

III. *An Account of a Mass of native Iron, found in South-America.*
 By Don Michael Rubin de Celis. Communicated by Sir
 Joseph Banks, Bart. P. R. S.

Read November 22, 1787.

Memoria que remite a la R. Sociedad de Londres D. MIGUEL
 RUBIN DE CELIS, Cavellero del Orden de Santiago, Teniente
 de Fragata de la R. Armada de S. M. C. Academico cor-
 respondiente de la R. Academia de Marina de Francia, y de
 la R. de la Historia de España.

HAZE mas de treinta años que en las provincias del gran
 Chaco Gualamba, de adonde varias Naciones barbaras
 arrojaron a los Españoles, y desde cuio tiempo està quasi desierta
 la parte meridional del Rio Bermejo, y occidental del gran
 Paraná, los pocos Indios que se hallan en la jurisdiccion de San-
 tiago del Estero, teniendo por unico exercicio el facar Miel y
 Cera de los montes, de la que hay una cantidad prodigiosa en
 los arboles, descubrieron en el medio de un campo un trozo
 de metal que llamaron fierro puro, y que sobrefalia de la tierra
 por una banda cosa de un pie, y se veia quasi toda su cara
 superior: anunciose a los Virreyes del Peru, como un descubri-
 miento raro, y con razon al parecer, pues donde no hay mon-
 tañas, ni la mas pequeña piedra en cien leguas al rededor, una
 cosa semejante merezia el nombre de maravillosa, sin embargo
 de constar haber en Europa minas de fierro puro. Hubo parti-
 culares que con riesgo eminente de sus vidas, ya por la escasez
 de aguas, que no hay fino la que en tal qual cavidad natural se
 recoje de las llubias, ya por la escasez de viveres, ya por el
 riesgo

riesgo de los Indios barbaros, ya por los varios animales feroces, como Tigres, Leopardos y Antas, ya por los muchos reptiles ponzoñosos, ya en fin por las infinitas espesuras, se arrojaron, quiza seducidos de la codicia, à hazer la trabesia para extraher algo de la materia: remitieron de ella à Lima y Madrid, donde no se adelantò otra cosa que ponerla el nombre de fierro mui dulce y mui puro. Como que el fierro, por razon politica, no se trabaja en aquel continente, aunque de el hay muchas minas, y como que se aseguraa que la veta del fierro corria muchas leguas, siendo así que lo visto solo era un creston sobrefaliente à la tierra, y que despues de escavado tenia tres varas de N. à S. dos y media de E. al O. y una terzia de alto, me destinò el Virrey del Rio de la Plata à que examinase prolijamente la dicha masa, y en el caso de ser mina, y util, proyectase sobre Poblacion. Sali con competente escolta, a principios de febrero de ochenta y tres, del Rio Salado, antigua reduccion de los Indios Vilelas, figuiendo el Rumbo de E. $\frac{1}{4}$ N.E. bien que debi seguir el del E. $\frac{1}{4}$ S.E. todo corregido.

El aspecto del pais que media entre el Rio y la Mina, distante setenta leguas de la Reduccion, es mui curiosa; una llanura inmensa, alternada de montes especifimos y campos fertiles, forma la mas agradable perspectiva.

Observè la latitud de la mina 27 gr. y 28 min.

No hay Poblacion alguna en toda la travesia, por escasez de aguas manantiales: la que gastan los meleros, que en pequeñas caravanas residen la maior parte del año meleando en los montes, es la llovediza como se ha expresado. Estos y algunas tribus de Indios errantes y barbaros, cuia vida es semejante a la de los Tartaros, que en cierta estacion del año vienen de las marjenes del Rio Vermejo à cabar o facar una raiz silvestre llamada Koruu: que solo la mascan continuamente, siendo para ellos de primera necesidad

necesidad, así para preferirse de los efectos de una atmósfera infestada, como de las mordeduras continuas de los reptiles ponzoñosos : son las únicas gentes que se hallan en estos dilatadísimos y amenos Campos.

El quince llegué a los nombrados de Otumpa, donde se hallava la masa quasi enterrada en pura greda y cenizas.

