones and shales, in which no useful coal-seams are found; other sections are shown upon the charts; the high dip of all of which, with the general disturbance of the strata, renders it more than probable that did any useful seams of Coal exist, they would have been found, as in addition to my own survey the native population have been searching the country in all directions. The occurrence of some of the same coal-seams, both on Ramree and in the direction of Sandoway, with the general dip of the strata inwards, gives the idea of a trough, the strata of which pass under the sea to rise on the other side; and in this case we have still less reason to expect the existence of hidden coal-seams, as the edges would have been all under examination, excepting only such as lie below the sea. There are one or two localities, on small islands, &c., where small quantities of Coal have been found, which I have not actually visited; but they all lie within the general N. N. W. belt, and I have doubtless seen the same seams at other places.

TENASSERIM PROVINCES.

Tenasserim
Provinces.

128. Four Coal fields are indicated in these provinces :—

- I. On the Great Tenasserim River, 67 miles above Tenasserim Town.
- II. Above the Falls of the Great Tenasserim.
- III. On the Thian Khan or great branch of the Little Tenasserim River.
- IV. On the Lenhea River.

The first of these are mere indications ; the second consist of a six-foot bed of crop Coal, which has already been worked to some extent, but abandoned as of inferior quality.

The third or Thian Khan Coal field is decidedly the most important, both from extent and situation, as well as the superior quality of the Coal. It was at first supposed to be situated beyond the boundary range of hills, but such is not the case ; so that there is really nothing to prevent this from becoming the most important Coal in India, particularly for the supply of Ceylon and the Straits.

Of the fourth Tenasserim Coal field, we as yet know nothing more than its existence on the banks of the Lenhea River.

I.—Great

NOTES.

REPORT on the Coal of the Great Tenasserim, by Captain *Tremenheere*, Executive Engineer, dated 10 June 1841.

This Coal field is situated on the Great Tenasserim River, about 67 miles from the port of Mergui. The delta of the river occupies 20 miles of coast, within which space there are many outlets, but the navigable channel discharges itself three miles south of the town. Its course in ascending has a south-eastern direction for 38 miles, when it turns suddenly to the northward ; it is here joined by the Little Tenasserim River from the south ; and the ancient capital of the province, the town of Tenasserim, is situated at the point of junction. The Coal is 17 miles due north of Tenasserim, but the sinuosities of the river increase the distance to 29 miles. Locality.

2. The banks of the river are, in a few places, 100 and 120 yards apart ; but 200 yards may be called the average breadth above Tenasserim : below this, it is in no part less than 300. The River.

It discharges a large body of water during the south-west monsoon ; the greatest difference of level at different seasons observed at the Coal site is 35 feet ; and though there is a rise of tide at Mergui of 18 feet, ships at anchor there during the freshes are said not to swing to the flood. At Tenasserim the daily rise and fall is 6 feet, which, 16 miles higher up, is reduced to $1\frac{1}{2}$ feet ; and though the highest springs are felt within eight miles of the Coal, the tide cannot be said to assist navigation for more than 54 miles.

3. I passed up the river, for the purpose of inspecting the coal-mine, between the 12th and 16th of April, when the channel is confined to nearly its narrowest limits. For the first 49 miles, it is little affected in point of utility by the changes of season ; it affords for that distance a broad and deep channel, entirely free from rocks or other impediments, and is at all times fit for inland navigation of any description. Above this, the course becomes more tortuous, and the rise of its bed increases by a succession of platforms, the edges of which present, at this season, sloping ridges of gravel across the stream which cannot be avoided. Obstructions in the river.

They are 14 in number, but the difference of level at each step is not great, and the current not accelerated thereby at any one point to more than $4\frac{1}{2}$ miles per hour. The depth of water above and below was usually three feet, but on these gravel banks it varied from 1 foot 10 inches to 1 foot 6 inches and 13 inches. They are from 40 to 80 yards in extent, and form with the sand-banks some sudden turns in the stream. Its width for the last 18 miles was very variable, but there is, one point excepted, abundance of waterway, and no other obstructions than the banks just described. At the point alluded to, the stream was restricted to 70 feet, with a current of $3\frac{1}{2}$ knots, the current at other parts being about two knots.

4. The time occupied in proceeding from Mergui, in a boat drawing two feet of water, was four days. Delays occurred at each of the shoals, but not of long duration ; the gravel was easily moved with the aid of the current, and the boat dragged over it. Time of passage from Mergui.

5. It has been mentioned that the general course of the river above Tenasserim is from north to south, which is likewise the case at the locality of the coal. It here passes through a valley four miles long in this direction, and two miles across in its broadest part from east to west. On the east, it is bounded by a high range of hills, to which the river is nearly parallel, and on the west by a minor range, which touches the river at its northern and southern extremities, and turns away from it one mile in the centre. There is a gorge at the central part of this minor range, giving rise Physical features of the Coal basin.

Tena-serim
Provinces.I.—*Great Tenasserim River.*

129. Coal occurs on the banks of the Great Tenasserim River, at a distance of 67 miles from Mergui. The river, at the place where the Coal occurs, enters a valley about eight miles in length and two in breadth. The valley is formed by mountain ridges, the highest of which, on the west side of the river, seems to be about 800 feet; but on the east bank they attain twice that altitude, at a distance of three or four miles from the river. The valley consists of Coal formation, such as thin beds of shale, containing impressions of plants, alternating with thin beds of coarse sandstone and Coal, partially subdivided by low hills, composed of clay, slate, and porphyry, along the flanks of which an outcrop of Coal is observed.

130. The

NOTES—*continued.*

rise to a stream which has been hitherto known as the Coal Nullah, as the Coal was first pointed out by the late Dr. Helfer in the bank of that stream, at the point marked I in the plan, from which spot the Coal exported recently from Mergui has been obtained.

The bed of Coal.

6. The bed of Coal, which has been worked under the superintendence of Second Lieutenant Hutchinson, is six feet in thickness, and crops out to the day in the left bank of the stream, its upper surface being on a level with the water in the dry season, and covered by a few feet of shale with the soil above. It dips to the east, or towards the river, at an angle varying from 24 to 29 degrees. There are several smaller seams below this, alternating with clay to the depth of 18 feet, but the upper one of six feet is the only workable bed.

The mine.

7. The mine was opened from the outcrop of the Coal, and carried down the angle of dip: the chief working has been to the left, or north of the first excavation, as the dip on that side is less by five degrees. Being situated in the bed of the stream, and covered only by porous material, it was much impeded by water during the rains; and though the course of the stream was turned, the pumps in use, of five-inch diameter and one-foot lift, were insufficient for unwatering the mine at each fall of rain and rise of the water-level in its immediate vicinity. The pumps were worked by hand labour. In December last, a marine engine of 10-horsepower was received for this purpose, which was put together on the spot, and enabled the work to proceed. The pumps were then connected with the engine, making 40 revolutions per minute, a speed which, owing to the smallness of the diameter and lift, it was necessary to maintain, but which is totally unadapted to mining operations. No pipes were received with the pumps, but hollow bamboos were substituted; and the means supplied were, in my opinion, quite inadequate for working a mine of any extent, or to the expectation, except under the most favourable circumstances, of a profitable return for money expended. The angle of dip at which the work has been carried on is one of great practical inconvenience, and I have much doubt whether, even with complete machinery, Coal could have been obtained from this mine, excepting for a very short period, so as to be shipped at Mergui, at a rate at all approaching to the average price of Coal in India. Much, however, has been done by the exertions of Lieutenant Hutchinson; about 1,000 tons of Coal have been got out during the 20 months since ground was broken, and the skill and ingenuity shown in the management of the very imperfect means placed at his disposal are highly creditable to that officer.

8. The operations should not, in my opinion, be considered as those of a coal-mine, but as an experimental working; and when the large sums of money expended at the commencement of undertakings of this nature in other countries, before Coal is reached, are also considered, I shall, I trust, be able to make it appear that the prospects from this Coal field are not discouraging.

The Coal formation.

9. Nothing satisfactory appears in the nature of this Coal deposit to enable me to refer it to the true Coal measures of the carboniferous system. There is no trace of limestone of any description, or of red sandstone, either old or new, within the distance of several miles, to which observations of the structure of the country have been made. The surface of the hills on either side of the basin, and for a considerable space towards the centre, is covered by an overlying claystone porphyry, which bears no relation to a deposit of Coal. This is thickly penetrated by veins of quartz, and the hills on the west (judging by the large masses of quartz with which the ravine abounds) consist principally of that rock; while the streams on the east, containing tin and fragments of slate, denote the primitive structures of the mountains on that side of the river. The only other rock in the neighbourhood is a ferruginous gritstone dipping immediately below the Coal-beds, but I saw in it no character to allow of its being placed so low as the carboniferous system.

The shales from the roof of the Coal have numerous vegetable impressions, but of small size, and they appear to be allied to existing species. The series of beds above the Coal which are seen in the opposite side of the river, and will be hereafter described, amounting to 500 feet, consist chiefly of soft shales of various colours, sandstone, and shale conglomerate, composed of the debris of other strata similar to their own. They are also intersected in two places by parallel dykes of igneous rock, but none of them seem to have undergone that degree of pressure and solidification which is apparent in coal-measure shales of the older periods, nor have there been yet seen any specimen of organic substances amongst them to authorise their being referred thereto.

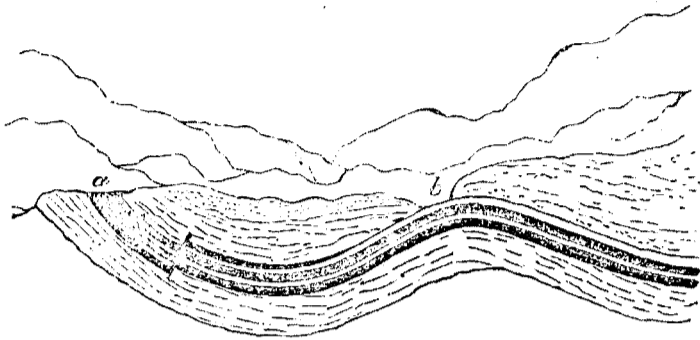
10. In the absence of guides by which these questions are usually decided, and with the anomalous character of the adjoining rocks, the true nature of the Coal must be determined by external characters, by its behaviour in the fire, and by its composition.

The quality of Coal.

11. It is found in a hard and solid bed, consisting of layers of slaty structure, parallel to the bed, and is easily separated in that direction. Between the laminae there are thin plates of arsenical iron pyrites.

It

130. The rocks dip at various angles, from 30° to 9°, towards the east and south. On the east side of the basin no observations on the dip of the strata appear to have been made. The annexed diagram shows the circumstances of this Coal: a six-foot bed is covered by merely a few feet of shale, a bed of clay, and a



recent deposit, coarse grit or sandstone alternating with shale; and three thin seams of Coal occur beneath the six-foot bed to a depth of 18 feet, which is the lowest depth to which the ground has been well explored. Such being the limited extent of our information, no opinion can be formed as to the probable existence of other large beds of workable Coal in this basin. There cannot, however, be a doubt as to its belonging to the true Coal formation, from the nature of the Coal itself,

NOTES—continued.

It is brought to the surface in cuboidal pieces, which do not, however, preserve their size under rough treatment. Its cross-fracture is conchoidal, and it is fibrous, dividing into thin plates in the opposite direction, while its flat surfaces present a ringed appearance, much resembling the ringing of wood, as seen in transverse sections. Its lustre is somewhat glistening when freshly broken on the mine, and colour dull black; but after exposure to the atmosphere it loses this appearance, and assumes a brownish black colour. It does not soil the fingers, but is deficient in that "glow" or metallic lustre which is eminently characteristic of mineral Coal. Its specific gravity is 1.2. In the flame of a spirit-lamp it exhibits some inflammable gas, and gives off a small quantity of brown oily bitumen; it does not swell, and emits but little smoke. It consists chiefly of carbon, and leaves, when well burnt, a very small portion of residue.

100 Grains of this Coal gives,—	Grains.
Of Volatile matter - - - - -	95.80
„ Soluble matter - - - - -	.98
„ Insoluble matter - - - - -	1.56
„ Earthy residue - - - - -	1.66
	100.00

In an open fire it refuses to enflame without the action of the bellows, and will not do so without a strong draught. When burnt in the fire, its appearance very much resembles that of common charcoal, the thin plates before mentioned assuming that divergent shape observable in charred wood. The conclusion to which, from the foregoing considerations, I have arrived is, that it belongs to that description of Coal termed Wood Coal or lignite.

12. Its serviceable qualities are not best determined in the laboratory. It burns well in the fires of the marine engine at the mine, and no difficulty is found there in keeping up the steam. The fire-bars were placed at small intervals to suit the Coal, which is liable to break up into small pieces. No rate of expenditure had been determined, as the engine was worked much under its full power: 20 tons were shipped at Madras in the "India" Steamer, and the report by the commander, Captain Henderson, and of the chief engineer on board, which was published, is satisfactory. It is stated to require great care and labour "to manage the fires well, but not more than is required with the Burdwan Coal; that it has a strong heat, and could keep good steam with careful firing." Its consumption, when compared to English bituminous Coal, was estimated as 4 to 3, during a short trial, and from 10 to 12 maunds per hour. I have heard, however, other statements, which are not so favourable. I find that a ton weight of the loose coal occupies 165 cubic feet. There are at present about 100 tons at Mergui, and I would suggest that a careful trial be made of this quantity, to ascertain its real effect in the duty of steam-engines.

13. I proceeded to trace the connexion of the bed with the adjoining rocks, and to ascertain, if possible, the position of the Coal-beds of this locality. The ground had been penetrated in four other places besides the mine (marked 2, 3, 4, 5 in the plan), all in its immediate neighbourhood. No. 2 shaft passed through the six-foot bed at the same level as in the mine, and it was found to dip at the same angle; below this, smaller seams, not exceeding one foot, alternated with seams of underclay for 18 feet; 20 feet of a quartzose rock and conglomerate were penetrated afterwards, and the shaft then discontinued for want of means to get the water out. The object of this sinking was to find deeper Coal. A detached fragment of Coal containing some bitumen was found. No. 3 shaft was driven through 40 feet of shale, with vegetable impressions covered only by the soil, and abandoned. No. 4 shaft was sunk with reference to future work: after going through the clays and sands at the surface, and 61 feet of conglomerate, dipping in like manner with the Coal, it stopped

The strata penetrated.

Tenasserim
Provinces

itself, as well as of the beds with which it is associated. It would seem, however, from all we can learn, as well as from samples of the Coal, to belong to the upper portion of the Coal formation; and it may be a question, as suggested by Captain Tremeneere, whether in a space so circumscribed, and cut off by primitive mountains, the lower and better beds of Coal are to be expected in this valley.

131. The

NOTES—continued.

at 95 feet, till means should be available for carrying it deeper, it being the intention to move the engine here at the commencement of the monsoon, when the old work would be no longer tenable; and if the dip of the Coal continued the same, it was expected to be reached at 300 feet. Boring No. 5 was carried 40 feet lower than this shaft, but without showing any indications which could be relied upon.

The site of the work-
ing.

14. It will be seen on the plan that the site of these shafts is on the immediate vicinity of the central part of the minor range of hills on the west bank of the river before noticed; their steep slopes extend within 250 yards of Nos. 1, 2, and 3, which are either upon or close to the upturned edge of the bed of Coal. As this, as well as all the accompanying strata penetrated, rested at the inconvenient angle of not less than 24 degrees, my first objects were to ascertain the extent of the Coal field, and whether the same or other beds might not be found in a position more convenient for practical purposes.

The Coal beds on the
east side of the river.

15. The configuration of the ground, an elongated trough or basin between two ranges of hills, gave me reason to believe that these were the natural limits of the Coal beds which had been exposed to view; and having, on my passage up the river, observed shale and sandstone with vegetable impressions in the left or east bank, about a mile below the coal-wharf at V, I examined, at an early period of my visit, the rocks on that side. I found here the whole series of Coal beds, consisting of sandstone shales and Coal interstratified, and lying with great regularity and low angle of dip between *o* and *c* for three quarters of a mile on the line A B in the plan. They are inclined down the stream, or towards the S.E. on the direction of the bank, and rest upon each other for the space mentioned, at an angle of from 9 to 7 degrees. Tracing the beds from point V, in the plan, two faults are found at *s* and *o*, between which points the strata are thrown down in the same direction, and to the east at an angle of 30°, but on the north side of the fault, *o*; they are undisturbed, and dip at an angle of 7°. At *a* a small seam of Coal appears; at *e* the shale is of blue colour, with numerous vegetable impressions and Coal, and at *d* there is a seam of Coal cropping out at the level of the river. The intermediate shales are variegated, brown, white, striped blue, and black.

Thickness of these beds.

16. Section No. 1 represents these beds as they appear at different points above the level of the river along the line of bank A B. The measurements taken on the line and the uniform angle of dip gives a total thickness of 500 feet.

17. At the point *c* there is a change in the rocks, and hardened red clay with rounded fragments of shale passes into the shales, but without any alteration on the angle of dip; and at 200 yards up the stream they cease altogether, the bank being then composed entirely of clay.

18. In proceeding higher up the river with a view to trace these beds and ascertain their true angle of dip, and after passing the hill at E, the northern extremity of the lesser range, there is a reach of the river bearing east and west, or nearly at right angles to its general course; and at the western part of this reach I again found the same series of Coal beds well exposed on the bank for half a mile along the line C D, as shown in section No. 2. They have evidently been the cause of this short and sudden bend of the river. The rocks first appear in this reach near the point D, where for a short distance, as at *b*, *c*, on the other face, they are hardened by contact with a dyke of igneous rock, which shows itself at *c'* in the line C D. At *p*, soft shales with seams of underclay and Coal are found; at *d'* a seam of Coal crops out at the level of the river, which being at the same level belongs without doubt to the same beds which are indicated on the other side of this tongue of land at *d*. The beds upwards from *d'* consist of striped blue and soft grey shales, the whole resting uniformly upon each other and dipping at one angle of 12° up the stream, or to the eastward till we arrived at the point *o'*, where there is another igneous dyke, and the strata are thrown down thereby to the eastward, at an angle of 30°. These were followed as far as the point S' in the Yaibou River, to which they continue at the same high angle, but beyond this and for some distance higher up the Yaibou all trace of them is lost.

19. The correspondence of the bed *c' c*, *d' d*, of the dykes *c' c*, *o' o* and faults S' S and the phenomena accompanying them leads at once to the inference that the edges of rock, as seen along the lines C, D, A, B, present two views of the same beds, that their angle of greatest dip is 12°, and that they are continuous from one side of this tongue of land to the other. In examining the country inland, the dyke *o* was distinctly marked at various points between *o* and *o'* and its direction is shown on the plan.

Igneous rock was also found at intervals between *c* and *c'*, *d* noting that though these igneous dykes passed through the Coal field, and disturbed the continuity of the beds, they remained between the two dykes and across the tract between *o' c'* *c o* unbroken, and resting on one another with great regularity, at an angle with the horizon varying from 7, 9 to 13 degrees. The space covered thereby is 1½ miles in length by 400 yards in average breadth.

The workable bed of
Coal.

20. The bed of Coal at *d' d* I believe to be of the same thickness and quality as that which has been worked at the mine. There is in the bed of the stream, near the opening of the mine at I, the fractured edge of a ferruginous rock distinctly marked, which dips immediately below the Coal at the same angle with it, and has been forced up at the same period. The bearing of this edge is 2½ degrees east of north, which is denoted by a black dotted line in the plan. The position of the outcrop of Coal *d'*, which was arrived at by observations independent of the line of bearing alluded

to

131. The six-foot bed though a surface Coal, was worked to some extent, but the result was not altogether satisfactory. The means employed are supposed to have been inadequate to afford a fair trial. But as the objection lay to the quality of the Coal, it may be doubted whether any means that could be brought to bear could improve it, otherwise than by the discovery of a better bed.

ABSTRACT of COAL on the Tenasserim River below the Falls.

District.	Field.	Locality.	Beds.
Great Tenasserim -	60 miles above Tenasserim Town.	In a small valley, quarter of a mile from the west bank.	6 feet.

The

NOTES—continued.

to, is as nearly as possible upon this line, and the Coal shown at these two points formed, I conceive, at one period a continuous bed. A quantity of hard specimens were collected at the points *d d''* as soon as the Coal was pointed out, but being on a level with and below the water, with a high precipitous bank above, the depth of the bed could not be ascertained immediately.

Instructions have been left with Lieutenant Hutchinson to penetrate the Coal near the two points *d'' d*, and report on the thickness of the working bed without delay.

Section No 3, which is taken in a direction from west to east, from the gorge of the lesser range at G. to the east bank of the river at *m*, shows the relative positions of the Coal which has been worked and the bed *d d''* at the point *m*, where the section strikes the opposite bank. It includes the shafts and other excavations, the depths of which are shown at their proper level. The space between these and the river is covered by sands, clays, and other superficial deposits without any indication of Coal.

The beds are broken off abruptly along the line A. B., and the depth at which they might be found on the west side of the river, in the absence of any other indication than the disturbed strata at 1, 2, 3, 4, would be subject to much uncertainty. The space to the northward of this between the line G. W. H. and the outcrop of Coal at *d* and the points *d L* would be subject to the same chances; but supposing the bed to be continuous with regularity across the river to the south, it would not be reached at any intermediate point between L and M along this line at a less depth than 330 feet below the lowest level of the river.

