XV. *An account of the discovery of a mass of native iron in Brasil.* *By* A. F. Mornay, *Esq. in a letter to* W. H. Wollaston, *M.D. Sec. R.S.*

Read May 16, 1816.

Dear Sir,

Near five years have elapsed since I presented you with a specimen of native iron from Brasil. Particular reasons prevented me at that time, from making it more generally known, and since then my private affairs have not allowed me a moment to look into my notes, and give you this short account of the block from which your specimen was cut, although I have so often promised it you.

In the autumn of 1810, I discovered near Bahia, a spring of water strongly impregnated with iron, which was esteemed a most valuable acquisition in that country. This circumstance called to the recollection of the government, that, about 30 years before, information had been received of the discovery of certain thermal springs, situated at the distance of 40 or 50 leagues to the northward; and as his Royal Highness the Prince Regent of Portugal had enquired, during his stay at Bahia, whether the country possessed any thermal waters, I was requested to visit the spot where they were supposed to exist. The Governor General offered me every facility and protection, and in order to induce me to undertake the journey, some of my friends described to me an

extraordinary *stone* which had been found still farther up the country, in the same direction. It had been supposed to be silver, or iron, or that ferruginous agglomeration so common in Brasil, which often envelopes gold, and I believe sometimes diamonds. On the other hand, some persons who pretended to have seen it, asserted that it was not a mass of any metal, but had only the metallic sound on being struck, common to numerous blocks of stone in the same neighbourhood, called by the inhabitants "serpent stones," in consequence of their exfoliating by decomposition at the surface. As the serpent casts his skin yearly, so they suppose these stones to do.

Some account of the discovery of this extraordinary mass had been given to the government of Bahia, and through the inspector general of the militia, a man of great talents and considerable learning, I obtained a sight of the papers on the subject existing at the government house. On reading them, I was decidedly of opinion, that the mass described was native or meteoric iron, and I determined to go to see it. But before I relate my own observations, I will give you the substance of the notes which I took out of those papers.

In the year 1784, a man of the name of BERNARDINO DA MOTA BOTELHO, while looking after his cattle, noticed the block in question, as being different from all the other stones on the spot, and informed the Governor General of the province of Bahia of his observation. His Excellency immediately ordered the head man of a neighbouring village, that is to say, at the distance of near fifty leagues, to go and examine it. He did so, and reported very marvellous things, calling the mass sometimes iron, and sometimes stone, but giving to understand that it contained gold and silver. The Governor

General commanded him, in consequence, to have it conveyed to Bahia. This man returned to the spot, and after having excavated round the block, so as to be able to get the ends of four powerful levers under it, he contrived by great exertion, with the assistance of thirty men, to turn it on its side. He observed the bed on which it rested, to be of the same scaly substance that was attached to the bottom of the mass, and about eighteen inches thick.

About the latter end of 1785, he conveyed to the spot a waggon, or rather a truck built for the purpose, and succeeded in getting the mass of iron into it, but having spent three days in this operation, the men employed were obliged to depart, in consequence of the neighbouring rivulet being brackish, and not fit to be drank. They returned, however, and yoked oxen to the truck, but they could not move it until they had put on twenty pair of oxen on each side. You must observe that their oxen are not of the strength of ours, that the ground was a loose gravel, and that the truck was constructed on the very worst plan, the wheels being fixed to the axle trees, and the two axle trees remaining constantly in a parallel position with respect to each other.

They proceeded, however, in this manner to the distance of about one hundred yards, when they got into the bed of the rivulet abovementioned, called the Bendegó. There it was stopped by the prominent point of a rock, and as the truck was only calculated to move in a straight line, it was abandoned.

I visited this mass on the 17th of January, 1811, and found it still on the waggon or truck, where it had been lying for five and twenty years. It is situated near the left bank of

the rivulet, but entirely in its bed, which was then dry, and is very seldom otherwise.

I send you a very correct outline of this mass. (Pl. XI.) It is about 7 feet long, 4 feet wide, and 2 feet in thickness, besides a sort of foot on which it now stands, of about six inches in height. The solid contents, however, cannot be inferred correctly from these dimensions, since the broad part is hollowed out underneath very considerably. After making due allowance for the cavities, I estimated, on the spot, the solid contents of the whole mass to be at least 28 cubic feet, which at 500lb. will make its weight to be 14000lb.

Its colour is exactly that of a chesnut, and is glossy at the top and sides, but the hollow part underneath is covered with a crust in thick flakes, outwardly of the colour of rust of iron, and staining the fingers. The flakes are very brittle, and the fresh fracture is black and brilliant, like some magnetic iron ores.