La apariencia exterior era de fierro perfectamente compacto ; no así la interior, como puede verse en las cavidades que manifiestan los cortes de los pedacitos, lo que induze à creer haber estado liquida en algun tiempo : fortifica esta idea una porcion de trazas exteriores en la parte superior ; se hallan las de pies y manos de Hombres de crecida estatura, las de pies de varios paxaros grandes communes en aquellos campos : y aunque perfectas las tales trazas no dejo de persuadirme a una de dos cosas, obien que sea un capricho ò accidente natural, obien que en el suelo, antes de caer allí aquella masa, existieren las tales huellas, y que en la caída de la masa liquida hubiesen resultado en la parte superior. A nada se asemeja tanto como a un amasijo de pan que, despues de haberse en el estampado pies manos y metido un dedo, se hubiese ferrificado.

Empezé à cortar con los cinceles, y para sacar veinte y cinco, ò treinta libras, fue necesario romperlos todos en numero de setenta.

Hize cavar al rededor del trozo, quien por la parte inferior tenia una capa del grueso de quatro ò seis pulgadas de escoria, procedida de las humedades de la tierra ; por la superior estava limpio.

Desprendido de la tierra, le hize dar una media vuelta con palancas, y cabè en la cama a bastante profundidad. No contento construí dos hornillos, que volè, y con cuidado examinè la tierra mas profunda, y la hallè perfectamente semejante a la superior,

superior, a la de todos aquellos campos, y a la de dos pozos que hize abrir a distancia de sesenta ò cien pasos del trozo y direccion del E. O.

El no encontrar raiz ni serie de generacion, avivò mas la admiracion mia, y empeze a discurrir de este modo.

O esta masa se crió aqui, o fue traída ò arrojada? Criarse aqui no es posible, segun el conocido proceder de la Naturaleza: ser trahida de donde, para que, ò como? de donde, no habiendo en centenares de leguas minas de fierro, ni memoria de que se hubiesen trabajado en el Reyno? para que? siendo de una materia sin estimacion, no pudiendose usar, y siendo aquel un terreno el mas escufado o inevitable de todo el Chaco, por la escasez de aguas; como? no teniendo noticia de que los Indios hayan conocido jamas las maquinas de acarreo; con que habrá sido arrojada por algun volcan.

Las razones que induzen a creer esto son varias. Regularmente los volcanes dejan despues de volados algunos pozos de agua, unas vezes termales, y otras frias: al E. del trozo, y distancia como de dos leguas, se halla vna aguadita bastante falobre vnica y manancial por todo aquel pais. En todo lo que caminé del Chaco no obserbè a la vista diferencia ninguna de nivel en el terreno: solo en la imediacion à esta aguadita hay vna rampa que corre N. S. y que por particular seme hizo notable antes de ver el trozo. Graduando poder tener de diferencia de nivel con el resto del pais de quatro ò seis pies: las imediaciones a la papa ò trozo, y a la aguadita, estan cubiertas de una especie de tierra menuda como la ceniza, y quasi de su color: el pasto de estas imediaciones, llamado Ahuvi, es sumamente pequeño, delgado, y aborrecido de los animales, asi como mui alto y mui grato a ellos el que està algo separado del trozo y de la aguadita: à pequeña profundidad en esta se encuentran unas

pedras quartzos de un encarnado hermoso, las que han usado los meleros solo para encender fuego : hay noticia de haber aquellos trahido tres pequeñas por particulares en su color, y unas pintas doradas ; una de ellas del peso de una onza vino a poder del Governador de Armas de Santiago del Estero, quien me dijo haberla echo moler, y me mostrò mas de un adarme de oro que de ella se havia extraido. Es indudable que entre aquellos inmensos bosques existe un Arbol con sus ramas de puro fierro ; son muchos los Indios que le han visto, y los de la reduccion llamada de Avipones saben su verdadero lugar : un Europeo distinguido vezino de la Ciudad de Salta lo ha tocado : la caida o inclinacion del trozo es del E. al O. haviendo dejado vna especie de corte al E. cuya direccion es N. S. de este corte es de donde se pudieron extraer con cinceles los pedazitos de metal : luego con estos antecedentes no es violento formar esta Ypotesi.