21. For these reasons I am compelled to recommend that the work hitherto prosecuted on the west bank shall be entirely abandoned, and if it be desirable to raise Coal from this Coal field, that the operations may be transferred to the other side of the river, within the limits of the space marked by a dark shade on the plan, and bounded by the igneous dykes before mentioned. The Coal measures within this space lie in a manner unusually favourable for mining, as, independent of their moderate angle of dip, they are protected from all but surface waters by the high inclination of the strata on the outer side of the igneous dyke *o'' o*, which dips away from them to the east at an angle of 30°, and the Coal may be reached within the limits of the space *o d* and *d'' o''*, in the plan at such depth as may be selected with reference to the extent of work intended. (*Vide* section, Nos. 1 and 2.) The total depth of these beds ascertained is 500 feet. There is every reasonable probability of their continuing the 6 feet seam of Coal (one most convenient size for working) as indicated at *d* and *d''*, and within this mass of Coal bearing strata there may be other beds of workable Coal. Experiments below the lowest beds here seen would not, I think, be attended with success.

Recommend^s the mine, &c. to be abandoned, and work to be continued on the opposite side of the river.

22. The superficial area covered by the portion of the bed of Coal on this side of the river considered workable, I estimate at 280 acres. Its dip varies from 12° to the N. E. by N. at the northern extremity *c D*, to 9° and 7° to the S. E. by S. at its southern edge A. B. It crops out at the surface at the two points *d d''*, and to the eastward of a line joining these points for the distance of 440 yards—it may be reached at any depth not exceeding 50 fathoms from the river level. Experimental shafts are in progress near the points *d'' d*; but pits for work should be placed first along the line *e'' g''* parallel to *d d''*, and distant 160 yards where the Coal will be found at 100 feet below the same level, provided the field is not otherwise broken up by faults and dykes than by the two longitudinal igneous dykes represented in the plan. No indication of such further disturbance has been yet observed; but to provide for the contingency I should recommend that the line for pit work should be kept as above suggested within a moderate distance to the eastward of the line of outcrop of Coal. The ground near this line is low and favourable for work, and Coal may be raised at either end of the bed at 500 yards from the river and lowered from the bank over deep water.

The extent of workable Coal.

23. It would lead, however, only to disappointment, if work be commenced on this side of the river without some important additions to the machinery at present available. The engine itself is of old construction and requires frequent repair, but for power it is effective when in order. Its speed, 40 revolutions per minute, is not adapted for mining purposes, which must be reduced to 15 per minute by additional wheel work to make it available as a pumping engine. The rest of the machinery on the spot consists of 1 forcing pump, 5 in. diameter and 10-inch lift without air vessel, 3 suction pipes, 5 in. diameter and 1 foot lift without pipes; 72 feet of 3-inch pipe, and 2 iron winches worked by hand. These, excepting the winches, are too small for use, and pumps, of proper dimensions are indispensably necessary, and should be supplied before it is attempted to raise Coal. A memorandum of the machinery and stores required for immediate use, together with drawings of gear, &c. by Lieutenant Hutchinson, is submitted herewith, enclosure No. 1. It involves the smallest outlay, which will enable the work to proceed with advantage.

Additional machinery required.

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Provinces.

The fault for which this coal was condemned, and the mine abandoned, was, that it contained pyrites, and was on that account subject to spontaneous combustion;

NOTES—continued.

Present and future
expenses.

24. The following is an account of the expenses of the present establishment, and of that which would be required after the requisite additions to the machinery have been made:—

For One Month.

Present Establishment.	Amount.	Number required when Machinery is complete.	Amount.
	<i>Rs. a. p.</i>		<i>Rs. a. p.</i>
Superintendent - - -	200 - -	- - - - -	200 - -
Sub-Assistant Surgeon - -	185 - -	- - - - -	185 - -
1 Overseer - - -	50 - -	- - - - -	50 - -
4 Miners at 30 rupees each	120 - -	- - - - -	120 - -
3 Smiths " " - - -	90 - -	4 Smiths at 30 rupees -	120 - -
1 ditto at 40 rupees - -	40 - -	- - - - -	40 - -
1 Carpenter at 45 - - -	45 - -	- - - - -	45 - -
3 ditto at 35 - - -	105 - -	- - - - -	105 - -
4 ditto at 30 - - -	120 - -	} Not required after the machinery is erected.	
1 ditto at 20 - - -	20 - -		
1 Head Cooley at 13 - -	13 - -		
6 Coolies, about the mine and workshop, at 12.	72 - -	- - - - -	72 - -
4 Coolies cutting trees for mine at 10.	40 - -	- - - - -	40 - -
1 " felling timber at 10.	10 - -	- - - - -	10 - -
10 " building and repairing at 10.	100 - -	- - - - -	100 - -
16 " carrying rice and other stores from the river side.	160 - -	Not required after a tram-road is placed.	
TOTAL - - - Rs.	1,370 - -	TOTAL - - - Rs.	1,100 - -
Convict Labour.		Convict Labour.	
21 Convicts about the gaol, hospital, and in charge of tools.	- -	21.	
1 Carpenter - - -	- -	1.	
8 Sawyers - - -	- -	8.	
32 Colliers - - -	- -	30.	
53 Passing away and heaving coal.	- -	15.	
10 Lower pumps - - -	- -	Not required.	
21 Road making - - -	- -	20.	
2 Oil Mill - - -	- -	2.	
7 paddy cleaning - - -	- -	7.	
9 Cooks - - -	- -	6.	
31 Sick and convalescent, at 16 per cent.	- -	11 at 10 per cent. for lighter work.	
195 Convicts at 5 rupees -	975 - -	121 Convicts at 5 rupees each	605 - -
Boat hire, and other small expenses.	150 - -	- - - - -	150 - -
		Supervisor of Bamboo Forests	20 - -
		1 Engineer - - -	50 - -
		4 Coolies on account of machinery at 12 rupees.	48 - -
Present Monthly Expenses - } TOTAL - Rs.	2,495 - -	TOTAL - - - Rs.	1,973 - -

An addition to the salary of the European Overseer who has the responsible charge of tools, materials, &c., of 30 rupees per month is recommended, and I venture to suggest that if the work proceed on the scale proposed, the allowances of the Superintendent be placed on the same footing as those of Engineer officers holding charges of equal importance and responsibility. I consider 2d Lieutenant Hutchinson

tion; but, as already remarked, all coal contains more or less of this impurity, which affects only particular parts of the bed, and by proper attention may be easily avoided. But independent of this, the coal itself is only of second or third rate quality.

Tenasserim
Provinces.

II.—Above the Falls.

132. Above the falls of the Great Tenasserim, near a small tributary called Nan their Keung, a mile and quarter from the main river, three small beds of Coal have been observed in sandstone; and about one day's journey lower down the river, thin seams of Coal are exposed in sandstone in the banks.

ABSTRACT of COAL on the Tenasserim River above the Falls.

District.	Field.	Locality.	Beds.
Great Tenasserim	Above the Falls	A small tributary called Nan their Keung, a mile and quarter from the main river - One day's journey low- er down the river -	3 small beds in sand- stone. Thin seams in sandstone.

III.—Thian Khan Coal Field.

133. Eighty miles from Mergui, two-thirds of the distance being open to easy navigation, and the remainder capable of being rendered navigable, inexhaustible beds of Coal of an uniformly good quality occur on the Thian Khan, one of the main branches of the Little Tenasserim. Under the impression that this Coal field was placed beyond the boundary range of our territory, and thereby cut off from access with the coast, the Committee overlooked its importance in former reports. But these geographical errors have been perfectly removed by Captain McLeod,

NOTES—continued.

Hutchinson qualified in every respect to conduct any operations at the Coal field that may be determined upon.

25. It is proposed to raise the Coal from two shafts by means of cattle wheels, which can be constructed on the spot from a model which has been left with Lieutenant Hutchinson. There is abundance of good timber at hand (the Peemah) for this purpose.

26. Placing the utmost limit of expenditure, with the means above detailed, provide for all contingencies at 2,200 rupees per month, the cost of Coal at the pit's mouth, when the machinery is fixed and the mine fairly open, may be thus estimated. If only 10 tons be raised daily from each shaft, 20 tons per day for 25 days = 500 tons per month at a cost of 2,200 rupees. The cost of 1 ton will therefore be Rs. 4. 6. 5., or 2 a. 6 p. per maund. The Coal is at present brought down the river on bamboo rafts. The present cost of transport to Mergui by contract amounts to 2 a. 9 p. per maund, being carried on men's shoulders a distance of 1,300 yards to the river; but if conveyed on a tram-road and lodged upon the raft, for which the new arrangements provide, the cost of carriage to Mergui would be reduced to 1 a. 7 p. per maund, making the total cost of Coal brought alongside shipping at that place 4 a. 1 p. per maund.

Price at which coal may be shipped at Mergui.

27. While upon the raft the Coal is almost wholly immersed in water. Landing it at Mergui should be avoided as much as possible, and it should in all practicable cases be shipped from the rafts.

To be shipped, if possible, from the raft.

28. During four months of the year, from 15th June to 15th October, a steam tug, with tenders lashed alongside, might be usefully employed in conveying Coal to Mergui, and would perform nine trips in the month, but owing to the sudden turns and set of the stream in various places before noticed, together with the shallowness of the water and the rapidity of the current at those parts during the rest of the year, I am unable to suggest any better or more economical method of conveying Coal down the river during that period than by the bamboo rafts hitherto used.

29. There is no apprehension of a deficiency of bamboos for their construction for an unlimited period; but to secure an unfailing supply within a moderate distance of the Coal field, and to prevent waste and destruction by the contractors supplying the rafts, the services of a native supervisor are necessary. The wages of such a person are provided for in the estimate of future expenses.

Supervisor of bamboo forests.

30. On the 2d of May I quitted the Coal field. The river had then risen 1 cubit, but it fell afterwards to its former level. The water this year was considered unusually low. Some loaded rafts which had been dispatched on the first rise were, after proceeding a few miles, detained at one of the shallows, and had not arrived at Mergui on the 20th, the day on which I embarked.

Tenasserim
Provinces.

McLeod, an officer of long experience and distinguished service on this part of the coast, who in an able article in the Journal of the "Asiatic Society," proves this Coal district to be within the British territory, and so far from intercepted by any range of hills whatever, that an open navigation extends to within 20 miles of the Coal at all seasons, and that rafts ascend to the Coal itself during the rains.

134. The first bed appears five days' journey above Tenasserim town, exposed on the bank of the Thian Khan river, to an extent of 240 feet, 6 feet in thickness, and dipping at an angle of 20°.

135. Two or three miles above this, a similar bed of Coal, or what is equally probable, several beds of similar size and quality, are observed in 14 different localities, partially exposed on both sides of the river, dipping at an angle of 25°. These beds seem to occur with grey and black slate clay, the latter is supposed to rest on blue limestone.

136. The

NOTES—continued.

EXTRACT of a REPORT on COAL discovered in the Tenasserim Provinces, by Dr. Helfer,
23 May 1838.

Five localities of Coal have hitherto been found in the Tenasserim Provinces, all situated in the province of Mergui.

1st. On the Great Tenasserim, nine days' journey from Tenasserim town, near the creek called Nan their Keungny, one and a quarter mile inland. Species, friable brown Coal intermixed with iron pyrite. Three veins occur in different localities. 2d. Eight days' journey from Tenasserim town, along the banks of the river. Species of lignite and light slaty brown Coal occur in veins, three or four inches thick, &c., vide "Journal of the Asiatic Society," 1833, p. 701.

FROM the REPORT of Dr. Helfer, in the "Journal of the Asiatic Society," Vol. VII. 1838.

On the Coal river, a branch of the Little Tenasserim, five days' journey by water, in a south-east direction, slaty Coal, sp. gr. 1.26 occurs. The bed, six feet thick, 240 feet long, dips at an angle of 20 degrees in the bank of the river. One hour distant an immense Coal field of either slaty or conchoidal pitch Coal occurs, highly bituminous, without pyrites. A succession of 14 localities where the Coal lies bare on clay on both sides of the river occur, running at an angle of 25 degrees, and the river breaking its way through the Coal; in all places six feet or more thick, resting on a stratum of slate.

This extensive Coal field is situated on a high level table land, only diversified by an isolated range of mountains, from which the river passes through the Coal fields. The river is above 15 yards broad, nearly dry part of the year, but uniformly navigable for rafts for five months of the year up to the Coal field.

The Coal itself is of superior quality, being that peculiar species known in England as pitch Coal, which is much higher in price than the common Coal, and on account of the greater quantity of bitumen which it contains, is used for the generation of gas.

A great advantage of the locality is the total absence of land carriage, as the pits are in fact opened by the river. The difficulty of navigation is confined to the last 20 miles, the passage being there obstructed by sunken trees and drift wood.

The last 30 miles being navigable only during five months of the year, it would be necessary to have a depot of Coal near this situation, ready to be shipped when the water begins to rise.

A depot should also be formed at Mergui, where vessels could easily approach the shore.

The stratum above the Coal is nowhere more than 25 feet, and consists of bad slaty Coal, grey, and debris of slate with coarse gravel and alluvium.

Digging:

- | | | |
|---|---------------------|-----------|
| a. One person digs in one day 20 maunds, in six days 120, in a year 6,240. Wanted for 10,000 tons, 43 men, say 45. | | |
| One convict at 4 rupees a month | 45 × 4 = 180 × 12 = | Rs. 2,160 |
| b. Working nine hours per day a person transports from the Coal pit (15 feet deep) to the water edge 200 yards distant, in 10 minutes, a cart load. To transport 10,000 tons therefore, 33 men, say 40, are required. | | |
| Being convicts at 4 rupees per month | 40 × 4 = 160 × 12 = | 1,920 |

Transport, on bamboo rafts.

- | | | |
|---|--|-------|
| a. Each bamboo raft, 25 feet long by 6 feet broad (double bottom, 2 feet high) holds one ton of coal, 10,000 rafts therefore necessary. | | Rs. |
| b. Two men fill and construct such raft in one day, it is therefore necessary to employ 20,000 men's labour for one day, at 3 a. 1 p. wages per day | | 6,666 |
| c. To load the rafts the same number of men is required as (a. b.) according to the above calculation | | 1,920 |
| d. The river is navigable for five months of the year, from June and to November exclusive. In this time 66 rafts must be dispatched every day. | | |

e. Going

136. The river is described by the late Dr. Helfer (to whom the discovery is due) as breaking its course through Coal beds of great extent.

These beds are imperfectly described, but they seem to occur with what Dr. Helfer described as grey and black slate clay, the latter being supposed by him to rest on limestone.

137. The various beds appear to be what is called cannel Coal, remarkable for consisting of upwards of 50 per cent. of bitumen, which to use the words of Mr. James Prinsep ("Journal Asiatic Society," 1838, p. 706) "shows it to be a superior blazing material, which is the main point in getting up steam, so much so," he continues, "that I understand one of the company's steamers is unable to get up steam with the Burdwan Coal without a large admixture of English cannel Coal. It also," continued, Mr. Prinsep, "makes an admirable Coal for gas."

Lieutenant Colonel Forbes and the secretary of the Committee were present during Mr. Prinsep's experiments with this Coal, and were equally impressed with Mr. Prinsep himself as to its remarkable superior properties for steam, gas, and coke.

The

Notes—continued.

e. Going slowly, the rafts arrive during the monsoon in three days, at the junction of the Coal river, with the other forming the Little Tenasserim. To this point two men are required to direct each raft, 10,000 rafts each	Rs.	19,998
f. Two men three days' pay from there to the junction of the Great Tenasserim river, going slowly two days' distance. At this place the river is so broad that eight rafts fastened two abreast can be directed by two men.		
1,250 rafts × 2 days at 5 a. 1 p.	Rs.	1,866
g. From the village of Tenasserim to Mergui, two days (with the tide) 16 rafts can be tied together, directed by two men.		
625 rafts × 2 men, at Rs. 5. 1 p.	Rs.	933
Pay of the labourers going back by a straight road cut across the jungle.		
Required 20,000 men's labour (each raft two men) three days	Rs.	20,000

Establishment.

1. One superintendent.	f. Ten miner overseers in coal pits, say 2,000 rupees per month.
2. One cashier and book-keeper.	24,000 rupees.
Two depôt overseers.	1,000 rupees, repair of different buildings, wear of implements and instruments.
d. One overseer for transport down river.	2,000 rupees, unforeseen expenses.
e. One overseer for building rafts.	

Abstract.

	Rs.		Rs.
a. Work in the Coal pits	2,160 ×	g. Transport from Tenasserim to Mergui	933
b. Transport to the water edge	1,920 ×	h. Return pay	20,000
c. Building rafts	5,666 ×	i. Superintendents	24,000
d. Loading rafts	1,920 ×	h. Repairs	1,000
e. First three days transport	19,998 ×	l. Unforeseen expenses	2,000
f. Next two days transport	1,866 ×		
		Rs.	82,463

N.B.—1. The employment of convicts by the Government would effect a saving in some of the above items.

Hence 6,000 might be deducted from 82,463 = 76,463—100 bamboo rafts of 25 feet length, fetch in Mergui the price of Rs. 1. 8. to 2 rupees; but say 1 rupee—30 × — 10,000.

300,000 bamboos.

Sale of bamboos - - - 3,000 rupees.

Deducted from 76,463 = - 73,463 "

73,463 rupees = 175,408 annas, divided by

273,170 maunds.

Price of one maund $4\frac{4}{7}$, or $\frac{1}{4}$ anna in Mergui, counting free labour at 10 rupees per month.

First Outlay.

	Rs.		Rs.
Coal in Loco	800	Instruments: spades, 400	400
Depôt at ditto	400	" pickaxes, 100	100
Depôt at Mergui	2,000	" crowbars, 40	40
Jetty and quay	1,000	" trucks, 400	1,200
Scales and Weights at the Depôt	500	Unforeseen expenses	2,000
Buildings for the superintendents	3,000		
		Rs.	13,440

To this must be added the expense of making a direct road through the jungle. The removal of impediments in the river, chiefly the trees shutting up the passage, which expenses it is impossible to calculate; they cannot, however, be great if convicts are employed.

Tenasserim
Provinces.

138. The following are the results of analysis of four specimens of this Coal by Mr. Prinsep, taken indiscriminately from as many bags. "Journal Asiatic Society," 1838, p. 706:—

All four burn with copious rich flame, coke close grained, and of highly metallic lustre.

	No. 1.	No. 2.	No. 3.	No. 4.
Water - - - - -	9.7	6.2	7.4	7.0
Specific gravity - - - - -	1.273	1.280	1.245	1.251
Volatle matter - - - - -	45.0	48.9	48.3	48.2
Carbon - - - - -	50.3	66.7	45.1	48.7
Earthy matter, slightly ferruginous - -	4.7	4.4	6.6	3.1
	100.0	100.0	100.0	100.0

Dr. Helfer states the river to be navigable to the Coal, but that only by means of rafts during the rains for five months of the year.

Captain McLeod ascended by water to within eight or nine miles of the Coal; when finding the stream too shallow even for a small raft, he continued the journey by land to the Siamese town, Thian Khan, and from thence to the Coal, crossing several small rivers which discharge themselves into the Thian Khan, on the banks of which the Coal is found.

ABSTRACT of COAL on the Thian Khan, a branch of the Little Tenasserim river.

District.	Field.	Locality.	Beds.
Little Tenasserim -	Thian Khan river -	Near the Village of Thian Khan.	Several beds, 6 feet thick and upwards.

Cuttack Coal
District.

CUTTACK COAL DISTRICT.

139. EXTENSIVE beds of Coal are situated on the Bramini river and one of its tributaries, in the Gopalpashad district. The Bramini enters the Bay of Bengal, near the mouth of Hoogley, not far from Point Palmyral. These beds would appear to deserve, both from their position and extent, more attention than they have received, but the Committee have left nothing in their power untried, with a view to improve their information on the subject.

140. *Talchergurh*.—Seams of Coal appear on the banks of a small nullah, called Balajora, half a mile from the Fort of Talcheer, where a bed 18 inches thick has been found within 13 feet of the surface. Beneath this a grey rock occurs, containing, as well as the shale above adverted to, characteristic impressions of plants of the Coal formation. The Coal is said to be of a good quality and glistening lustre, and to alternate with thin beds of shale.

141. From Talcheer, Coal may be transmitted at all seasons in 10-maund boats to Kumalhung, six miles distant. From thence to Hunsuah, on the coast, it may be transmitted for six months of the year in boats of 100 to 300 maunds, where it may be laid down at three annas per maund, allowing two annas per maund for carriage. Hunsuah affords a safe anchorage for large sloops at least during the N. E. monsoon.

Gopalpashad, Sungurra or Hingalee.

142. Fourteen miles from Talcheer, on a tributary of the Bramini river, which bears one or other of the above appellations, Coal is exposed extensively on both banks.

banks, projecting to an average height of 15 feet above the sand of the river for a distance of a mile.

The country between this and Talcheer is level, affording every facility for the construction either of a road or a canal. For the above particulars we are chiefly indebted to Lieutenant Kittoe.