The glossy surfaces of the block are not smooth, but slightly indented all over, as if they had been hammered with a rather large round headed hammer.

There are several cavities in it, from the diameter of a 12lb. cannon ball, to that of a musket ball; the larger ones being shallow, but the others much deeper. They all contain the same substance as is attached to the great cavity underneath, and some of them also fragments of quartzous stones, which I was obliged to break in the holes in order to get them out.

The brown colour of the surface of the block is merely a very thin coat of rust, for the slightest scratch with a knife produces a bright white metallic streak; and yet,

wherever the mass is struck with a steel, it gives out sparks abundantly.

When rubbed with a quartzous pebble in the dark, it becomes beautifully luminous.

The block is magnetic, and even possesses well marked poles. In the outline I have indicated their position. The N. pole is not so well characterized at the shorter point of the same end.

The N. pole of the block lies at present nearly E.N.E.; before it was removed it lay about N. N. E. I ought to tell you that LA MOTA BOTELHO, who first noticed this object, accompanied me, and, as he was present at its removal, he was able to give me much information, being a very intelligent man.

The N. pole is by much the most massive end, and lay deeper in the ground than the other.

No part of the mass has the power of attracting iron filings, whether the spot have been filed to brightness or not.

I had provided myself with a sledge hammer and tools for cutting off some specimens of the iron, but it was with the utmost difficulty that I could detach the few small pieces which you have seen, one of which I gave to you on my arrival in England. The largest I presented to my Lord DUNDAS, to whom I am under many obligations, and who promised to place it in the collection of the Geological Society. I also presented fragments to our lamented friend Mr. TENNANT, and to Dr. MARCET. Another specimen, beautifully crystallized, I disposed of to Mr. HEULAND, and I have only some small pieces left. As soon as the first piece was detached, I was struck with the appearance of internal crystallization not

hitherto noticed in meteoric iron, but as your specimen shows this circumstance very well, I need not describe it.

None of the fragments possess magnetic poles.

No vitreous substance appears about the mass, as in many of the known blocks of meteoric iron.

Having taken a few reagents with me, for the examination of the thermal springs which had been pointed out to me, I tried the malleable part of the mass on the spot, for nickel, and I thought at the time that its presence was indicated; but I am now satisfied that the phænomena which I noticed, might have arisen from iron alone.

I have found my specimens more liable to rust, I think, than wrought iron generally is; and in a damp atmosphere a liquid oozes out from the crevices.

I repaired to the spot where the mass was discovered, namely, on a rising ground on the left bank of the river Bendegó, and caused the soil and gravel to be removed until we came to the bed described in the government documents. We found it at less than three feet depth. I had expected to find in it a considerable protuberance, such as might have fitted the cavity underneath the mass of iron, for I was convinced that the block itself must have been firmly attached to the bed, otherwise it would not have required such a considerable power to turn it on its side.

However, I did not; and thinking that we were not exactly on the spot, I caused two trenches to be opened down to the bed, and crossing each other, the one being between two and three yards long, and the other between one and two. Every part of the bed that was uncovered was perfectly flat and horizontal, except where we dug first; there it was broken, and,

according to the statement of LA MOTA BOTELHO, that was done when the block was removed.

I found no termination to the bed in the directions of the trenches, and at the spot where the mass had laid, it was about one foot thick, or hardly so much; but at one end of the longer trench, not above three inches. I did not break through it any where else. Nearly the same loose gravel appears underneath the bed, as over it. I brought away specimens of the bed, which I considered extremely curious, supposing them to contain nickel. On my return to England I told you, therefore, that I hoped I had found iron ore containing nickel, for I thought that the bed, on which had rested the mass, was one of those of which there are so many all over the province. But as I gave you some specimens, I will not describe it.

The surface of the soil, or rather coarse gravel, at the spot, is about 10 or 15 feet above the main granite rock of the country.

I can only give you an approximation of the latitude and longitude of the place. Th sun was much too high at noon to take its altitude with a sextant and mercurial horizon; and the artificial horizon, which I had been compelled to construct myself, occasioned such a loss of light, as to make it impossible to observe the southern stars for determining the latitude. Different altitudes of the sun at a distance from the meridian, did not give me satisfactory results. I had with me an excellent watch, and having computed the latitude to be about 10° 20′S. I concluded the longitude to be 33′ 15″ W. of Bahia, after making every allowance, and comparing this result with those obtained before and afterwards, at the house of Major DANTAS, called Camuciatá, near Itapicurú.