Cuttack Coal District.

ABSTRACT OF COAL in the Cuttack Division.

Province.	District.	Field.	Locality.	Beds.
Orissa	Bramini River	Talchergurh	Balajora Nullah	1 foot 6 inches.
		Hingolee	Saugra Nullah	15 feet, probably several beds of this size.

BURDWAN.

Burdwan.

143. THOUGH one of the nearest Coal fields to Calcutta, and supplying the metropolis of British India with fuel now for a period of 30 years, we have nothing like a regular account of the beds of Coal it contains.

144. *Singharun Nullah*.—In the bed of this nullah, halfway between the point at which it is crossed by the Benares new road and the Serampore Indigo Factory, or about a mile from the junction of the nullah with the Damooda, a seven-foot bed of Coal is found, of good quality. This bed can be traced as far as Aytwia, where it is intersected by a basaltic dyke.

145. *Barracar*

NOTES.

FROM MR. J. Homfray, to the Collector of Burdwan, dated 27th August 1841.

I HAVE the honour to acknowledge the receipt of your favour, covering a copy of a letter from the Coal Committee, requesting information regarding the minerals and ores of this district. I now endeavour to give you a summary of the information which, I believe, is what they require; if it should not be so they can again call upon you and I will try to supply it.

The district of Burdwan, by which is meant that portion which is subject to its judicial and magisterial control, consists of alluvial soil; in the many changes that have taken place in the division of it, and the adjoining districts of Bancorrah or Jungle Mehals and Beerbhoom, it will be necessary for me to include some observations, associated as the minerals are in those three districts, the description of each being so similar, that it ought and really is the same throughout, and the adjoining districts of Chuta Nagpore, or that portion of it which formerly belonged to Ramghur, has a claim to be included therein.

These portions of the above mineral districts have the river Damoodah and Adji intersecting them through the centre, and, with their tributary streams, drain the lands on each side of them; but with the exception of the Barracar river, which is of considerable magnitude, there is not one of them navigable. The Damoodah, which is the largest of these rivers, is, during a period of about 10 weeks, navigable for boats; from the shallowness of the water loaded boats can only descend the stream during such time as the mountain torrents prevail, and which are governed by the quantity of rain in the hills. The same observation applies to the Adji, but which is a much more ungovernable stream, its current more rapid, and therefore the duration of the torrents so short that little time is afforded for boats to descend, whilst at its lower extremity the current is of such strength that it is extremely difficult to stem, and, like its brother the Damoodah, at its higher parts, is rocky and dangerous to navigate. The Barracar, which falls into the Damoodah, is navigable for 12 to 15 miles for boats of 200 maunds burthen; the highest point to which the Damoodah is navigable is to Ghauteale, above which place there are rapids and rocks which completely impede its navigation.

Quitting the plains, the first place where the alluvial soil changes is near to Furredpore jungle, through which the new road to Benares passes, and in its centre the Dawk Bangalow of Kyrasole is placed, and to which there is a gentle ascent of four miles from the alluvial soil, and passing over a red-coloured soil, with a conglomerate sandstone occasionally protruding; a line thence across to the Adji due north may be taken as the eastern boundary of the mineral district, although nothing is found until on the new road we come to the Singharun nullah, which stream falls into the Damoodah, near the Serampore Indigo Factory; between this point and that river nothing is found, but one mile northward we come upon the first outcrop of the Coal field, and which mineral is found in the stream for considerable distance, the vein of coal being about seven feet in thickness, and of good quality; a person continuing along the road to the Barricar river will in several places perceive the outcrop of several small veins of coal, and when within two miles of the Barricar river will find himself on the ironstone measures, which are there exposed to the day for a great distance,

Burdwan.

145. *Barracar River*.—A bed of Coal, eight or nine feet thick, is found on both banks of the Barracar river at Burmury.

146. *Damooda*.—About seven miles above the confluence of the Singharra nullah with the Damooda, and on a little nullah called Mooneah, the collieries formerly worked by Gilmore & Co., Mr. Homfray, as well as those of Carr, Tagore & Co., are situated close together. The latter is called Ranee Gunge.

The bed worked in these three collieries is the same, 90 feet below the surface, and nine feet thick, the superincumbent beds being sandstone and shale.

147. *Salmah*.—On the Damoodah river, five miles above Ranee Gunge, a deep pit is said to have been sunk with the intention of coming upon another bed of Coal seven feet thick, observed in the vicinity.

In

NOTES—continued.

until he arrives at the Jeyn temples at Bojooneah, where the Barracar is crossed; there are three veins of ironstone, but all of them two to three inches thickness, and the mine itself poor in metal. I apprehend it was from these beds the greatest portion of the iron worked by the natives in former days was obtained, but at the present day not one pound of iron is manufactured east of the Barricar river.

These very well defined measures first rise out of the river about a mile south of the Bozooneah, and continue northward, through the country, exposed in very many places, until it reaches fairly over to the Adji, where they are seen so low down as Hidgegureah Hill; these measures are the best guide to all investigations into the course of the minerals in that part of the country. Returned to the Singharum nullah, the vein of Coal there found can be traced at its northern outcrop generally at one to two miles' distance from the new road, as far as Aytwia, until it is intersected by a very large basaltic dyke, when it is lost; its place in the mineral field is then supplied by the before-named ironstone measures, beneath which there is another very fine vein of Coal eight to nine feet thickness. *This vein is found on both banks of the Barracar river for some distance, and over the Adji; it is succeeded by sandstone, and soon afterwards wedges out against the schistose rocks, which form one immense mass of hills to Curruckpore, near Monghyr, returning to the Damoodah; at the junction of the Sihgharum nullah, about two miles upwards, the first sandstone rocks are found on the banks of the river; but proceeding higher up this river to a distance of seven miles to a little nullah, named Nooneah, the collieries of Messrs. Gilmore and Homfray, and Messrs. Carr, Tagore are situated close to and adjoining each other, the latter bearing the name of Ranee Gunge, from its proprietary rights having been invested in the late Ranee of Burdwan, and it is from which circumstance the erroneous name of Burdwan collieries takes its origin, since it is not within many miles of the Burdwan district, the most appropriate name is the Damoodah Coal valley.

* The Barracara or
Bunnoory coal.

The vein of Coal at these collieries is about nine feet thick, and is won at a depth of about 90 feet, the superstrata being sandstone and black shale, such as is usually found to accompany the mineral in other countries—proceeding upwards, there is Coal found on the banks of the river but of worthless quality; and at Salmah, five miles higher up the river, a deep pit is sinking, and has been in operation for some years past, with an intention of sinking down to another thick vein of Coal of seven feet, which has been ascertained to exist in another part of the country. In sinking this pit (at present August 1841), to a depth of above 190 feet, no less than six veins of Coal have been passed through, varying in thickness from 18 inches to 2½ feet, but all of them inferior in quality; it is expected that the main vein will be met with after passing through one more vein of Coal. Only one vein of ironstone has been passed in that pit—the strata are of sandstone, of very hard nature, similar in every respect to that in England which accompanies Coal, and very dissimilar to that at the lower collieries before named. At 12 miles higher up is the China Coory Colliery upon a vein of seven feet thickness; the same vein is found on both banks of the river, and is largely worked by Messrs. Carr & Co. at four different collieries. About five miles above China Coory is the junction of the Barracar river, at which place numerous faults, traceable to the neighbouring mountain hill of Pachite, which is about three miles south of the river, dislocate the strata, often throwing them not only out of their usual course, but uplifting them so that other veins of Coal are brought to the surface, and which are found and worked up the Barracar river, thence across the country to the Adji and into the Beerbhoom district, where for many miles Coal and traces of it are found beneath the hills which run towards Rajmelal. Coal is also found in many small rivers beneath those hills, but everywhere of very inferior quality, and from its proximity to those hills, which are evidently of igneous origin, the field in that country must always be precarious.

At a few miles from the union of the Damoodah with the Barracar river, a fine vein of Coal has been thrown up by one of those great faults above alluded to, and it has lately been commenced to be worked by myself. Its quality is superior to any of the other veins hitherto worked, and its thickness, about eight feet, makes it a noble addition to the Coal resources of this valley; it is difficult to be brought to the navigable part of the river; the colliery is yet in its infancy, and may yet be given over. The limit of this vein of Coal is extremely confined, it being again lost as it approaches towards the schistose hills of Panraid; it is situated within the Chuta Nagpore district. Proceeding up the Damoodah, coal is lost on its northern bank, except where in one place it is thrown up by a fault, and where the whole extent of workable Coal cannot exceed two to three biggahs, or about one acre upon the south bank. The China Coory vein is found and worked by Messrs. Carr & Co., and it is traceable all the way to Ghautcale, which is six miles above the union of the two rivers, and where the navigation ceases. Coal of excellent quality and good thickness is found some way above there on both banks, but its distance from the navigable part of the river precludes its being worked at present. The Coal continues and is found for full 30 miles higher up this river, adjoining to Ranighur, and is a continuation of the same extensive Coal field of the Damoodah;

returning

In August 1841, a depth of 190 feet was said to have been attained. In this work six beds of Coal were penetrated, each varying from 18 inches to 2½ feet in thickness.

148. *China Coory*.—On the Damooda, about five miles below the confluence of the Barracar with the Damooda, and 12 miles higher up the latter river, a bed of Coal is said to have been extensively worked by Carr, Tagore, & Co.

ABSTRACT of COAL in the *Damooda* District.

District.	Field.	Locality.	Bed.
Damooda - -	Singharun Nullah	1 mile from the junction with the Damooda.	7 feet.
	Barracara - - -	Burmury - - - - -	8 or 9 feet.
	Ranee Gunge - -	7 miles above the Singhara Nullah -	9 feet.
	Salma - - - -	5 miles above Ranee Gunge -	7 feet.
	China Coory - -	Within 5 miles of the confluence of the Barracara.	7 feet.

149. The various parties who hitherto worked the principal mines on the Damooda, are now united as the Bengal Coal Company, with the exception of Mr. Erskine and the Doba Company, who have each separate collieries on their own interests.

150. The average annual expenditure of Burdwan Coal for the public use for the first four years after the introduction of steam navigation in 1828, was 83,226 maunds. The expenditure for private use may have been about as much more; making the total expenditure then about 1,66,452 maunds per annum. The average expenditure of this Coal during the past four years may be taken at about 12,00,000 maunds, being an increase from 1830 to 1842 equal to 6,007 per cent. per annum.

151. Taking the present expenditure of Burdwan Coal at 17 lakhs maunds, and its probable annual increase during the next five years at half the foregoing ratio, allowing the other half to be supplied from new sources, the expenditure of Burdwan Coal would at this rate, for the year ending in May 1850 amount to 63,11,961 maunds.

152. The

NOTES—continued.

returning down to where the first traces of sandstone are found, near to Serampore, we find on the south bank of the Damooda, at a distance of about two to three miles, a range of hills of igneous origin, in reality of all compositions, of granite, porphyry, and all the sub-divisions of granite. This range runs parallel with the Damadoo when in a line with the collieries; we find the first basaltic dykes thence, and the whole of them, which are very numerous, can be traced to that source. Beneath these hills, in many places, a white porcelain earth, in character the same as the Kaolin of China, is found, and from which I had some coarse pottery moulded in England, but it was pronounced to be unfit for fine ware; between the river and a place called Mulliary it exists in quantity, and there is also much found in other localities towards Bancoorah. Accompanying the Coal is also found very good fire clay, and from which firebricks are constructed by Messrs. Jessop in Calcutta, which they use occasionally in their iron melting furnaces; it requires much care in the selection. Near the Gautcale is found the plates of talc, but it does not raise in pieces of sufficient size to be of any value above the ordinary description elsewhere found; so also under the Beerbhoom Hills I have found talc.

To the south, towards Burraboom, we have a very poor description of copper ore; it is even now worked by stealth. I doubt the ore vein being sufficiently rich to warrant any extensive work thereon. It is found on both sides of the Subanreeka river, and lies in the same schist rocks which like those I have described as existing in the upper divisions of the Barracar river.

Of iron ores differing from the clay ironstone which accompanies the Coal, there are many localities, all of them in the midst of those hills which run parallel with the Damooda to the south, particularly near to the large hill of Sasoonah and between it Beharynauth Hill, and it exists all the way towards Ramghur. Iron is smelted in those localities, but no steel is made.

Lead ore is found in the Beerbhoom and Bhauglepore Hills, near to Devgur, where it has been long known. Some years since I found it also to exist at Doomka in the hills, about 30 miles north-west of Beerbhoom. It is very poor, at least as far as I found it, sinking only to a depth of 35 feet; it is worked occasionally in several places near to those two places. Mineral springs of hot water are very numerous above the junction of the Barracar and Damoodah river, mostly sulphurous.

Some years since several small parcels of gold dust were procured from washing in the bed of a river, but it never could be traced to any exact spot, although many endeavours were made by Mr. Hopner and myself. It is near to Loonkoo Toomranah, which is near to Toree. It has, I understood, been latterly noticed by Captain Wilkinson, late political agent in that division of Nagpore.

The above is an outline of the mineral feature of these parts. My large map and survey, although I have been gradually adding to it, is yet very far from complete, and is, of course, not in a state to

Burdwan.

152. The distance of the nearest mines from Calcutta is about 90 miles in a direct line, without any impediment to the most improved means of transit. But the circuit by which the Coal is carried down the Damooda is 200 miles nearly, and that at an expense of 10 rupees per 100 maunds for boats, and an equal sum for the expense of large depôts at the foot of the rapids of the Damooda, and for wastage and loss of boats; thus making the present expense of carriage 20 rupees per 100 maunds, or 3 *a.* 2½ *p.* per maund nearly, which at the present annual expenditure of 17 lakhs of maunds is 3,40,000 rupees. In five years, supposing the expenditure to be 63,11,961 maunds, the outlay for carriage alone to Calcutta would be 12,62,392 rupees.

153. It may be worth considering whether so large a sum (annually increasing with the demand of Coal) be well spent for boats, and whether it produces a corresponding improvement in the boat trade on the Damooda. In 1832 there were two tenders offered for the supply of the public expenditure of Coal, the general expenditure of the article being then ¼th of what it is at present.

154. One of these tenders was at 6 annas, the other at 5½; yet notwithstanding the great increase of demand, it may be doubted if the average cost of Burdwan Coal in Calcutta is now much, if at all below 5 annas; and as 3½ annas go for carriage, we may perhaps conclude that, without some better means of delivery than the present state of the Damooda affords, the increased demand for Burdwan Coal cannot be attended with any very material reduction in price in Calcutta.

155. With regard to the Coal trade on the Damooda, the floods in the upper part of that river, and the danger, risk, and uncertainty to which they give rise, are all incompatible with that steady improvement which should attend this branch of industry; so long, therefore, as the Damooda is the only means of delivery, the degree of enterprise directed towards the Burdwan mines must be comparatively limited.

The present difficulty of access being such as to deter new parties from entering into competition with those already in possession of the field, the remedy would be to improve the means of access to it.

- 1st. Either by a canal on the Adji;
- 2d. Or by connecting the Damooda directly with the Hoogley at Calcutta, provided the upper part of the river above Burdwan be capable of improvement;
- 3d. Or by railroad.

NOTES—continued.

exhibit. You will perceive that I have dwelt more on the River Damooda than upon the Adji, although Coal is found on its banks and also in various localities near to it; but that ungovernable torrent prevents any use being made of those Coals which I know exist there in abundance.

The late Mr. Jones who commenced the colliery now belonging to Messrs. Carr and Co., drew up a report, which I need only state is calculated in every way to mislead, it is extremely erroneous as far as the colliery part is concerned, and which was its object to illustrate, and not worth relying on. I wish that this outline may be of any service to the inquiry; much more might be added, but as an outline is required so I sent it. You will see that at this time the following collieries are at work; a general opinion prevails that only two collieries exist; here is a list of workings, some of which as noticed are only on the surface or crop Coal:—

1. Mungulpore at the E. commencement of the Coal field on the Singharum nullah, at present stopped and only lately commenced, is five miles distant from Damooda, belongs to Mr. Erskine.
2. Mamoodpore, about two miles higher on the same nullah, is surface Coal, is carried on carts to the Adji six miles, belongs to Mr. Blake.
3. Agarab.—Carr and Co., originally Mr. Jones, and called by him Raneegunge.
4. Narain Coory.—Gilmore and Homfray, adjoining to the above.
5. Damooleah.—Carr and Co., originally Jessop, an open surface Coal, one mile from No. 3.
6. Damarah.—Ditto, surface Coal near the bank of Nooneah nullah, five miles from No. 3 on same bank.
7. Salmah.—Homfray, in progress of sinking, five miles from No. 4 on south bank.
8. Choonparah.—Gilmore and Homfray, ditto, nine miles on south bank from No. 4.
9. China Coory.—Carr and Co., formerly Betts, 18 miles from No. 3 north bank, also a main worked on the opposite bank.
10. Dhee Sherghur.—Ditto, three miles above No. 9, a surface work on the bank.
11. Narainpore.—Ditto, six miles above No. 9 on south bank.
12. Barracar.—Gilmore and Homfray, new colliery, 28 miles from No. 4, at work and promises excellent Coal under a good depth of ground; this is in Chuta Nagpore district.
13. Burmoory.—Juggernat Doss on the Barracar river, not working at present; in fact, Nos. 3, 4, 9, and 12 are the main collieries, the others being out of work.

There are at and near to Cherooleah on the Adji river, very extensive quarries of coarse sandstone paving flags, but they are inferior in texture and grain to those obtained from Chunar. Whilst at Muddenpore from large quarries of schist, plates, dishes, and stoneware are manufactured, and cut and sent down for sale by the Barracar river.

A D J I.

Adji.

156. The first mines we come to on ascending the Adji river are situated 12 miles above Elambazar, or about 47 miles from the confluence of the Adji with the Hoogley at Cutwa. For a distance of 60 miles to the west of Elambazar, the country on both sides of the Adji river, is one extended Coal field. But it is not until we have advanced into the hills where the surface becomes broken and elevated, that the beds of Coal are laid bare and exposed in ravines and other natural sections.

157. *Churalya*.—Situated on the southern bank of the Adji, at a distance of 60 miles from Cutwa. A six feet bed of Coal here occurs within a quarter of a mile of the river. A section of the place is formed by a small watercourse, showing the Coal to be covered by 13 feet of soil. Beneath, it rests on 23 feet of sandstone, which becomes soft by exposure. This sandstone is intersected every two or three feet by thin seams of Coal and shale.

158. *Mahudnuggur*.—On the opposite or north bank, three-quarters of a mile from the river, and not above a mile from Churalya, a bed of Coal 13½ feet, also exposed by a watercourse, is seen covered merely by six feet of hard clay.

159. *Mammudpore*.—Coal is worked by Mr. Erskine in two places at Mammudpore, two coss south of the Adji Ghat at Seedpore.*

160. *Pariharpore*.—A good deal west of the Mammudpore, only four miles from the Damooda, and eight miles in a south-westerly direction from the Adji at Durbadanga Ghat, Mr. Erskine works a bed of Coal which rather belongs to the Damooda than the Adji basin.

ABSTRACT

N O T E.

* To the west of this, the extent and quality of the Coal improves, but we have no scientific particulars whatever as to the peculiarities of the different beds that have been penetrated. Mines are now opened on the Adji side by the Dhoba Company, by Mr. Erskine, and by Mr. Hollings and other parties, we believe under the denomination of Beerboom Coal Company.

With regard to the quality of the Adji Coal, it may be sufficient to state the result of two trials. Two hundred maunds of the Churalya bed were tried at the Mint, the result was that 28 maunds from this bed were found to be equal to 25 maunds of the best Burdwan (*vide* Proc. Committee, 11th January 1842, paragraph 3,) from Mr. Erskine's mine, 13 miles below Churalya. The daily consumption in a 20-horse power engine was found to be 27 maunds 14 seers, leaving 24 per cent. of ashes; 29 maunds 9 seers of Burdwan Coal were required daily to keep the engine to the same work, leaving 25 per cent. of ashes. (*Vide* Proc. Committee, 6th December 1841, paragraph 2.)

Boats of 200 maunds burden can ascend the Adji to Elambazar in the rains. Beyond this the country affords every facility and excellent material for the construction of good roads.

Plans have been suggested for improving the Adji river, but Colonel Forbes is of opinion that a canal six feet deep extended parallel to the stream would be cheaper. (*Vide* Proc. Committee, 4th October 1841, paragraph 8.)

Sixty miles of canal on the Adji river would save 200 miles in the carriage of Burdwan Coal to the upper parts of Bengal, and 100 miles in the distance it is now carried to Calcutta. It would also obviate the necessity of keeping up a two years' stock at Omptah to guard against contingent demands that might arise after the navigation of the Damooda closes, whereby the quality of the Coal deteriorates. The saving of 100 to 160 miles of carriage, together with the loss and expense of depôts, both estimated at two annas per maund, would allow of a toll to that amount on the proposed canal.

The present expenditure of Burdwan Coal may be estimated at 15 lakhs of maunds, which at two annas toll per maund, would yield 1,25,000 rupees per annum on the proposed canal for Coal alone, which at 5 per cent. would admit of an outlay of 25 lakhs, or 41,565 rupees per mile for a distance of 60 miles.

We do not take into account the other uses of a canal on this line; but for the mere conveyance of Coal alone, it is evident it would pay even at the present rate of expenditure. But the expenditure has trebled itself within the last seven years, and may go on increasing at the same rate, so that the return in seven years on Coal alone might be reckoned with tolerable certainty to be 15 per cent. The great public benefit of such a work would consist in effectually opening the Burdwan district, and destroying the present monopoly on the Damooda, which is directly opposed to public improvement in the supply of Coal.

Adji.

ABSTRACT of COAL in the Adji District.

District.	Field.	Locality.	Bed.
Adji River -	Churalya - -	{Quarter mile from the south bank of the Adji - - -}	6 feet.
	Moheednuggur -	{North bank of the Adji, three- quarters of a mile from the river - - - -}	13½ feet.
	Mammudpore -	Two coss south of Seedpore -	Size not stated.

Rajmehal.

R A J M E H A L.

161. *Bansli River*.—At the pass of the Patchwarry on the Bansli river, 30 miles from its confluence with the Bhagarutty near Belgotta, Coal has been for the last 30 years known to exist without eliciting any inquiry.

Meanwhile the necessary supplies for the public steamers in the vicinity are carried a distance of 600 miles at a heavy expense.

Doobradgepore.—On the Bramany river, 15 miles south of Patchwarry, Coal is found in various situations for a distance of 15 miles on both sides of the river. It is still unexamined notwithstanding repeated urgent calls of the authorities on the spot for proper aid. The Superintendent of the Nuddyah rivers was suggested as a likely person to improve our knowledge on this subject from his vicinity to the place. He was therefore requested to visit the spot. (See Proceedings, 6th January 1841, para. 15.) The season being too far advanced before the request was communicated to him, he could only send persons out

NOTES.

LETTER from Mr. James Pontet, to the Secretary of the Coal Committee, dated 10 November 1838.

I HAVE the honour to acknowledge the receipt of your letter, dated the 19th October, and herewith I send my reply to the different paragraphs.

Para. 1. At present only one bed of good Coal has been discovered (in the Rajmehal Hills) by me, 400 maunds of which has been forwarded to your Committee and its arrival acknowledged by Captain Forbes, under date 22d September last; the above bed is 16 miles from a navigable river four months out of the year.

Para. 2. The best depôt for the Coal is at Coytah, 24 miles western from Moorshedabad on the Brammany nullah, accessible from June to September, for boats of 100 to 500 maunds burden. Flat-bottom boat would be desirable, but I think sufficient country boats from 70,000 to 80,000 maunds are procurable from Moorshedabad. I cannot at present state what will be the cost per maund, as it will have to go 16 or 20 miles by land, which I have not yet had a trial of; however, I do not expect the Coal will cost more than six annas a maund at Berhampore, it will all depend on what the land carriage costs; the boat hire is 10 rupees per 100 maunds to Berhampore.

Para. 3. No parties are engaged working Coal mines in this neighbourhood, and the best mode of bringing the mine into operation would be, I think, first to discover the extent of the bed, the quality, and the actual cost per maund landed at Berhampore; with this information tenders might be invited to supply the different depôts. The mine is so far from this station, and only to be visited by Europeans from December to May, that I cannot give any more particulars until I go out, which will be next month. If the Government will allow my son the pottah of the mine for its discovery, I shall be happy to exert myself to obtain the above information, and raising as much Coal as possible from January to May, and send it to Coytah.

From the same to the Secretary of the Coal Committee, dated 22 March 1839.

I HAVE received your favour of the 29th January, which I would have replied to earlier, but was in hopes to have had some satisfactory information to convey to the Committee. Agreeable to my letter of the 29th December, I proceeded to the mine, and was in that direction all January, set the kulashies with boring rods at work, and found the vein to run to the N.W. of the Brammany nuddy (25 feet below the surface). The rods have not answered my expectations, they appear of too light a kind for a strata of stone; after the first vein of Coal, we came upon a hard

out to make inquiries, the result of which would regulate his own movements ; since which time however the Committee have heard nothing more on the subject.

162. *Hurrah*.—Detached masses of Coal were collected on the surface at Teermohun and at Hurrah, and transmitted to Calcutta for trial in 1831 ; neither the circumstances nor the locality were described at the time. The only information to be gleaned from the correspondence on the subject is, that 1,000 maunds were transmitted to Calcutta, and found to be unfit for steam.

163. *Mootee Jarma*.—At the village Moharajepore, near the Mootee Jarma, or waterfall, Coal was found, and samples transmitted to Calcutta in 1831, but no description of the locality having been at the time communicated, recent attempts to refine it have proved unsuccessful. The Coal was considered inferior.

ABSTRACT

hard black stone, and finding the operation of boring through it so very tedious, I took upon myself to select a spot for a shaft, and procured well-diggers and stonecutters from Narrainepore, who have been the last two months at work ; at present to all appearances satisfactory ; as one of the men among the stonecutters (who opened a shaft at Burdwan) says this mine bears the same resemblance to it, I am induced to persevere a few feet more, in the hopes of coming to a useful vein ; the first 23 feet of soil is red and black earth, mixed with kunkur (from sample 1 to 4), and under that, to the depth of 40 feet, are 13 different stratas (three of Coal, and the rest various kind of stone), *vide* 5 to 17 (from the samples forwarded this day for the steamer passing Rajmehal) ; may be your Committee will be able to form an opinion whether it is likely I shall succeed in coming to a good vein. The last despatch made to you was at the mercy of natives entirely, the season being so far advanced when it was ordered, and it is more than probable to have had some from the surface, which your Committee complains of. I could, from along the banks of the river (if required) procure 5,000 or 6,000 maunds of good Coal, but as I have discovered that the vein is of not sufficient depth to work, so I conclude your Committee would not wish it. Certainly no reliance can be placed upon my discovery for the ensuing season ; if I come upon a good and deep vein, as expected, in a few days, I shall extract as much as I can before the rains. The boring-rods have been applied in seven different directions, and the vein appears to run more westerly than otherwise. Unfortunately the two kulashies who accompanied the rods have both been laid up with jungle fever, which has retarded their operations greatly for the last month ; they will commence again in a day or two, when I hope to be able to report how far the vein does extend ; at present we have only found it 300 yards as from the river, and three quarters of a mile wide. I shall feel obliged if you will inform me whether your Committee approve of my proceedings, and to what depth may I carry the shaft ; the stonecutters inform me before they come upon the present vein (working at Burdwan) they had to penetrate through 30 feet stone. The expenses now incurred consist thus of—

	Rs.	a.
4 Stonecutters - - - - -	22	-
15 Coolies for the shaft - - - - -	45	-
1 Sirdar - - - - -	4	-
2 Peons - - - - -	5	8
12 Coolies for the rods - - - - -	24	-
	Rs.	100 8 per mensem.

I have paid to this date Rs. 607. 11. 4. on account of the Coal mine, &c., and beg to enclose the account, which I hope will be found satisfactory ; by it you will perceive I have unexpectedly exceeded the sum sanctioned by your Committee, but being a trifle to gain such an object, I trust you will use your interest to get the balance sanctioned, also an additional advance should the Government wish the present operations to be continued. An early answer will greatly oblige.

From the same to the Secretary, Coal Committee, dated 13 May 1839.

I HAVE wished to acknowledge the receipt of your favour the 4th ultimo before now, but owing to the dreadful sickness (jungle fever) in my establishment (four men having died), I have not been able to send those particulars I thought would be acceptable to your Committee. Shortly after the receipt of your favour, I sent to forbid the men extending the excavation, which they had previously done from the water coming in too quick upon them. I had a "Mhate" at work, but it would not keep the well free, to admit of the men working ; my want of experience in sinking a shaft properly has been a great bar to completing my discovery this season ; the men are so sanguine that the vein is not more than two or three feet off, that after the rains I shall prosecute my attempt by making the well long instead of round, so as to admit of more men working. During the ensuing rains I hope to procure leave of absence to visit Burdwan, when I shall make myself acquainted with the different appearances of the strata above the vein in that quarter.

Agreeable to your Committee's request, I have returned the boring-rods (on the 4th instant), addressed to Colonel R. Powney ; expense of the boat hire and carting has been 23 rupees, which I hope you will remit me at your earliest convenience, as well as the balance of the former account.

Rajmehal.

ABSTRACT of COAL in the *Rajmehal* District.

District.	Field.	Locality.	Beds.
Rajmehal	Bansli river	Patchwarry Pass	In Sandstone.
	Braminy river	Doobradgepoor	Numerous beds not described, alternating with sandstone and shale.
	Teermohun	Hurra - - -	
	Sicrigully	Mootee Jarra	Not traced.

Palamow.

PALAMOW.

164. WITHIN 30 miles of the Soane river, and about 100 miles in a direct line from the confluence of that stream with the Ganges, numerous beds of Coal exist. They all lie in the valley of Palamow. The Coal districts in the vicinity of this valley are as follows:—

- I. Hotar, in the upper part of the valley.
- II. Singra or Sidra, in the middle part of the valley.
- III. Gorossan Nullah, five miles beyond Chapari.
- IV. Rajhara, on the Sodabah Nullah.

The

NOTES—continued.

The bed or field of Coal has been traced a mile south-west of the Brammny river (in Belputtu); and I am inclined to think it is a continuation of that in Burdwan. I have likewise traced it 15 miles to the north-west, between the Brammny and Hurrah, where Captain Tanner some years ago opened a shaft. From the different specimens of earth, Coal, and stone I forwarded to you by the steamer in March, your Committee can inform me whether I should be successful in tracing the vein, if I proceed in the excavation.

TRIAL of Rajmehal Coal sent to the Mint by Dr. *M'Clelland* on the 31st May 1841.

THE steam having been got up in the first instance by English Coal, and on the engine being started, the firing with the Rajmehal Coal commenced, and during the time it was used the steam was kept up to full force; the fire had a good blaze, and the fire-bars admitted a bright ash pit.

The Coal submitted for experiment, weighing 13 maunds 3 seers 0 chittack, worked the Mint 20-horse power steam engine 2 h. 50 m., being at the rate of 4 maunds 24 seers 9 chittacks per hour, against 3 maunds and 5 seers of the best Burdan Coal expended per hour on the same engine, and working under similar circumstances.

(signed) *W. N. Forbes*, Mint Master.

2 July 1841.

REPORT on Mr *Pontet's* Coal sent to the Mint by Dr. *M'Clelland*, Secretary to the Coal and Iron Committee, on the 10th January 1842.

THE Coal having been tried at the Mint 20-horse power steam engine, it was found that it failed to keep up the steam; and in consequence of the frequent stoppage of the engine it became necessary to discontinue the experiment. The Coal appears greatly inferior in quality to that sent at a previous period to the Mint by Mr. *Pontet*.

(signed) *W. N. Forbes*, Mint Master.

7 February 1842.

EXTRACT of a LETTER from Mr. *W. B. Tytler*, Superintending Engineer Steam Department, dated 22 September 1839.

THE only obstacles to the free navigation of the Soane may be summed up in a few words, viz.: currents to ascend against running 12 miles and upwards an hour, with channels cross, variable, and tortuous, eddies wheeling in all directions, and the water in this river constantly rising and subsiding, as it is more or less affected by the mountain torrents and the overflowing of its tributary streams, in the higher ranges of hills in Palamow. These obstacles are to be considered by no means

The beds are of good workable size, some of them are large and situated on the banks of the Coyle river or its tributaries; the quality of the Coal, as far as it is known, is heavy and inferior, but from some beds it is better, and from others very good.

The Hotar bed, situated in the upper part of the valley, is the least accessible, access to it being intercepted by a range of hills which interrupt the navigation of the river for some miles. This is the more to be regretted as the bed thus placed is of unquestionable superiority.

The other beds in the middle and lower parts of the valley are all within reach of water carriage, with more or less difficulty, perhaps, for a distance of 15 to 20 miles.

I. *The Upper Palamow or Hotar Coal.*

165. The place at which Coal was first discovered in Palamow, is indicated on Arrowsmith's large Map on the west bank of the Coyle river, at a point 50 miles from the conflux of the Soane. Major Sage, who visited the place in 1830,

NOTES—continued.

means insurmountable: but the time consumed in ascending the Soane with boats of any considerable burden, will act as a serious drawback to the profitable navigation of this rapid river.

Regarding the local situations, where I experienced the greatest difficulties in ascending the Soane, I beg to submit that between Maneah and Daudnaghur the stream was so strong as frequently to defy our united efforts to get ahead at all; and I was obliged on several occasions to call in the aid of the villagers to pull up the vessel with ropes. This plan answered very well where good footing was obtained on any of the high banks; but when obliged to track on sands in following the channels, the boatmen became tired and dispirited by getting into quicksands, and in consequence my progress upwards was the more retarded as their fears prevailed. From Daudnaghur to the Benares road we had a rise of the river; but being favoured with a slight easterly breeze, this compensated for the increase of water, although our progress upwards was not at a more rapid rate than the foregoing days.

From the Benares road to Bundoo Ghaut the river subsided, and the breeze freshening at the same time, our vessels made more way: but the river rising again as we neared the Amirkah chain of rocks at Bundoo, and the stronger currents setting direct over them, I deemed it advisable to take the eastern channel, being the safest of the two; but even through it I was obliged to warp up with the light anchors of my pinnace, the anchors being carried ahead by my pilot dinghee. This is the most rapid part I met with on the Soane; it is not so much owing to the declivity of the bed of the river, as to the water being confined into a narrow space, by the obstruction of the rocks on the western bank, extending out nearly to the middle of the river's bed. From Bundoo Ghaut to the mouth of the Coyle, although so short a distance, owing to the sudden subsiding of the Soane, we experienced much difficulty in getting out of the upper end of the eastern channel, partly for the want of water, but chiefly owing to the undefined nature of its numerous inlets, and its broad shallow entrance. On the 27th August, just as I had entered the mouth of the Coyle, about 4 p.m., I determined on proceeding on up the Coyle in my 200 maunds' dinghee.

The average depth of the water in the Soane I found to vary from 6 to 20 feet; and at no part, so far as I have seen, would a steamer have the slightest difficulty of navigating this river as high as the Coyle, provided she had power to steam the rapid currents.

I found the water in the Coyle between its junction with the Soane and Garia Ghaut, flowing at about the same rapidity as that of the Soane; and the same remarks apply generally regarding cross currents and eddies, but so uncertain is its rises and falls, and so sudden and frequent do they take place, that no certain depth of water can be found in its channels throughout the rainy season. From Garia Ghaut to Mangeowah, and thence to Seckseekie and Maugean, villages on both sides of the river, the Coyle runs over a rocky channel at an increased rapidity, and to an extent about one-third of the bed of the river; but the other two-thirds lying higher along the south-west bank, the water is wholly confined to this rugged course, to navigate through it is a difficult task as it is at present; but if the chief rocks now in the way were removed by blasting, no other obstacles whatever is found to prevent or obstruct navigation on the Coyle as high as Shapore, six miles above Singrah in Palamow.

EXTRACT of a LETTER from Captain *W. Sage*, dated 27 April 1836.

IN visiting the place marked "Coal mine" in Bannel's Map, No. 8, I found a village called Hotar; and at some distance up the Barra river, an extensive bed of Coal in every respect the same as the bituminous Coal in the Gorassan, lay exposed to the eye. In the neighbourhood of the Coal beds grows the saul; I measured one tree, which at three feet above the ground was found to be 14 feet 7 inches in girth, and which rose from 40 to 50 feet without a branch. Iron is found in great quantities, as also numerous granites. Extensive mango topes, with other signs of villages and cultivation, convinced me it had once been tolerably peopled.

The country is rich in cattle, particularly in a small breed of sheep like the Welch, having very fine wool, blankets from the country are consequently in request; grain on bullocks is exported

Palamow.

1830, found the Coal to be in every respect like that of the Gorossan, rich and bituminous. Iron is found extensively with the Coal, and the country, where uncultivated, is covered with extensive forests of saul, some of the trees measuring 14 feet in circumference. The country is also rich in cattle used for the transport of grain, so that there is nothing wanting, Major Sage remarks, but roads and water carriage, to render Palamow a rich district.

Mr. Homfray, who visited this district in 1837, reports the upper field to be about 14 miles in length and 6 in breadth, and to contain a main bed of Coal 3 feet 9 inches thick, of good quality. Unfortunately, the navigation of the Coyle is obstructed for 13 miles before reaching this Coal, which must therefore, in the present state of things, be regarded as inaccessible.

ABSTRACT

NOTES—continued.

in considerable quantities. Gram, wheat, and barley were selling at 100 seers for the rupee; the rivers abound in trout and other fish, and nothing is required to make Palamow a rich mercantile and manufacturing country, but roads and a water communication direct with the Ganges.

To bring the Coal into use I would propose to throw a stone bund about 60 feet at the top, of granite, so as to form a reservoir across the Coyle at Garia Haut, basing it on the gneis rock, which in the dry weather is perceptible quite across the stream. I would propose a cut across the tableland into the nearest branch of the great Pompon river, which should be levelled and locked all the way to the Furwah Bridge below Patna; this would form a capital depôt for the steamers, and eventually realise a considerable saving to Government.

Another way to get down the Coal, &c., would be to blast the rocks at Garia Ghat and Maugean, which would deepen the river and give it during the rains a free communication with the Soane, and by this river with the Ganges at or near Moneah. A young engineer should be sent to survey the country and lay down a line for a canal, as the most advantageous way of bringing the resources of that extensive tract of country into play. The extent of the cut it may be necessary to make will be trifling.

The advantages accruing to the Government from the establishment of such a communication are obvious. A country almost depopulated, and yielding little or no revenue, would speedily teem with people and commerce; the minerals, now valueless from their inaccessibility, will be brought into the more civilised districts, proving a source of wealth to all parts of the country; and the arts once introduced into Palamow and its neighbouring districts would extend their influence through the countries of Sirgaubah, and readily open for themselves a passage into the states of Hyderabad and Nagpore, more particularly if the new road intended by our late Governor General, Lord William Bentinck, from Midnapore to Nagpore, and on to Bombay, should be constructed.

Steamers will soon be found on the Jumna as high as Delhi, and on the Ganges as far as Gurmuckteaser, and immense will be the saving to Government in having a Coal depôt at Furwah, only a few miles from Patna, and from which the whole of the western stations may be supplied.

I have thrown these remarks hastily together in consequence of your questions to me regarding the Coal countries of Palamow, and from a conviction of the great capabilities of the neighbouring districts, nature having bestowed on them all the requisites for a manufacturing country, and leaving to art the single operation of opening a water communication.

EXTRACT from a REPORT on the Coal Fields of Palamow and Amanath, by *J. Homfray*, dated 10 July 1837.

At a distance of a few miles to the south of Singra commence an extensive range of granitic hills which run from the Tikoo Hills parallel with the Amanath, and here bend to the westward, and crossing the Coyle, continue in that direction west. These hills are from 200 to 500 feet in height, and covered with wood; at the base of these hills is a large tract of ground covered with boulders of the same genus; beyond these, to the south, and between it and Palamow, the hills assume the character of very high mountains. The breadth of these two chains is about 10 to 12 miles, and they are intersected by various passes or ghauts fit for the passage of cattle, but none for carriage. It is from this great chain of granitic hills that all the masses of rock found in the Coyle river, and which impede its navigation, take their rise; it will be seen on the Map,* where they are delineated in its course, until we arrive at a small nuddee leading up to Clandoo, half a mile beyond which place the passage is completely blocked up by the immense granitic rocks of all sorts which are there, the river finding its way through the narrow passages and in gentle falls for the distance of 10½ miles, renders all hope of turning that part of the river to any useful account quite hopeless; whilst on either side the immense rocks which come down and shut close to the river, forbid the making a carriage road, unless at an immense outlay of money, there being only a very short distance which is clear of these impediments. The present communication is by a road through two very steep ghauts from Clandoo to the Daouree Nuddee, which although not of very great height, are difficult to surmount; cattle are unable to carry more than half their usual burthen. Suddenly these rocks terminate and we have a broad river and sandy bottom full 250 yards in width, with sandstone at its edges. At a ford near Mungurdar Nuddee, in the river edge, four or five thin bands of Coal from 4 to 12 inches in thickness, but no thick vein; near to this place is Heter, and this is conjectured to be the site of Rennel's "Coal mine," since there is no other place on the river for some miles where any Coal is found, until we reach the small nuddee

* N.E.—A map was originally furnished with this Report, but subsequently withdrawn.

ABSTRACT of Coal at *Hotar*, in the *Upper Palamow* Field.

Province.	District.	Field.	Locality.	Bed.
Palamow - -	Upper part of the valley.	Palamow village	50 miles from the conflux of the Soane.	3 feet 9 inches.

II. *Singra or Sidra*.

166. On the north-east bank of the Coyle river, at a distance of about 35 miles in a direct line from its confluence with the Soane, Coal occurs in two situations.

Singra.—At this point the Amanath river falls into the Coyle, intersecting several beds of Coal from 1 foot 6 inches to 6 feet in thickness.