The rapidity of growth in plants is wonderful in the neighbourhood of the Bendegó, although the main granite rock is so near the surface as to protrude in many places; and what lies on it is chiefly a coarse gravel, consisting of rolled fragments of quartz, felspar and granite of the size of eggs, together with smaller pebbles and sand, which contains, of course, a great deal of mica, but hardly any vegetable earth.

At about 40 leagues to the southward, are found hills of yellow and red sand stone, in which organic remains have not been found; while to the northward, there is a formation of similar hills, in which are observed most beautiful impressions of whole fishes and remains of vegetables.

Between the Bendegó and the sandstone hills to the southward, I observed a great deal of what I certainly take to be basalt. I met with balls from the diameter of two inches to that of upwards of three feet, and numberless prisms, with three and with six faces, scattered about; all of these small, that is to say, about three or four inches in length, and two or three in diameter.

To the southward of the sandstone hills is a sandy plain, almost barren, extending many miles, perhaps 60 or 80, east and west to the sea, but not 20 in breadth, where I crossed it. Small conical hillocks are scattered over it, some of which, the largest, have flat tops, and appear all to be of the same height, about 20 fathoms.

Appearances impressed me with the idea, that they were the remains of a plain which formerly extended over the one on which I then stood, but which had been washed away in a tumultuous manner by a violent current running nearly in an easterly direction. The larger hillocks appear to be

stratified, but they consist of loose sandy materials, except in so far as they contain beds of a dark red iron ore, containing imbedded minute crystals of magnetic iron ore: the thickness of these beds is about two inches, and they are exactly similar to those which are found in the clay hills of Bahia.

The smaller hillocks consist of confused heaps of gravel and loose stones, intermixed with a very large quantity of the same iron ore in fragments, and lumps of manganese, very compact, and of a steel grey colour, containing arsenic, but apparently no iron.

The dreary appearance of this plain is increased by the numerous nests of cupim, (white ants,) standing upright like so many tombstones. On being viewed nearer, they are conical, rather compressed, so that the base is elliptic. All those which I examined were precisely of the same shape. The materials of which they consist are white sand, whitish clay, and particles of wood.

Many of them were full five feet in height.

The soil of the valleys and low grounds, which are occasionally swampy, is abundantly impregnated with sea salt, which the inhabitants wash out for their own consumption; but it contains some bitter salts, which render it purgative to those who are not accustomed to it.

The thermal springs which were pointed out to me, were several, but they hardly deserve the name.

One of them was at 86° of Fahrenheit when the atmosphere was at 81°.

Another was at 88°, when the atmosphere was at $77\frac{1}{2}°$; and also at 88° when the atmosphere was at 80°.

The water of both of these is the purest I had ever seen.

Many small fish were swimming in the basin of the last, from which runs, at all seasons, a considerable rivulet.

A third was at 90° when the atmosphere was at 73°. The water very pure.

A fourth was at 101° when the atmosphere was at 85½°; also at 101° when the atmosphere was at 93°.

Taste of the water rather ferruginous, and very brackish, extremely disagreeable and nauseous. No peculiar smell, and very transparent, although it deposits iron and lime, and an iridescent film is formed on its surface. Contains no sulphuretted gas. The rocks of the neighbourhood contain pyrites not magnetic.

This spring is called the Mai-d'agoa, and is situated on the left bank of the river Itapicurú, near the water's edge, at a short distance from a place called the Mato-do-cipó.

It was during this journey that I had an opportunity of seeing that curious plant called cipó de cunanam. It grows abundantly between Monte Santo and the river Bendegó. It is a climbing plant destitute of leaves; it was so when I saw it, and I believe it to be always the same; it bears no thorns; but often growing so as to form an impenetrable *plica* which the cattle will hardly approach, much less attempt to break through, because when the juice of this plant sticks to their hair, it occasions blisters and great irritation. It contains a milky juice, and I suppose that it is an euphorbium. When I made a cut at the bush with my hanger, in the dusk of the evening, the wounds inflicted presented a beautifully luminous line, which was not transient, but lasted for several seconds, or a quarter of a minute. Having taken a piece of the plant, I bent it in the dark until the skin cracked, when every

crack showed the same light, which is of a phosphorescent appearance. I continued to bend the twig until the milky juice dropped out, when each drop was a drop of fire, very much like what I have seen on dropping inflamed tallow. I did not observe any particular smell. The milky juice is said to be very poisonous; it is caustic, and occasions much itching and irritation when applied to the skin. It becomes viscous in the air, and soon dries of a yellowish colour, slightly tinged with green, when it has the appearance of a gum-resin.