That which it was proposed by Major Sage in 1830 to work, is described as a non-bituminous Coal, or anthracite, $\frac{3}{4}$ feet 7 inches thick. Mr. Homfray, who subsequently

NOTES—*continued*.

nuddee of Burwellia, running to the eastward and at half a mile up that stream there is a fine vein of Coal 3 feet 4 inches thick. This Coal is found also to the westward, at Myapore, and indeed, for an immense distance southward and westward; it is traceable even down to Singboom and towards Rutenpore; this I learnt from an intelligent native zemindar with whom I was in company for three days, so also to the eastward, and this is what constitutes the Palamow Coal field.

Within the Burwellia Nuddee this vein of Coal is 3 feet 4 inches, exclusive of some little adhesive black shale, which makes the apparent thickness of the vein to be 4 feet 6 inches. Both sides of this nuddee are very high sandstone hills, and underneath which the Coal is traceable to the eastward and northward, continuing to crop out in a vast number of places, until we bring it fairly over to the Daouree Nuddee, the upper end of which winds into an extraordinary deep and narrow valley within which this vein, as well as another smaller one of 1 foot 6 inches, lying at 6 fathoms beneath it, is found. This valley is generally 10 to 12 yards in width at the very bottom, and sloping rather steep on each side to about 40 or 50 yards in width to the foot of the abrupt precipice of sandstone rock, generally 100 to 150 feet in height, and often much more. This valley is filled with saul trees which are all of small girth, 30 inches to 40, but of immense height, reaching to the level of the top rock, where they become stag-headed and lightning struck; for a distance of three or four miles within this valley the Coal is traceable until in one place, underneath a rock of full 150 feet in height, I found it so firm and promising as to sink and drive in the vein for some yards, raising about 700 maunds of Coal therefrom. There is a shale which overlies the Coal, and between it and the rock roof. The Coal, however, is very dull and sotty, burns with little flame, gives out an intense heat, with very little or scarce any smoke; it retains fire for days together, and to me appears to be a stone coal. There are traces of vegetable impressions upon the top of the coal, but I was unsuccessful in obtaining any kind, either in the sandstone or the shale. The valley abruptly terminates and opens into a woody plain of some miles in extent, in traversing which the shales and the Coal are found all the way round to the foot of the high mountains towards the S. E. in the direction of Tikoo. From the summit of these hills a fine view of the valleys is obtained, and the marked difference in the shapes and appearances of the sandstone formation from that of the surrounding hills of primary origin is finely observable. Ironstone is here found in abundance close to the village of Baumundya, in the Daouree Nuddee, in veins of three and four inches each; these veins are also found in the ravines all the way to Pohea Agar, and at which place there are a number of iron melting furnaces upon the native plan. Iron is here sold generally at 2'12 to 3 rupees per maund of 48 sicca weight seers; it is in lumps of 4 to 5 lbs. each, and has undergone the process of hammering and remelting four times at the time of sale. The ironstone which I found under consumption had been previously roasted and was afterwards put into the little furnace made of clay, and bellows, similar in all respects to that described in the "Gleanings of Science for October 1831." Of the quality of this fine vein of Coal, I shall say little, the quantity of residuum or ashes was small and extremely light, but the difficulty in igniting the Coal is considerable. This Coal, even if worked, would have to be conveyed away on bullocks, as the only practicable present mode, for the reasons before advanced. Here then we have a noble field of Coal, extending five to six miles in breadth towards the south-west and proceeding over an immense extent of country; I know it exists for many miles beyond the Burwellia, and, I think, we may fairly identify it with that found in Singboom from its constant occurrence along the Coyle river in the upper end of that stream. It seems extraordinary that the Damoodah Coal-field should also be traceable all the way up to this same range of hills, passing Ram Ghur and many other places of note, where it is found, and from some samples of Coal from the west of Ram Ghur, I am led to expect, as the Coal approaches those hills, that its quality very much deteriorates. The extraordinary fact of the gigantic reed, whose impressions we constantly discover in the carbonaceous strata, is here found growing in luxuriance. I have brought some whose roots were actually extended four feet into the Coal-bed. This is the only example I know of the living reed being found near to Coal.*

* N.B.—The reed alluded to by Mr. Homfray turned out to be only a grass, *Saccharum spontaneum*, which grows very generally throughout Bengal. No grass or glumaceous plant, we believe, is found in a fossil state in Coal.

Palamow.

subsequently visited the place in 1837, describes the bed as only 3 feet 8 inches thick, and of limited extent and inferior quality.

It is overlaid by several thin beds of sandstone and shale, with one thin bed of Coal 13 inches thick.

167. Mr.

NOTES—continued.

EXTRACT of a Letter from Captain *W. Sage*, dated 27 April 1836.

THE subject of a supply of Coal being one just now of great interest, I purpose giving you a slight sketch of the country abounding in Coal bassets in and about Palamow. I passed into this country in January 1830, crossing the Soane at Bunde Ghât, nearly opposite to Rotas Ghur, and obtaining the left bank of the Coyle or Coel river at Manjian; leaving Guroo I recrossed the Coyle and encamped at Singra, or, as in map, Sidra. The Amanath river joins the Coyle about 100 yards west of Singra. In its course it has cut off a portion of a hillock, 1,200 × 100 × 40, and the following section is observable.

	<i>Ft. In.</i>
Earth, clay, pebbles, &c. - - - - -	11 6
Shale - - - - -	0 11
Pebbles - - - - -	3 7
Coal, No. 2. - - - - -	1 6
Sandstone conglomerate, increasing in compactness as it descends -	8 0
Non-bituminous Coal, No. 3, or anthracite - - - - -	4 7
	30 1

This Coal rests on a blue sandstone, readily splitting into tables or large flags, depth not ascertained; it is a good useful Coal, burns to a soft white ash, without flame. It was traced nearly three miles up the Amanath. From 1,200 to 1,600 maunds were sent to Dinapore and used in the smitheries, and in brick-burning answered well.

EXTRACT from Mr. *J. Homfray*, Report dated 10 July 1837.

UPON glancing over the map of the Coyle river, which falls into the Soane, and which accompanies this memoir, there will be seen, at a distance of about — miles from the Soane, and on the right or east bank of the Coyle, a tolerable large river, which falls into it near to the village of Singra.

At the mouth of this river is the Amanath coal-field. Commencing immediately at the junction with the Coyle river we have a sandstone, and at a very short distance up the river are seen on the west bank, first, a vein of coal 3-8, and a little above it, another of about 3 feet, which is, however, divided in its centre by a band of stone of 8 inches, thus dividing it into two veins. This coal is opened to-day for about 600 yards in length, when, from its declining or dipping, it sinks below the river; on the banks of earth also is found another small vein of coal, but which is better seen on the opposite side of the river, where there is a high sandstone rock and the coal vein in full view; it is also seen in several other sites in the river for about one mile distant, where it is terminated by a large basalt dyke, and thus ends the coal on that side or up the Amanath. Near to where this little coal is seen, under the rock there is a small nuddee, which is called Junjunsree, falling into the Amanath, and having its rise, about seven or eight miles distant, under the high hills to the east. Up this little river the upper vein can be traced some distance, but in no place is there more than a few feet of rock over; it is, consequently, soft and tender, and the sandstone rock is scarcely deserving the name of rock, being more a sandy conglomerate. Stretching to the north and east the ground is very full of ravines, and the crop or outburst of this coal is everywhere found, so that, in fact, there appears to be but little covering over it; on the east the traces are cut off by an immense number of small earthy hillocks, among which the sandstone and crop coal is found, and then it seems to terminate, but on the north side it runs rather a greater distance underneath the little village of Bulserah and Seguat, where all traces are lost of Coal. Around this circle of coal is found, and at a distance of two miles on the west and south, and on the direction of the rise of the vein sandstone, and underneath it the usual ironstone measures, in which are two remarkable fine veins of ironstone—the measure is 14 feet in thickness; the upper vein varies from 7 to 12 inches, and and even 14 inches in thickness, and at 4 feet below it is another vein in balls of ironstone, 5 or 6 inches, and in large oval balls, such, exactly, as are common in Europe. Beneath this is a sandstone, and at some distance below it a black aluminous shale, of which the cattle are said to be remarkably fond, and when sick will, of their own accord, go to several well known places, in order to lick it with their tongues. Beneath it is found a sandstone and quartz, and then syenitic quartz, and then the passage is into masses of granite boulders. This ironstone has but a very little covering over it, and it is seen in every little ravine around there, and in the nullahs which fall into the Amanath and Junjunsree rivers, as well as the Doorgatty Nuddee and Soodaban, and down the Coyle River to nearly opposite the village of Rampore and Panjooree. This ironstone is the extreme boundary of this mineral district, the Coal at one corner of it being contained within a very limited circle, the ground being all around here gently undulating, and nowhere having many feet higher than the river bed. Near, however, to the Bulserah village, there is one spot which indicates a little better appearance as to solidity, and should the Coal prove to be really worth pursuing, I should continue to sink a pit, which is already marked out as near to a peepul tree (the only one thereabout); and the reason which would make me believe it to be the most eligible spot is, that the little or upper vein of Coal being thereabout 20 feet below the surface (by calculation), that having all the veins,

one

167. Mr. W. B. Tytler, Civil Engineer employed in steam department, having visited Palamow in 1839, reported the existence of a 6-foot bed of Coal a little above the village of Miral, near Singra, and states the extent of the Coal-beds there to be quite inexhaustible. (See Proceedings 5th August 1839, paragraph 7.)

ABSTRACT of Coal near the village of Singra.

Province.	District.	Field.	Locality.	Beds.
Palamow - -	Middle district -	Singra or Sidra -	Singra village - Above Miral vil- lage - -	{ <i>a</i> , 13 inches. <i>b</i> , 4 feet 7 inches. 6 feet.

III. Gorossan

NOTES - continued.

one over the other, the bottom or main Coal might probably be there found more solid than what it has proved at Singra, or at the opening higher up the river. The field would, however, be very limited, as the great number of ravines materially decreases the quality of surface, and probably 200 to 300 biggahs would be the extent, there being two dykes perceptible to the eye, which somewhat tends to increase my hope of its extent being greater than what is stated. These ravines are more numerous on the south side towards Miral, but the ground towards Seguat has the appearance of being tolerably even and undisturbed. I have alluded to the quality of the coal hitherto obtained as very inferior; in fact, it scarcely appears to have been consolidated, and there is in this formation of sandstone and Coal something so very unusual, that I must dilate on it, to show that the nature of the Coal is imperfect, and that we can scarcely hope to obtain anything better from a formation which, to me, appears to be so recent and imperfect. Should, however, contrary to my expectation, the Coal prove chemically of value, it may then be worth while to continue the sinking of that pit marked out near to the peepul tree, but otherwise I should scarcely think it worthy of pursuit.

The order of the Strata is thus :

Sandstone	Surface	Ft. in.	20 0	This is merely a conglomerate, having large pebbles therein, particularly at the bottom.
Coal	-	-	1 4	
Shale	-	-	0 10	
Sandstone	-	-	18 0	This is very soft, and full of pebbles.
Coal	-	Ft. in.	0 10	} 3 2 Very streaky Coal.
Stone	-	-	0 8	
Coal	-	-	1 8	
Shale	-	Ft. in.	30 0	} This sandstone is remarkable for the number and size of pebbles, increasing in size downwards, until they actually occur in contact with the Coal, and that, too, when there is one vein of Coal superimposed over the other. I know of no other instance of such a conglomerate; the pebbles on the Coal are, some of them, 1 lb. to 2 lbs. weight, and those in the upper sandstones appear to be of the same genus, although they must have been so fixed at different ages.
Sandstone	-	-	8 0	
Coal	-	-	3 8	
Shale	-	-	3 0	
Sandstone, assumed measures	-	-	60 0	
Sandstone measures	Shale	Ft. in.	5 0	} 14 0
	Ironstone	-	1 0	
	Shale	-	4 0	
	Ironstone	-	0 6	
Sandstone	-	-	12 0	
Aluminous schist	-	-	3 0	
Sandstone	-	-	12 0	

Quartz, and beneath it granite.

Now, this extraordinary occurrence of pebbles in a series of rocks lying one over the other, with intervening veins of Coal, is something to me new. Of single conglomerates there are many instances, but here the pebbles seem to have subsided through the sandstone, when it must have been in a semi-fluid state, as it will be seen by the specimens that the largest pebbles are at the lowest part of the sandstone, and that they gradually decrease in size upwards, until the upper portion of the measure is but a coarse gritty sandstone. From this very extraordinary circumstance, I infer that we cannot hope for any very solid ground hereabouts, and without it I fear that any mining operation would be very hazardous; and from the want of solidity in the rock, would be attended with constant danger to the colliers. Should, however, these objections prove futile, the situation being within half a mile of an excellent ghaut, where the coal could be laden on to small boats proceeding down the Coyle river to the Soane, would be extremely favourable.

Palamow.

III. *Gorossan Nulla.*

168. On the Gorossan Nulla (which we cannot find laid down on maps to which we have access), Major Sage, in 1830, discovered a highly bituminous Coal, of very superior quality. The locality at which the Coal occurs is not described. Two beds are intersected at the same spot, which is stated to be about five miles beyond Chapari. The uppermost bed is only 13 inches thick, the lower one, which is separated from it by one foot of shale and one foot four inches of sandstone, is three feet nine inches thick, and said to burn with a cheerful blaze in an open grate.

ABSTRACT of Coal on the *Gorossan Nulla.*

Province.	District.	Field.	Locality.	Beds.
Palamow - -	- - -	Gorossan Nulla	Five miles beyond the village of Chapari	a. 13 inches. b. 3 feet 9 inches.

IV. *Rajhara.*

169. Mr. W. B. Tytler reported, in a letter dated 22 September 1839, the discovery of a distinct Coal basin, near the village of Rajhara, 10 miles north of Singra, and consequently within 25 miles, in a direct line, of the Soane river. He was led to this discovery by the numerous fragments of Coal he found in the Ladabah Nullah. He traced these fragments for about eight miles from the confluence of this nullah with the Coyle, when he came upon a vein nine inches thick.

Since then Mr. C. B. Taylor, an agent of Messrs. Carr, Tagore, & Co., or the Bengal Coal Company, has established a mine at this point.

We have understood Mr. Taylor to state the bed of Coal here opened to be six feet.

ABSTRACT

NOTES—continued.

EXTRACT of PROCEEDINGS of the Coal Committee, dated 5 August 1839, paragraph 7.

RECEIVED a Report of Mr. Tytler, announcing the discovery of a bed of Coal on the Amanath, near the village of Miral, and close to Singra, the place visited in 1836 by Mr. Homfray. The bed is said to be of good quality, and inexhaustible, 6 feet 2 inches in thickness. The specimen forwarded to the committee appeared to be a dull slaty coal.

EXTRACT of a Letter from Captain *W. Sage*, dated 27th April 1836.

I passed through Shapur, Chainpur, Chandas, and Chapari, above five miles beyond which I found Coal beds on the Gorossan Nullah, or river, entirely different from those of Singra. The Coal is very bituminous, burns with a clear bright flame, and makes a cheerful fire in an open fire-grate.

Section of the bank of the Gorossan river :

	<i>Ft. in.</i>		<i>Ft. in.</i>
Earth, sand, and gravel - -	8 0	Shale - - - -	1 0
Sandstone - - - -	6 4	Sandstone - - - -	1 4
Shale (bituminous) - -	1 0	Coal, No. 2 - - - -	3 9
Sandstone - - - -	2 1		
Coal, No. 1 - - - -	1 1	Total - - - -	24 7

EXTRACT of a Letter from Mr. *W. B. Tytler*, Steam Department, to Captain *J. H. Johnston*, dated 22 September 1839.

I beg to report a new Coal basin, which I discovered while passing through the jungles between Seeckie and Singrah, on the 6th instant. This field is near a village called Rajharah, about 10 miles due north from Singrah, on the Ladabah Nullah. I traced this field of Coal by the fragments of Coal I found on the sands of this nullah, which I explored eight miles from the banks of the Coyle, where the basin is situated. The vein of Coal is only nine inches thick, and quite in the bed of the nullah, the banks of which are thickly covered with jungle. The quality of the Coal is about equal to that of Upper Miral, which it resembles more than any other Coal I have seen in this country.

Palamow.

ABSTRACT of Coal in the *Rajhara*.

Province.	District.	Field.	Locality.	Beds.
Palamow - -	Lower portion of the valley.	Ladabah River -	Rajhara - -	{ a. 9 inches. b. 6 feet.

CENTRAL COAL DISTRICTS.

Central
Coal Districts.

170. So called in this report from their being situated beyond the influence of navigable rivers and coasts.

They are as follows:—

- | | | |
|---|--|--|
| <p>I. Ramgurh.
II. Chotessgurh.
III. Singrowli.</p> | | <p>IV. Surgooja.
V. Sohagpore.</p> |
|---|--|--|

Although situated beyond reach of the great lines of navigation, the resources of these districts are calculated to effect improvements of the most important nature when properly directed.

The facilities they will afford, in the first instance, in furnishing all the material that can be requisite in the construction of roads, must go far in determining the scale and the direction of such works throughout the tracks in which such valuable resources occur.

The two first, it will be observed, extend in a direct line between Calcutta and Bombay, presenting abundant supplies of Coal and of iron materials along the line for a distance of 360 miles. The third and fourth fall equally within the direct line from Calcutta to Mirzapore, and with the fifth into that between Mirzapore and the Nerbudda. The greater portion of three most important lines would thus be supplied with all the requisite materials, on the spot, for the construction of the most improved roads. The Coal these central districts afford has, in most instances, been found of a very superior description.

These districts being more or less elevated, their climate is consequently exempt from many of the objections to the plains; and the manufacture of iron on a small scale by the people indicates a disposition on their part for manufacturing pursuits.

I. *Ramgurh*.

171. *Bullea*.—About 30 miles west of the Coal districts of Burdwan and Adji, and 14 miles south of Hazareebaugh, Coal occurs about a mile or so from the village of Bullea, on the banks of the Sancheraie, a tributary of the Haharoo Nulla. The bed is stated to be three feet in thickness, and of considerable extent.

Badam.—Again, about 30 miles to the left of the trunk-road from Calcutta to Benares, at a place called Badam, extensive beds of Coal have recently been discovered by persons employed in making a road from Chota Nagpore and Hazareebaugh. The Coal resembles that of Burdwan; the road crosses over the beds.

Central
Coal Districts.

About half a mile to the east of these last, beds of Coal were observed, of very promising quality and great extent. The following are the results of analyses of three samples from these beds, recently received from Lieutenant Colonel Ouseley :

No. 1.	Sp. Gr.	- - -	1.31	No. 2.	Sp. Gr.	- - -	1.19	No. 3.	Sp. Gr.	- - -	1.29
	Carbon	- - -	61		Carbon	- - -	53		Carbon	- - -	60
	Inflammable matter	- - -	27		Inflammable matter	- - -	31		Inflammable matter	- - -	32
	Ash	- - -	12		Ash	- - -	16		Ash	- - -	8
	in	- - -	100 parts.		in	- - -	100 parts.		in	- - -	100 parts.

172. At Angballa, about 43 miles east of Hazareebaugh, close to the 187th mile-stone, on the new Benares road, a bed of Coal occurs in a nullah on the right side of the road proceeding from Calcutta. The bed is said to be large.

ABSTRACT of Coal in the *Ramgurh* District.

District.	Field.	Locality.	Beds.
Ramgurh -	Bullea - -	{ In the Sancheraie, a tributary of the Habaroo - - - - - }	3 feet.
	Badam - -	{ Within 30 miles of the Benares road - - - - - }	Several large beds.
	Angballa - -	{ On the right-hand side of the new road from Calcutta to Benares, near the 187th mile-stone - - }	Size not stated.

II. *Chotessgurh*,

NOTES.

EXTRACT of a LETTER from Mr. Assistant Surgeon *William Dunbar*, dated 23 February 1841.

ON the banks of the Sancheraie, a small nullah running into the Habaroo, I first saw the Coal, in a bed about three feet in thickness, with a gentle dip or inclination to the west. It was splintery, very black, lying below a friable sandstone and alluvium containing kunkur. The bed seemed to be of great extent, and I have no doubt that any quantity of Coal can be procured at this place.

At Bullea there are large and very extensive ironworks, employing a great many persons; and yet, strange to say, though most of the inhabitants are aware of the existence of this extensive Coal-bed, they never use it for their furnaces, but are at great expense in transporting wood and charcoal from the forests, several miles distant. I endeavoured to impress upon some of the workmen how advantageous it would be, and what a saving would accrue to them, were they to use this Coal; but by their answers they evinced their utter indifference to the subject, and their determination to adhere to the customs of their fathers. The Coal-bed is not above a mile distant from the works.

EXTRACT of a LETTER from Lieutenant Colonel *J. R. Ouseley*, dated 16 August 1841.

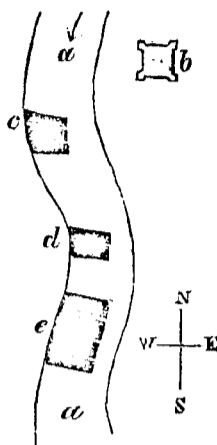
COAL is well known to be abundant in Pachete, and some seven or eight years ago it was discovered, on the old road from Hazareebaugh to this, by Lieutenant Richard Ouseley, the Assistant to the Commissioner: it was somewhere near Bullea, one march from Hazareebaugh. I am happy to say I have, in making the new road, found an immense field of Coal, about nine or ten miles south of Hazareebaugh, of which I shall do myself the honour of sending a specimen. The best is in a nullah a mile off the road; it nearly equals some anthracite Coal I discovered in the Hoshungabad district some years ago, which was declared by the Bombay Committee to be better than any other Coal, Scotch or English (I believe 84 per cent.); I sent down 200 bullock-loads, and it was tried on board a steamer. This Coal would I think prove, on digging a little deeper, to be just the same; there would be no greater difficulty in removing it than from Palamow, where there is a great quantity of Coal of the Pachete kind.

EXTRACT of a LETTER from Colonel *Ouseley*, to *F. J. Halliday*, Esq.; dated Chota Nagpore, 31 December 1845.

WHEN I made the road between this and Hazareebaugh, at a place called "Badam," they had to cut along the southern slope of an ascent rather deeply, when a large field of Coal was found; this was of the same description as that called Burdwan Coal; but to the east of it about a mile, I found on examination some beautiful Coal, of which I send a specimen. It is only second to that I discovered at Bénar, in Hoshungabad, in 1834-35. Coal of this kind will do more than double what the Burdwan (Pachete) Coal does, has little ash, and I think would not leave much scoria on the bars of the furnace. In a few days I purpose proceeding again to the place. I have no doubt that this Coal will coke as well as that of Bénar, a desideratum of much importance, as Indian Coal has not been found to coke (so says Dr. McClelland), with the exception of that at "Bénar."

The

II. *Chotessgurh, Berar Rajah's Country.*



173. On the Hutsoo* river, a large branch of the Mahanuddy, great beds of Coal occur a little to the south of the fort of Koorba. The bed of the river, for a distance of 716 yards, appears to be composed of alternate beds of white sandstone, slate-clay, and Coal. These rocks dip from 1 to 3½ inches in the foot. The annexed sketch exhibits the relative position of this Coal to the fort : *a. a.* the bed of the Hutsoo river, about 300 yards broad ; *b.* the fort ; *c.* bed of coal intersecting the river in the direction of W.N.W., dipping N.N.E. 1 inch in 12, and presenting an outcrop of probably about 100 yards ; *d.* a bed called coal-clay, as marked on Colonel Ouseley's sketch ; *e.* a bed of Coal dipping 1 inch in 14, and apparently, from the sketch of Colonel Ouseley, 200 yards in thickness.

The quality of this Coal is stated to be very superior, although not yet established on analysis.

Although this Coal is situated at a distance of 320 miles inland from Point Palmyras, yet the Mahanuddy is easily navigable to Sumbulpore, within 100 miles of the Coal ; it deserves to be considered, therefore, how far the superior quality of this Coal might render the Koorba beds worthy of attention for the supply of the coast.

ABSTRACT of Coal at *Chotessgurh.*

Province.	District.	Field.	Locality.	Beds.
Chotessgurh	Ruttanpore	Hutsoo River	{Near the Fort of Koorba }	<i>a,</i> — ? <i>b,</i> 200 yards.

III. *Singrowli.*

NOTES—*continued.*

The Coal I now send is superficial. On cutting deeper into the mass, which is not in thin strata, as is usually the case, but of vast thickness, I am convinced it will prove as good as any Welsh or English Coal. It is also as well that I should mention that iron is now made close to where this Coal is, but with charcoal.

EXTRACT of a LETTER from Lieutenant Colonel *Ouseley* to the Secretary of the Coal Committee, dated 16 August 1841.

I found Coal also in the Husdah River at Koorba, near Ruttanpore (in Chotessgurh), of a very valuable kind, and laid open by the river for a vast extent.

EXTRACT of a LETTER from the same, to the same, dated 27 April 1845.

The Koorba Coal could be sent down the "Husdah" to the Mahanuddy in the rains, and a collection made of it at Sumbulpore, whence the boats could reascend as often as the weather would permit.

At Chichowli on the Husdah, where there is a small fall of 20 feet over black marble, it may, perhaps, be necessary to have another Coal depôt here, the boats from Koorba to Chichowli unloading and returning to Koorba—the Sumbulpore boats loading at Chichowli, for there are no further obstructions to the navigation. All this part of the country I have personally examined.

I have sent for some of the Koorba Coal, which you shall have as soon as it arrives. This Coal is nearly as good as that of Bénar, and the field appears to equal it in size. I give a separate sketch of the locality in which I found it on the 14th March 1840.

* Or more strictly Husdeh ; but Hutsoo is the name given on Arrowsmith's map.

III. *Singrowli.*

174. On the tablelands at the head of the Soane, 50 miles to the westward of Palamow, Coal has been found in several situations.

Kotah.—On the Bulloa Nuddee, a mile N.N.W. of the village of Kotah, four thin seams of Surface Coal have been found, varying in thickness from 6 inches to 14 inches.

The beds are supposed by Captain Wroughton (to whom we are indebted for what we know regarding them) to extend towards Burdee, in the same district.

175. At a place called Lewallah Mookhe, eight miles S.W. from Kotah, and seven miles W. from the town of Sipore, in the territory of the Rewah Raja, a bed of Coal one foot thick occurs.

ABSTRACT of Coal in *Singrowli.*

District.	Field.	Locality.	Bed.
Singrowli -	Kotah - -	Mowzah - -	{ 6 inches 1 foot 2 inches
	Sukhwon - -	Lewallah Mookhe - -	

IV. *Surgooja.*

176. On the western side of a high tableland called Maynpat, situated between the tributaries of the Hustoo and the Soane, Coal of superior quality occurs in several situations.

The first is in the bed of the Rehar River, a tributary of the Soane, about seven miles east from Burra, on the road to Dondra. The extent of the Coal is not particularly described, Colonel Ouseley merely remarking that it is of very fine quality, like that of Koorba, and in great quantity.

At Manpore, about 14 miles west by north of Burra, and about eight or ten miles west of the celebrated hill-temple of Ramgurh, a bed of superior Coal occurs. The situation is further defined as 16 miles south of Cherghur.

ABSTRACT of Coal in *Surgooja.*

Province.	Field.	Locality.	Bed.
Surgooja -	Manpore - -	16 miles south of Cherghur	3 feet
	Rehar River - -	7 miles east of Burra -	Many yards thick

V. *Sohagepore.*

NOTES—continued.

Referring to Arrowsmith's map, the Singrowlie Coal at Kotah would seem to be situated as near to Chunar as the Palamow Coal is to the Soane, or Burdwan to the Hooghly.

Captain Wroughton, adverting to this subject in a letter to the Revenue Board, 30th April 1840, remarks:—"Many reasons induce me to believe that I can pursue the Kotah strata to some situation adjacent to the Goput River, which forms a conflux with the Soane at the town of Burdee, from whence the Coal could be conveniently and cheaply conveyed, by a road uniting with the Mirzapore and Jubbulpore Road."

The following indications of the existence of Coal in the direction of Burdee are stated—the first on the authority of Captain Wroughton, the others on that of Captain Waugh. It is not, however, to be understood that the *carboniferous* beds alluded to are Coal, but something, in the opinion of Captains Wroughton and Waugh, usually connected with it:—

1. In the Demarh Nullah, which flows into the Goput at a point S. 25 W. 27 miles from the town of Burdee, situated at the conflux of the Soane and Goput Rivers, *carboniferous* beds are found.

2. Again, in the Goput River, at the village of Summurd, a distance of 37 miles S. 25 W. from Burdee, *carboniferous* beds occur.

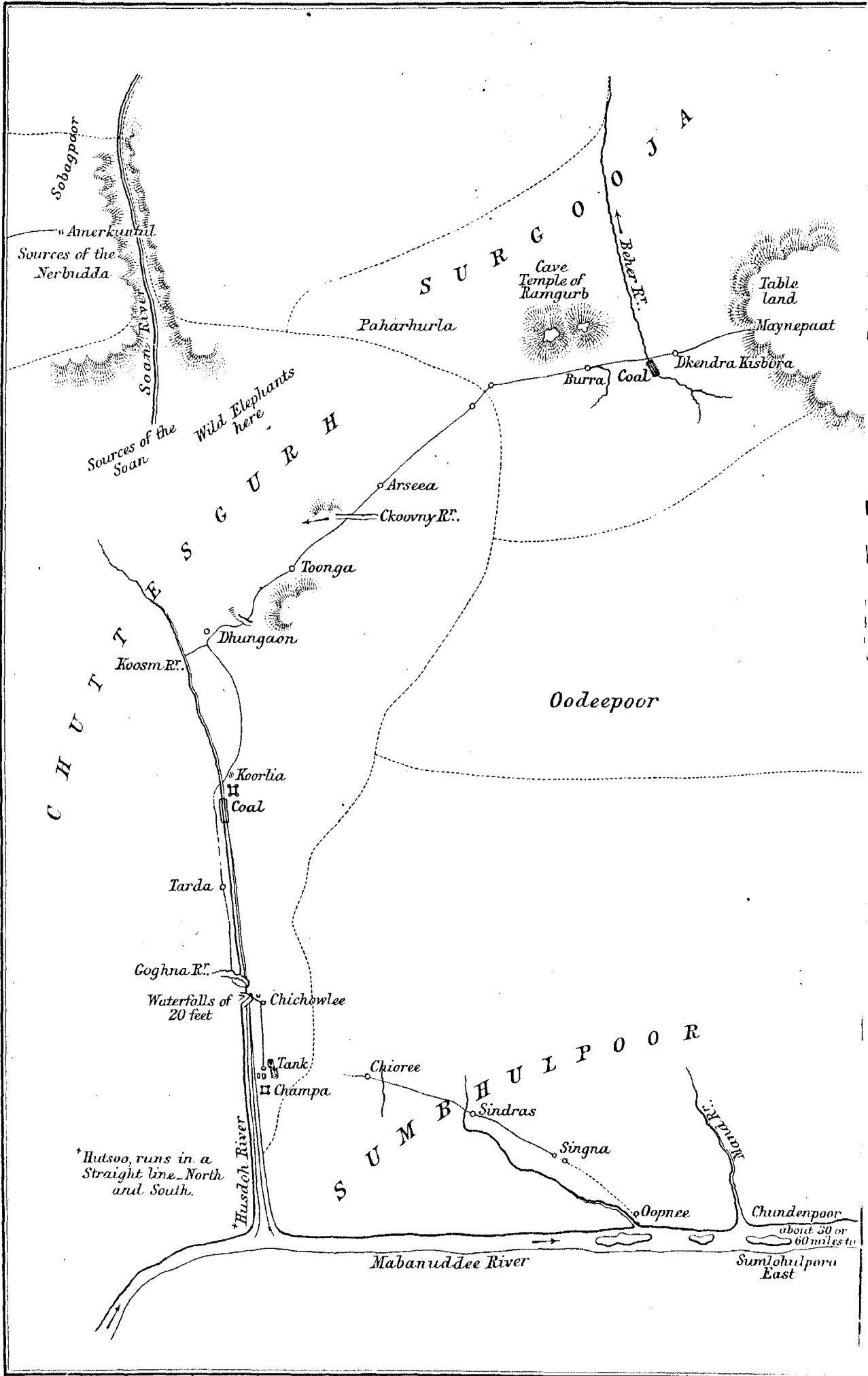
3. Again, at two places about 4½ miles S. 25 W. from the last-named.

4. Again at Neoru, S. 13 miles from Sammurd, *carboniferous* beds are found.

5. At a place called Pipperah, 60 S.W. 14½ miles from the Grand Trigonometrical Station Moreagurh, similar beds occur.

6. Again at Koraree, in the Kanuk Nuddee, 4½ miles south of the preceding, *carboniferous* beds were observed by Captain Waugh on the route from Amerkuntuk to Chunar, *via* Burdee.

N. B.—From the conflux of the Goput and Soane at Burdee town, this last point bears S. 21 W., distance 68 miles to Moreagurh Grand Trigonometrical Station.



V. *Sohagepore.*

177. In the same parallel of latitude with Singrowlie, and intermediate between that district and Jubbulpore, Coal has been found of excellent quality in several places, indicating so many great Coal districts.

A few miles north-west of Sahagepore, and at an equal distance from the Soane, Coal is reported on the authority of the late Major Franklin to exist, but there would appear to be some doubt as to the precise locality; and again it is said to occur three miles south-east of Sohagepoor, at the junction of the Tipah with the Soane, but this locality is also doubtful.

178. *Keyverji River.*—About two miles from the junction of the Keyverji river with the Soane, and one mile from the village of Seetamadhi, the Keyverji river intersects a bed of soft black shale, at a distance of 20 yards from the east bank; in this situation Coal occurs, but to what extent is not stated.

179. *Johilla River.*—On the banks of the Johilla, a feeder of the Soane, near a place one mile south-west from Palee, Coal occurs. The two last localities have been communicated to the Committee by Dr. Spilsbury, on native testimony.

Cheirdiah.—Coal is said to occur in the Rewah territory near Cheirdiah, but on what authority does not appear.

ABSTRACT of COAL in the Sohagepore and Nagpore Districts.

Province.	District.	Field.	Locality.	Beds.
Central Province	Nagpore -	Soane -	{ North-west; Sohagepoor	Not stated.
			{ South-east; Sohagepoor -	Not stated.
	Sahagepore -	{ Keyverji -	Near Seetamadhi -	Not stated.
			{ Johilla -	Near Palee - - -
Rewah -	- - -	Near Cheirdiah.	—	

NOTES—continued.

EXTRACT of a LETTER from Lieutenant Colonel *Ouseley* to the Secretary of the Coal Committee, dated 16 August 1841.

In the Rehar river, I found also great quantities close below the table land of the Mynpat, Surgooja.

Coal is applied to no use whatever by the natives. Indeed it was very singular to find that they were in every instance where newly discovered, ignorant of its being combustible; accident, one would have supposed, might have given them that knowledge. I shall send for specimens of all the Coal I know of as being distinct beds or fields, and of the iron ore, and forward them to you.

EXTRACT of a LETTER from Lieutenant Colonel *Ouseley* to the Secretary of the Coal Committee, dated 27 April 1845.

THE Koorba Coal is much the same as that at Benar. So is the Coal of the Rehar river.

— Between Burra and Dondra Kishora in the Surgooja Province, west of the Maynpat, in the Rehar river, which falls into the Soane, there is very fine Coal like that at Koorba, and easily got at.

1. In the pergunnah of Dhungewan, district of Sohagepore, at a point two miles east by south from the village of Pusan in the Keyverji Nuddee which falls into the Soane at a point 5½ miles north-east from the chief village of Dhungewan, an outcrop of surface Coal is found of about one foot thick.

2. Johilla Nuddee, at a point 6½ miles south-east from Singurrah, Coal occurs with shale and a species of iron clay, about 20 feet down the bank; thickness of the Coal, one foot.

The above is stated on the authority of Captain Wroughton. The following on that of Dr. Spilsbury, in a letter addressed to the Secretary of the Coal Committee, under date 2d October 1840.

The Keyverji and other specimens and papers relate to the sites of Coal, not very promising certainly, but without visiting the spots it is difficult to say what promise would be afforded of better; but still it shows what an extensive Coal field there is at a greater or less depth. In the Johilla, a feeder of the Soane river, near Palee, we met with traces, as the specimens collected on a trip to Umurkantuk (which I am now sending down) will show; and again near Cheirdiah in the Rewah territory.

NERBUDDA.

Nerbudda.

180. THE Nerbudda valley promises to be the nearest, if not the only direct source from whence supplies of Coal are to be furnished to Bombay, from the continent of India.

Our limited knowledge of the Nerbudda, and the objections to the climate, whether well or ill-founded, are obstacles that may retard, for a time, the necessary improvements required to render the Coal available.

181. There are difficulties, however, which from the necessity of overcoming them, seem to have been only intended as proper incentives to human enterprise. Of these, perhaps the obstruction to the navigation of the Nerbudda is one, particularly as the Coal of the Nerbudda valley is situated more conveniently with regard to Bombay, than that of Pennsylvania, to New York and Philadelphia.

In the case of the Nerbudda, the difficulty would consist in evading the impracticability of the river by means of a railroad for a distance of 60 to 90 miles between Tullockwarra and Chiculda, which, so far as we can glean from all official reports that have been made on the subject, would give 290 miles of improveable river.

The Nerbudda Coal is 350 miles distant from Bombay, while that of Carbondale in Pennsylvania, is 250 miles distant from Philadelphia and New York; but in the former case we should only have a difference of level of about two feet per mile to overcome, while in the latter the Americans had an average of 9 feet 7 inches per mile throughout to encounter.*

182. The greater part of the Coal in use at Bombay is, we presume, at present the produce of English mines; and we know the Peninsular and Oriental Company depend chiefly on English Coal for the supply of their large steamers between Calcutta and Suez. But whatever the resources of Great Britain may be in a mineral so essential to her own domestic improvement, they should not be unnecessarily drained for the navigation of the eastern seas.

This reason alone might be sufficient to warrant such arrangements as would render the abundant repositories of superior Coal in India available for the gradually increasing public wants.

183. Coal occurs extensively, and of very superior quality, in three different districts in the valley of the Nerbudda.

I. Gurrawarra district, on the Seeta Rewah or Sakar river, which falls into the Nerbudda about 70 miles above Hoosingabad.

II. In the Baitool district, intersected by the Towah river, which falls from the south into the Nerbudda at Hoosingabad.

III. At the head of the valley on the banks of the Nerbudda itself, near Jubbulpore.

I. Gurrawarra.

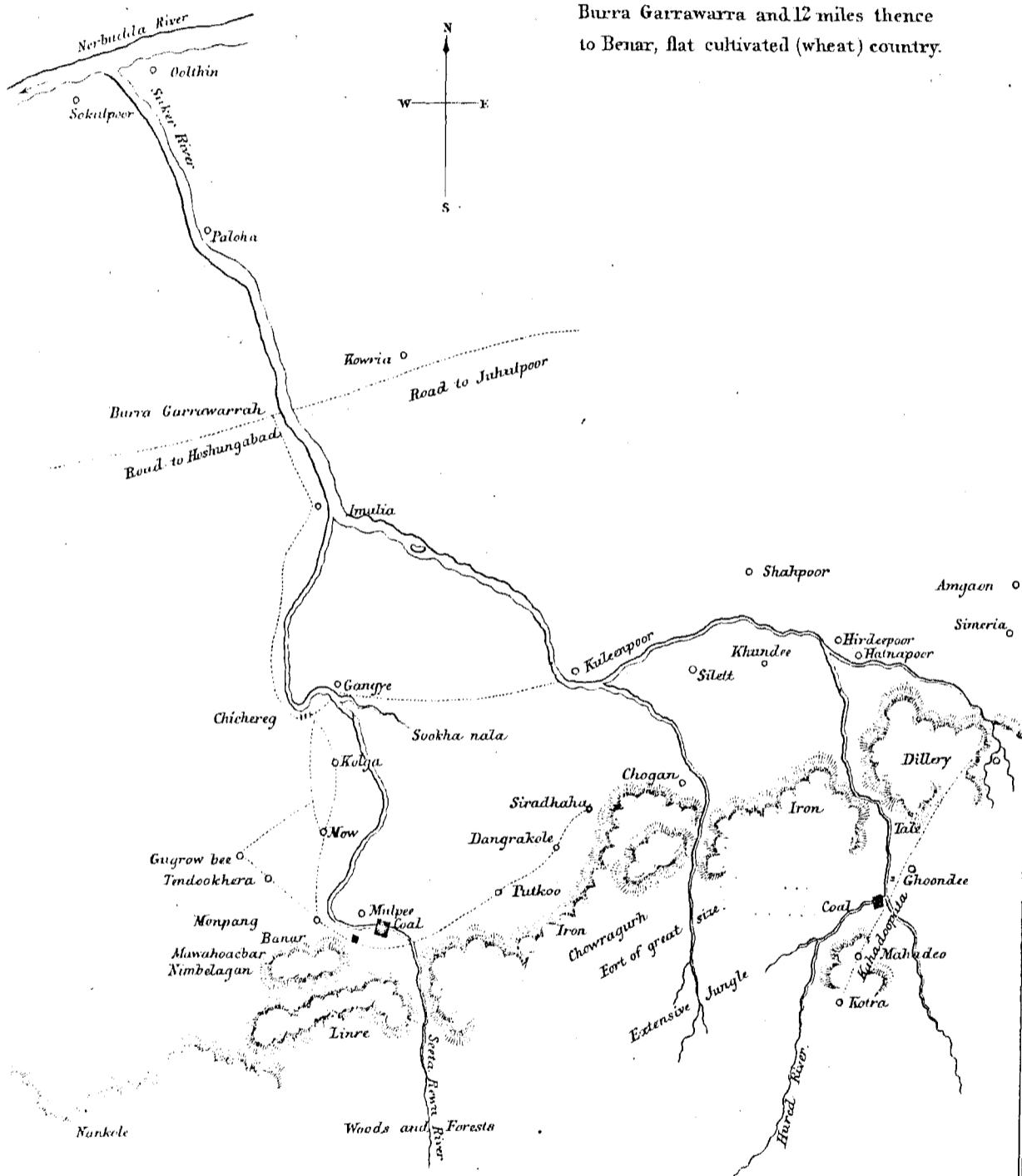
184. The most important Coal beds in the Nerbudda valley are situated in the Gurrawarra district, 70 miles above Hosungabad. Indeed they would appear from the notes of Colonel Ouseley to be the most important in India, not merely from their extent, but also on account of the superior quality of the Coal. They occur at Benar on the Seeta Rewa river, a branch of the Sukur, which falls into the Nerbudda river in the Gurrawarra district from the Mahadeo Hills, on the south side of the valley.—(See sketch.)