The above account contains all the information that I can give you on the subject: should you think it deserving to be laid before the Royal Society, I would beg of you to add your observations, as they would render the communication interesting.

I am, with sentiments of the highest esteem and respect,

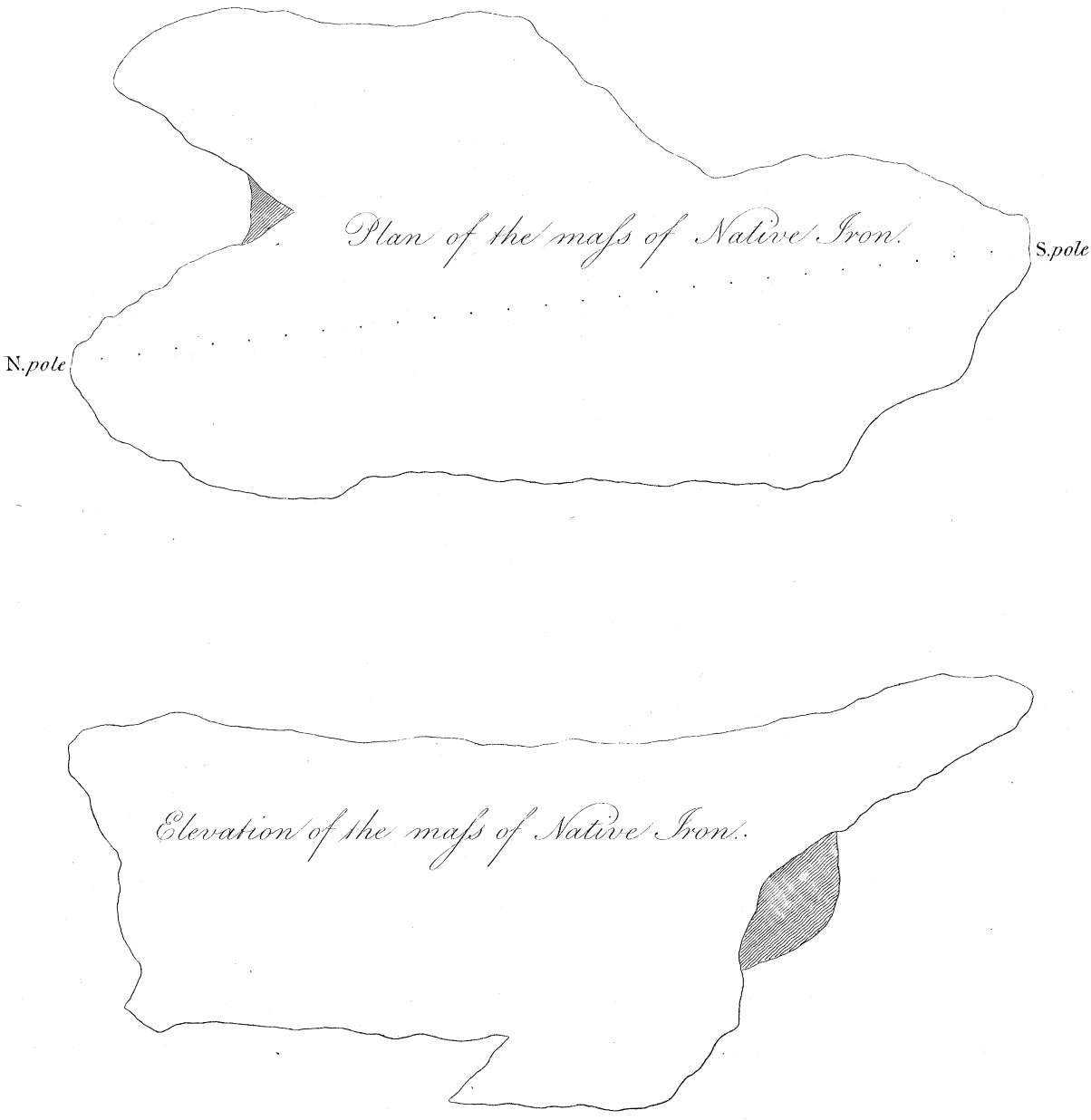
My dear Sir,

Your faithful friend and devoted servant,

A. F. MORNAY.

London, 27th April, 1816.

To Dr. Wollaston,
Secretary of the Royal Society.


Plan of the mass of Native Iron.
S. pole
N. pole
Elevation of the mass of Native Iron.