185. The Benar Coal is exposed on both banks of the Seeta Rewa river, at a point where that stream issues from the Mahadeo Hills. The Seeta Rewah flows from

* *N.B.*—A Report on this subject will be found in the records of the late Coal Committee, some time since deposited in the Asiatic Society.

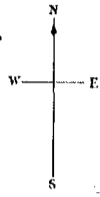
SKETCH OF THE COUNTRY NEAR THE BENAR COAL FIELD.

About 12 miles to the Nerbudda from
Burra Garrawarra and 12 miles thence
to Benar, flat cultivated (wheat) country.

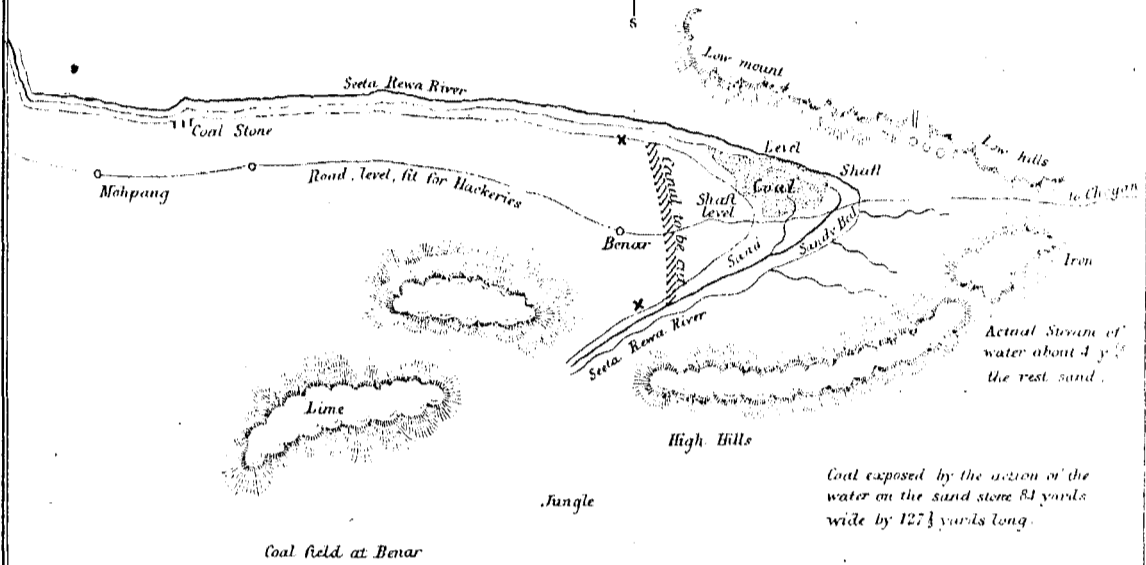


SKETCH N^o 1.

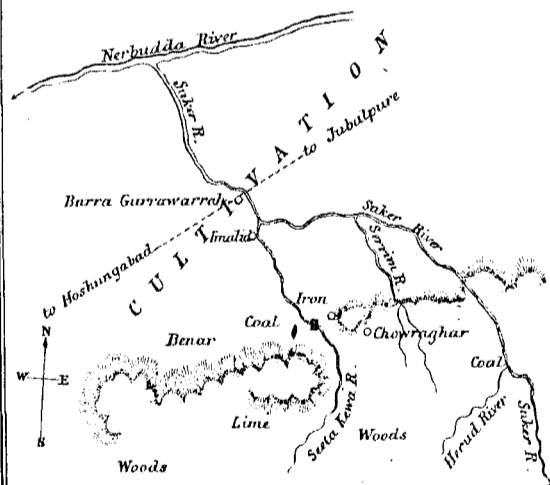
By cutting a Canal from x to x the River would be left dry all the year, where the coal is.



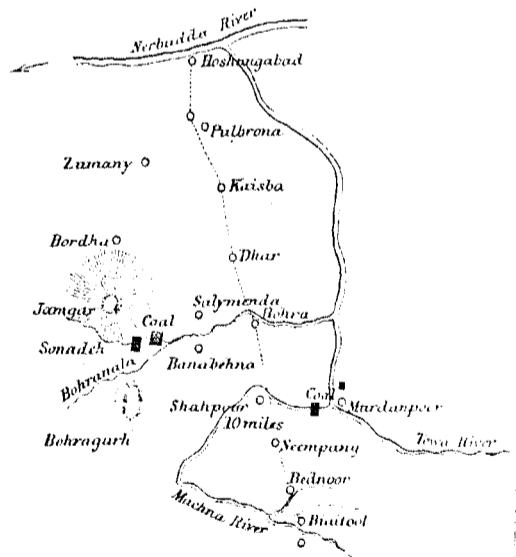
From Benar to the Coal about 400 yards.



SKETCH N^o 2.



SKETCH N^o 3.



from thence through a rich cultivated plain, a distance of 12 miles to the town of Gurrawarra, where it joins the Sukur which falls into the Nerbudda, after a continued course of 12 miles more, through the same rich flat country. The whole distance from the Nerbudda to the Coal mines at Benar, being 24 miles, with a cart road the whole way.

Nerbudda.

It would appear from the annexed notes of Lieutenant Colonel Ouseley that there are three beds of Coal in this locality of 20 feet, 40 feet, and 25½ feet in thickness, respectively, covered merely with—

- 1st. Sandstone, 5 to 6 feet.
- 2d. Good Coal, 3 feet.
- 3d. Quartz sandstone, 1 foot, after which come the three successive beds of Coal of the dimensions above stated.

186. *Kotra*.—On the Hard river, one of the tributaries of the Sukur, 20 miles to the eastward of Benar, three beds of Coal were found by Colonel Ouseley, the largest of which is 4 feet in thickness. These beds are situated near the confluence of the Hard with the Sukur.

ABSTRACT of COAL at Gurrawarra.

District.	Field.	Locality.	Bed.
Gurrawarra	Seeta Rewa River	Benar	a, 20 feet. b, 40 feet. c, 25½ feet.
	Kotra	Junction of the Hard with the Sukur Rivers	a, 1 foot. b, 2 feet. c, 4 feet.

II. *Baitool District.*

187. Baitool Coal district is situated at a distance of 30 to 40 miles from the Nerbudda river at Hoosingabad. The intermediate country is rough and hilly, without water carriage. But the beds of Coal are numerous, large, near the surface; and the mineral itself of superior quality.

188. *Towah*

NOTES.

By Lieutenant Colonel Ouseley.—Benar, discovered 4th January 1845, centre of the bed examined, as far as 40 feet thick, right bank 20 feet thick, left bank 25½ feet thick.

Benar Coal exposed by action of the water, 84 yards wide, and 127 yards 12 inches long in the river.

- Sandstone - - - - - 5 to 6 feet.
- Good Coal - - - - - 3 feet.
- Quartz Sandstone - - - - - 1 foot.

Thirty or 40 feet in the centre bed of the Coal 83 per cent. better than the Scotch Coal tried on the "Indus" Steamer at Bombay.

Reported by Colonel Wood, Secretary, Bombay Government, 29th June 1839.—I could not ascertain how thick the lowest bed of Coal was, more than 40 feet.—(See sketch, No. 1.)

By excavating, no doubt the 24 miles from the Coal to the Nerbudda would admit of conveying the Coal by water. But it is to the railway I look for the removal of the Coal; for the Bombay and Calcutta line should actually commence here, where the iron is produced (this is the only Coal that cakes in the way the Welsh Coal does, in long heaps); and along the base of these hills the railroad should run; they are a continuation of the "Mahadeo" Hills or "Sissinchul," and extend away west, under different names, to Asseergurh. In Rajaborang and the Relybest Hill, Coal is found, pieces having been brought in to me; but I never visited the locality. Ever since 1836 I have thought it advisable that this Coal should be first applied to smelting the ore (iron) making it into rails, and laying them from the mines towards Bombay and Calcutta at the same time.—(See sketch, No. 2.)

The annexed sketch shows the relative position of the localities of Coal in the Baitool district, on the authority of Colonel Ouseley.—(See sketch, No. 3.)

Nerbudda.

188. *Towah River*.—At a place called Mardanpore, on the Towah river, four miles east of Shawpore, and at a distance of 40 miles from the Nerbudda river, a little above Hoosingabad, a six-foot bed of Coal has been found by Colonel Ouseley.

189. *Boragurh*.—At Boragurh, near Mardanpore, two small beds of Coal were found by Colonel Ouseley, one of them 21 inches and the other 12 inches thick.

190. *Sonadeh*.—Eight miles south of Bhoorda, on the Bhoorna river (one of the tributaries of the Towah), Coal occurs on both banks; neither the number, size, nor other peculiarities of the beds at this locality being mentioned.

ABSTRACT of COAL in the Baitool District.

District.	Field.	Locality.	Beds.
Baitool - - -	Shawpore - - -	Mardanpore - - -	6 feet.
		Boragurh - - -	{ 1 foot 9 inches. 1 foot.
	Bhoorna River -	Eight miles south of Bhoorda.	Size not stated; from 9 inches to 2 feet thick.

III. *Jubbulpore District.*

191. Coal occurs at the head of the valley, on the banks of the Nerbudda itself, of a very superior quality, and in extensive beds, as far as they are known.

192. *Lemata Ghat*.—About nine miles from Jubbulpore, a very large bed of Coal, many yards in thickness, crosses the bed of the Soane obliquely near Lemata Ghat. This Coal is of first-rate quality. (*See 77 in the Analyses of Indian Coals.*) It is quarried in small quantity by the European residents at Jubbulpore from the bed of the river, where it is left dry after the rains.

193. A second bed occurs 400 yards lower down the stream, also of large size, but the quality of the Coal is said to be soft.

194. In the station of Jubbulpore, Coal has also been found at a depth of 70 feet, thus proving the existence of extensive Coal formation in this vicinity.*

ABSTRACT of COAL at Jubbulpore.

District.	Field.	Locality.	Beds.
Nerbudda - - -	Jubbulpore - - -	Lemata Ghat - - -	12 feet.
		400 yards lower down the river - - - - -	6 feet.
		Cantonments at a depth of 70 feet - - - - -	Not traced.

NOTES—continued.

NOTE by Colonel Ouseley.—Sonadeh Slope, down towards the north, 6, 7, 8, or 9 feet sandstone.

1 foot 9 inches Coal - - - - - 1

9 inches sandstone.

9 inches Coal - - - - - 2

3 feet sandstone.

1 foot Coal - - - - - 3

2 feet sandstone.

10 or 12 inches Coal - - - - - 4

Two miles west of Sonadeh more Coal is found.

* Lieutenant Colonel Cox, 58th Native Infantry, forwarded to the Agri-Horticultural Society specimens of a superior Coal, said to be from the Nerbudda, and which nearly corresponds in composition with Scotch Cannel Coal. (*See 100 in the Analyses of Indian Coals.*)

C U T C H.

195. FORTY miles from the northern coast of Cutch two thin seams of Coal have been observed, varying from 1 inch to 20 inches in thickness. They are exposed by the bed of a river near Bhooj, between Seesugud and Koohee, at a place called Trumboo, and also at Doojapore.

Cutch.
— •

196. No expense has been spared to follow up these indications, but without success; a depth of 190 feet was penetrated, chiefly through thin bedded sandstone of various colours, its texture changing to coarse and fine argillaceous, siliceous, and ferruginous, friable and hard, together with numerous layers of clay and pyritous iron ores, with a few layers of slate clay; and finally, at a depth of 190 feet, extremely fine particles of quartz, with an artesian spring of water, were reached.

ABSTRACT of COAL at Cutch.

District.	Field.	Locality.	Bed.
Cutch - - -	Near Bhooj - -	{ Doorjapore - - - - In the bed of the Trumboo } River - - - - }	20 inches. Several thin seams.

TABLE of INDIAN COALS analysed in the Laboratory of the Honourable Company's Dispensary, from January 1839 to April 1846, in continuation of Prinsep's Table, "Journal Asiatic Society," 1838, p. 177.

No.	LOCALITY.	QUALITY.	Specific Gravity.	Composition in 100 parts.			From whom received.
				Volatile Matter.	Carbon.	Earthy and Ferruginous Matter.	
60	Moulmein - - -	Cannel Coal - - -	1.177	42.8	54.6	2.6	Mr. Blundell, 7th May 1839.
61	Hoong, south of Ramree, six miles.	Caking Coal - - -	1.32	36.	49.	15.	Capt. Bogle, 1st June 1839.
62	Tyroo Ghat, Assam - -	Ditto - - -	1.3	40.	55.	5.	Capt. Jenkins, 3d August 1839.
63	Palamow Mirall - - -	Slate Coal - - -	1.26	44.	50.	6.	Mr. Tytler, Steam Department.
64	Palamow - - -	Slaty Crop Coal - -	1.48	32.	58.	10.	Ditto, specimen marked "Palamow."
65	Palamow, "Singra" - -	Ditto - ditto - - -	1.2	25.	63.*	12.	Ditto - ditto, 10th September 1839.
66	Mergue - - -	Caking Coal, excellent	1.27	55.	40.	5.	Mr. Blundell's assistant, Lieutenant Hutchinson, 27th August 1839.
67	Byrung Ponjie Sylhet - -	Ditto - - ditto - -	1.3	34.	64.5	1.5	Major Lister, 4th September 1839.
68	Ditto, variety - - -	Slaty, inferior - - -	1.4	25.	29.	46.	Ditto - - - ditto.
69	Ditto - ditto - - -	Surface Coal - - -	-	30.	50.	20.	Ditto - - - ditto.
70	Ditto, a different sample	Caking Coal - - -	1.3	51.	42.	7.	Ditto - - - 2d January 1840.
71	Chuppra, on the Soan - -	Slate Coal, mixed - -	1.5	32.	57.5	10.5	Mr. Ravenshaw, January 1840.
72	Borneo - - -	Ditto - excellent - -	1.27	59.6	34.	6.4	Capt. Johnston, 18th April 1840.
73	Boorhath, Assam - - -	Caking Coal, ditto - -	1.2	45.	52.7	2.3	Lieut. Strong, 24th June 1840.
74	Ditto, another bed - - -	Cannel Coal, ditto - -	1.28	44.	48.	8.	Ditto - - - ditto.
75	Cheduba, Arracan - - -	Ditto - inferior - - -	1.30	46.8	41.2	12.	Capt. Bogle, July 1840.
76	Khota, Singrowly - - -	Middling - - -	1.29	54.	32.2	13.8	Capt. Wroughton, 22d Sept. 1840.
77	Jubbulpore - - -	Excellent - - -	1.49	50.	47.1	2.9	Dr. Spilsbury.
78	Near Dearee, the Soan - -	Middling - - -	1.42	37.6	58.1	4.3	Mr. Ravenshaw, 24th Nov. 1840.
79	Qulimany (Cape) - - -	Surface Coal - - -	1.6	23.2	40.16	36.6	From South Africa (Mozambique).
80	Tavoy River - - -	Cannel Coal - - -	1.72	62.	28.26	9.74	Mr. Blundell, February 1841.
81	Chittagong or Tippera Hills	Good slaty Coal - - -	1.375	64.6	24.4	11.	Mr. Sconce, April 1841.
82	Petchelee Gulf - - -	Anthracite - - -	1.71	20.	74.	6.	Reed, through Captain Johnston, April 1841.
83	Doolbradepore - - -	Inferior slaty Coal - -	1.4	42.	38.	20.	Mr. Jas. Puntet, May 1841.
84	Jaipore, Upper Assam - - -	Superior - - -	1.3	48.	46.2	5.8	Mr. F. R. Hampton, 8th July 1841.
85	Pulo Chermin, Borneo - -	Very superior - - -	1.34	64.	32.5	3.5	Marine Board, 8th November 1841.
86	Pulo Keng, Arrang, Borneo	Inferior - - -	1.39	43.	30.5	26.5	Ditto - - - ditto.
87	Bikrampore, Cachar - - -	Superior - - -	1.3	64.8	33.2	2.	Capt. Guthrie, Engineers, 7th March 1842.
88	Gudada River, Dhubary - -	Inferior - - -	1.4	57.4	24.6	18.	Discovered by Mr. J. Bedford, Assistant Revenue Surveyor, 1st February 1842, received from Major Jenkins.
89	Bunarosse Caribari Hills -	Brown Coal, burns freely	1.4	50.	40.6	9.4	Ditto - - - ditto, March 1842.
90	Mirampara, or Balajora Caribari Hills.	Ditto - - -	1.2	64.	26.	10.	Ditto - - - ditto, March 1842.
91	Salkora, Caribari Hills - -	Good brown Coal - - -	1.3 to 1.4	70.	25.4	4.6	Ditto - - - ditto, March 1842.
92	{ New Mine? - - - } { Burdwan? - - - }	Superior - - -	1.3	36.	60.	4.	Major Henderson, August 1842.
93	† Shoughie (China) - - -	Very superior - - -	1.29	33.6	64.	2.4	Assistant Surgeon G. Playfair, late Surgeon of the Phlegothan, 1843.
94	Near the falls of the Jamoona (Assam).	Without exception the best specimen of Coal on the list.	1.2	46.	53.4	6.	Major Jenkins, 24th April 1844.
95	The bed of the Terro Nuddee (Assam).	Superior - - -	1.3	62.	35.2	2.8	Major Jenkins, 26th April 1844.
96	{ a. } { b. } { c. } Nicobar Islands - - -	Weathered specimen - -	{ 1.3 1.3 1.3	{ 61.4 57. 49.	{ 34.2 40. 46.	{ 4.4 3. 5.	{ Messrs. Mackay & Co., 27th May 1845.
97	Dikhoo (Assam) - - -	Most superior - - -	1.3	28.	66.	6.	Capt. Rogers, 25th January 1845.
98	Diphoo, a tributary of the Jamoona, eight miles above the falls.	A dull earthy Coal - -	1.3	44.6	38.8	16.6	Messrs. Masters & Wood, March 1845.
99	Badam - - -	{ Very superior - - - Good - - -	{ 1.29 1.31	{ 32. 27.	{ 60. 61.	{ 8. 12.	{ Col. Ousely, December 1845.
100	Jubbulpore - - -	Cannel Coal - - -	1.3	59.	37.	4.	Forwarded by Lieutenant Colonel Cox to the Agri-Horticultural Society, and sent for analysis by James Hume, Esq., 19th March 1846.

J. McClelland, Assistant Surgeon,
Secretary Coal Committee.

* The large proportion of carbon in this Coal would render it an excellent fuel if mixed with Cherra Coal, in which bitumen preponderates, while both might be had more reasonably at Dinapore than Burdwan Coal.

† Locality of the mine is about 15 miles from the mouth of a tributary of the Yanktse-Kiang called Woosung, which joins the former at a distance of 40 miles from the sea.

DESCRIPTION of the annexed MAP and SECTIONS, illustrative of the Distribution of COAL in *India*.

No fact is better established than that Coal was originally formed in small isolated or detached basins.

It is incorrect, perhaps, to say that the same bed may run to any very great or considerable distance, however appearances considered, without reference to full geological particulars, may seem to suggest such a conclusion. Lieutenant Hutchinson, in his Report on the Coal beds of Arrakan, refers the veins observed at Bolonga and Sandoway, though 200 miles apart, to one and the same bed; and Mr. Homfray, in a Report on Palamow Coal, dated 10th July 1837, states that it is traceable to Burdwan and Beerbhoom.

Such supposed connexion is, however, more apparent than real, and depends on the direction of mountains, rather than upon the original extension of the same bed, which can seldom be traced more than a few miles.

This fact in the history of Coal is of much practical importance; for however much the associated rocks may appear to be alike, we have reason to expect the local circumstances on which the value of the Coal depends to have something peculiar in them, in every situation in which it occurs.

West of the Ganges the best Coal is always either the deepest or most remote from water carriage. There may be exceptions to this rule, but we know the Hazareebaugh, the Surgooja, the Schagepore; and the Nerbudda Coals to be superior to those of Burdwan, Cuttack, Rajmehal, and Palamow.

This we can explain from the fact which has been established by Mr. Murchison and others in the history of Coal, namely, that the main or richest and best beds are always lowest in the series. Being lowest, they consequently require to extend a greater distance at an inclined angle before they reach the surface. Thus, in the Section A, B, plate 2, the upper bed of Burdwan Coal crops out at Serampore (*a*), when the lower, or main Coal (*e*), extends 60 miles further into the hills before it crops out.

Out-crops of Coal are always arranged around or on the flank of mountains or disrupted strata. Parisnauth is the base to which the Burdwan Coal is inclined on the south-east, and the Ramghur beds on the south, Palamow on the north, and Rajmehal on the east.

The high lands of Mynpatt would also appear to be the base around which the Surgooja beds are arranged.

There may be a difference of quality and appearance between the upper, or surface, and the lower, or main beds of Coal; but still they both equally belong to the same formation.

Captain Tremenheere was therefore doubtless in error in supposing the impression of plants he observed in the Coal beds on the Great Tenasserim to be those of recent plants.

So also is Mr. Homfray most unquestionably in error in supposing the grasses he found growing over the Coal beds of Palamow to be those from which the Coal of that valley were formed.

Were those observations correct, such beds could not belong to the true Coal measures, as we know they do, from the nature of the mineral itself, as well as from other minerals and fossils with which it is connected.

Section C. D. plate 2, represents the general level from Hingolee to the coast.

Section G. H. plate 2, represents the same from Chotasgur to the coast. I. K. plate 1, represents a general section of the Coal formation from Silhet to Upper Assam, which, together with Section A. B. plate 2, and all similar sections throughout this Report, are only to be regarded as affording a general idea of the

subject rather than a correct representation of the form and disposition of the beds.

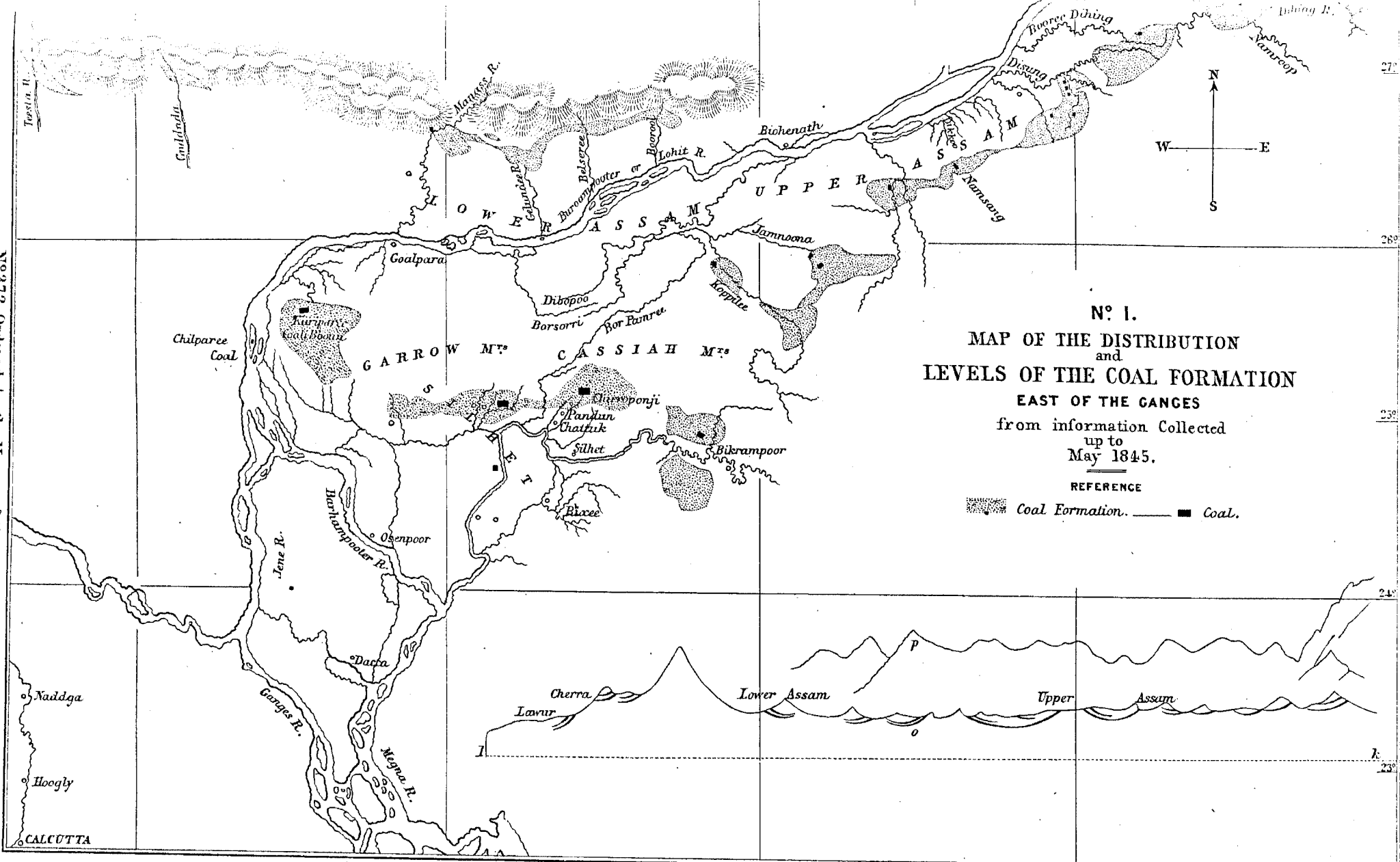
The Maps will require no further description, as they either explain themselves sufficiently, or are referred to in the text.

A skeleton Map, or Key to the Coal localities in India, has been prepared in the Surveyor General's Office, by order of Government, the Coal sites being marked on it from information on the records of the Committee, except the sites in Singrowlie, which are put down on the authority of Captain Wroughton.*

11 July 1845.

J. M. Clelland, Assistant Surgeon,
Secretary, Coal Committee.

* The map in question, together with the records of the late Coal Committee, have been made over to the Asiatic Society.



N^o 1.
 MAP OF THE DISTRIBUTION
 and
 LEVELS OF THE COAL FORMATION
 EAST OF THE GANGES

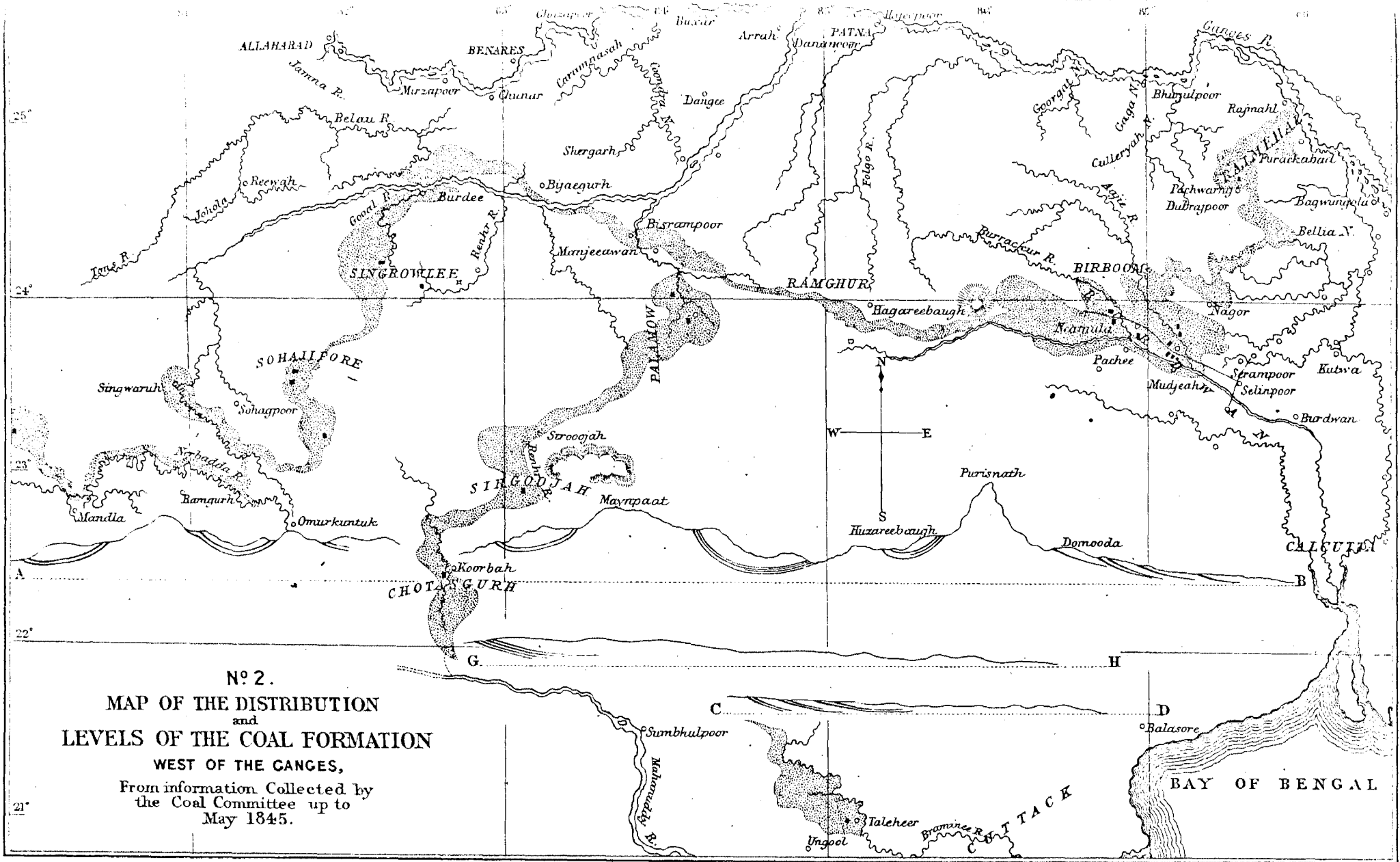
from information collected
 up to
 May 1845.

REFERENCE
 [Stippled Area] Coal Formation. [Square] Coal.

N^o 372 Ordered, by the House of Commons, to be printed, 19 June 1863

Henry H. Harwood, Printer

No 272. Ordered, by the House of Commons, to be printed, 19 June 1863.
H. Colburn, Printer, Strand.



No 2.
MAP OF THE DISTRIBUTION
and
LEVELS OF THE COAL FORMATION
WEST OF THE GANGES,
From information Collected by
the Coal Committee up to
May 1845.

RETURN EAST INDIA. (COAL FIELDS.)

To follow page 106

RETURN. EAST INDIA. (COAL FIELDS.)

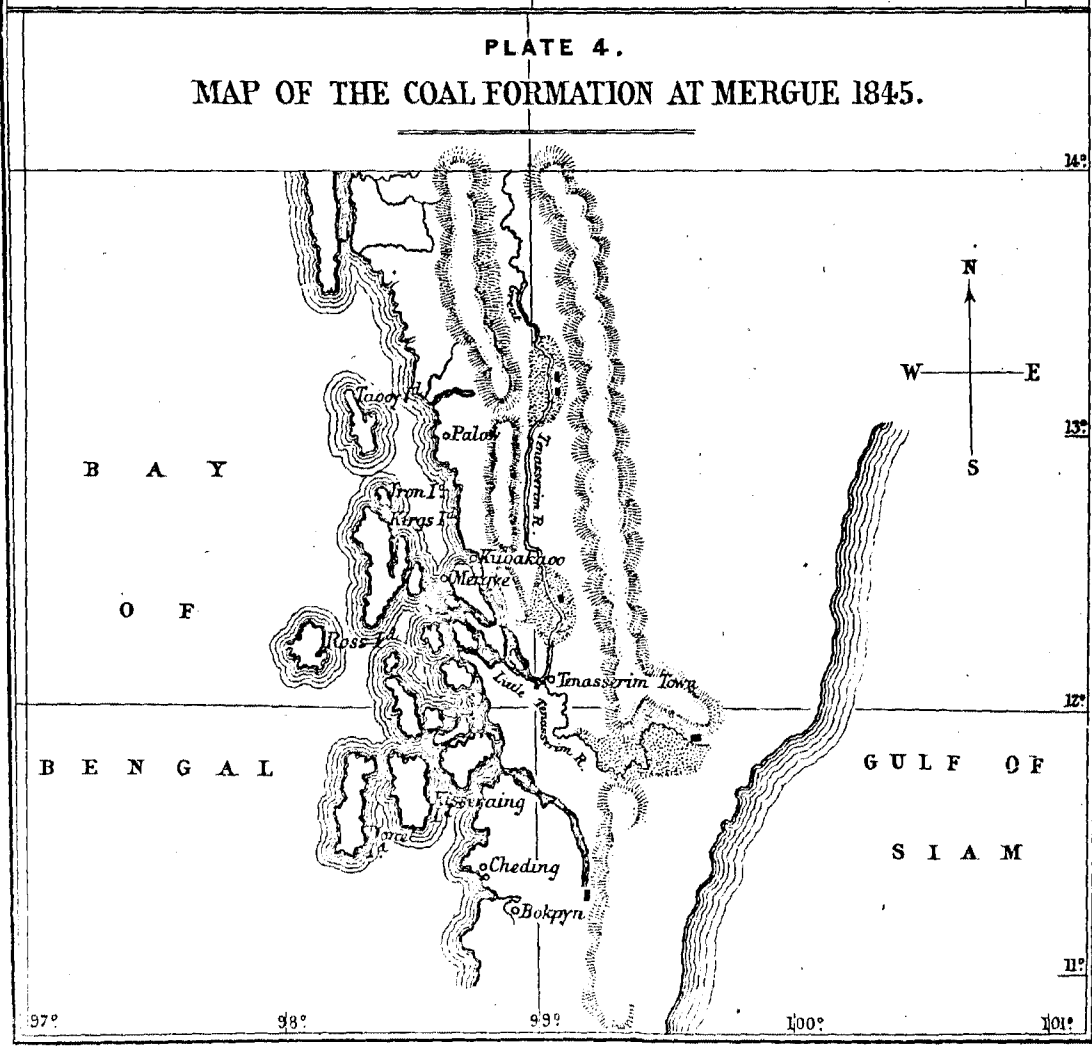
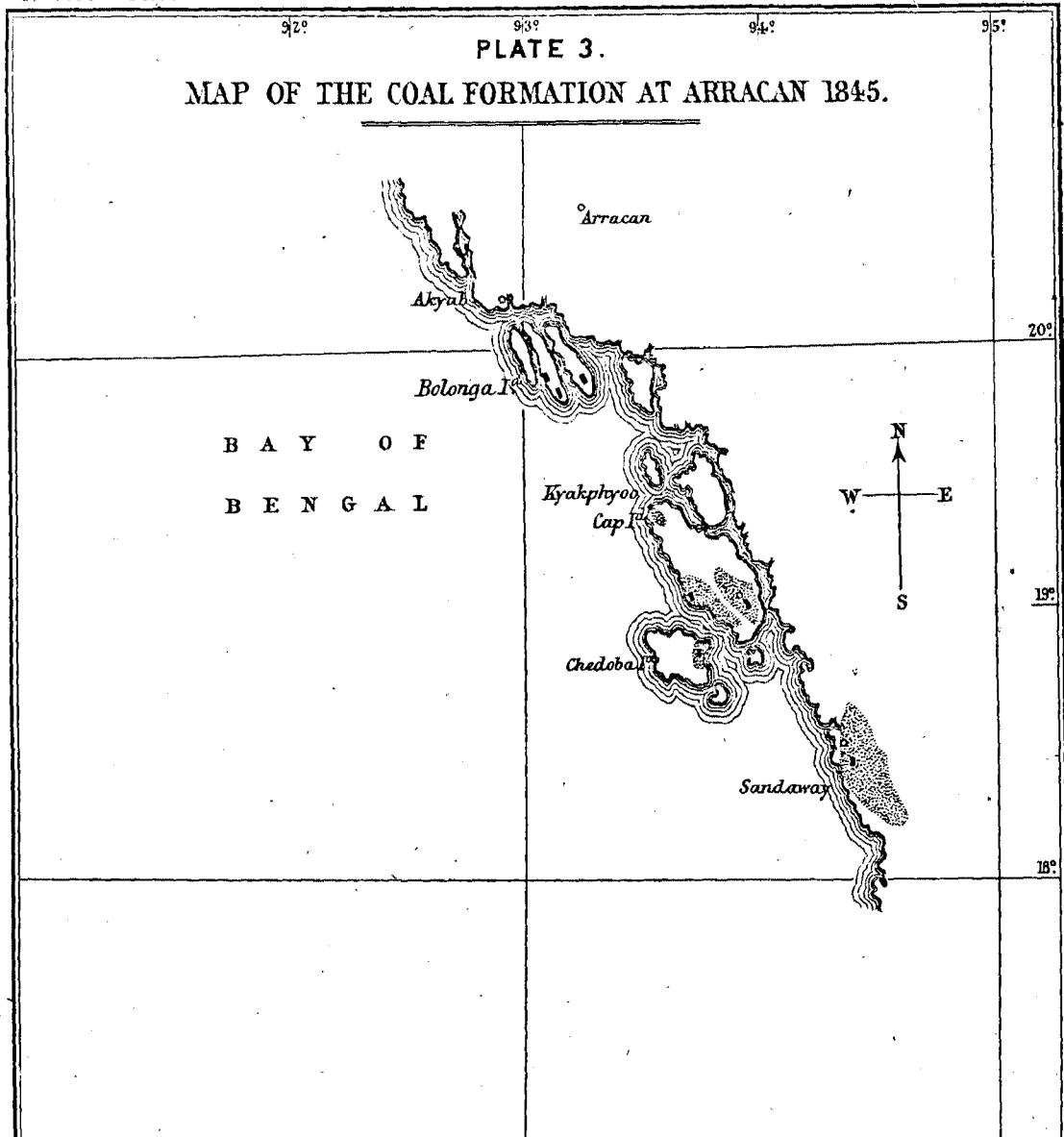


PLATE 6.

MAP OF THE COAL FORMATION AT CUTCH 1845.

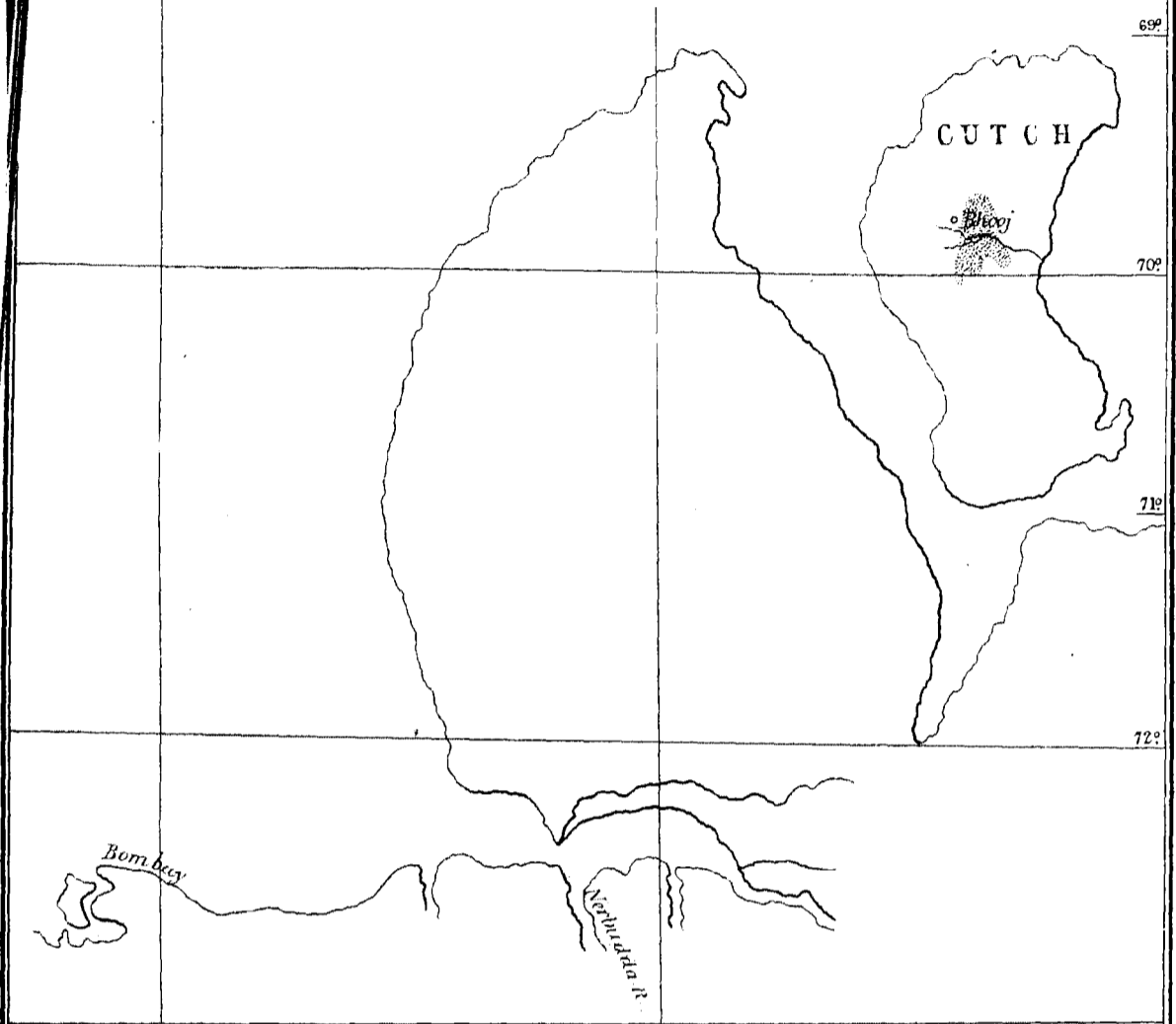


PLATE 5.

MAP OF THE COAL FORMATION AT NERBUDDA 1845.