Volose el volcan en la aguadita falobre, lebantò vna porcion de tierras que por su poca gravedad se quedaron en la imediacion ; aunque al principio amontonadas, las continuas aguas del Chaco, que se halla inundado la tercera parte del año, las ha ido igualando con el otro terreno : la direccion de la materia grande arrojada fue del E. al O. y como pesada alcanzò a la distancia en que se encuentra : alguna otra porcion de materia mas pequeña, y acaso mas fluida, se separò a otro rumbo, haciendo canales, al modo que quando se arroja un baso de agua ; esta pequeña materia ya fria, y lamida con las aguas la tierra que al principio la sostenia, devio de formar lo que hoy se llama arbol de fierro : las materias salitrosas y antimoniales, que acompañan de ordinario à todo mineral, devieron igualmente esparcirse y infertilizar los contornos.

En el Reyno de Santa Fee de Bogotà se encuentra la Platina en polbo mezclada con el oro : pocos ignoran la mucha afinidad

que tienen estos dos metales, con que no feria extraño, segun el conjunto de todas estas razones, que el fuego del volcan hubiese derretido la Platina, y arrojadola como materia superior a la de oro, que era inferior. Este principio de los volcanes es el mas natural para comprobar el porque se hallan tambien fueltas las afamadas papas de Plata de Guantajaia, sobre cuiá formacion se han dicho exquisitas extravagancias y ridiculezes.

Cubicado sobre poco mas o menos, reputando la gravedad especifica del metal algo maior como lo es que la del fierro, vendrà a pesar mas de trescientos quintales.

El Cav. MIG. RUBIN DE CELIS.

R. Isla de Leon,
2 de Junio de 1786.

Some specimens of the Iron accompanied this Paper, and were laid before the Society; who afterwards presented them to the British Museum. C. B.



A P P E N D I X

Translation of Don Michael Rubin de Celis's Letter to the Royal Society, relative to a Mass of native Iron, found in South-America. See p. 37.

ABOUT thirty years ago, the various barbarous nations who inhabited the provinces of the great Chaco Gualamba, expelled the Spaniards from thence; and since that time, the countries on the southern part of the river Vermejo, and western of the great river Paraná have been almost totally deserted. The only employment of the few Indians who dwell within the jurisdiction of Santiago del Estero is to gather the honey and wax, with which the woods abound. These Indians discovered, in the midst of a wide-extended plain, a large mass of metal, which they called pure iron; part of which projected above the ground about a foot, and almost the whole of its upper surface was visible. Intelligence of this discovery was immediately communicated to the Viceroy of Peru. That such a mass of iron should be found in a country where there are no mountains, nor even the smallest stone within a circumference of one hundred leagues, could not fail to appear extraordinary, notwithstanding we know there are mines of pure iron in Europe. Some private persons, at the great risk of their lives, both from the uncertainty of procuring food

or even water (of which none is to be found but what rain happens to be preserved in some natural cavities of the earth), from the danger of meeting the roving Indians, from the various wild beasts found in those plains, such as tygers, leopards, tapirs, from the swarms of poisonous reptiles, and finally from the endless thickets, led on by hopes of enriching themselves, boldly undertook the journey, to obtain some of the metal. They transmitted a part of it to Lima and Madrid, by which no other advantage was gained than to ascertain it to be very soft and very pure iron. As it is forbidden by law, for political reasons, to manufacture iron in that country, though different parts of it abound with iron mines; and as it was asserted, that the vein of iron extended many leagues, the visible part being only its crest projecting above the ground, which, when dug round, was found to measure three yards from N. to S. two yards and a half from E. to W. and about one-third of a yard in thickness; the Viceroy of the river Plata sent me with orders to examine this discovery with accuracy; and, in case I found it a beneficial mine, that I should establish a colony there. I accordingly set off, well escorted, in the beginning of February, 1783, from Rio Salado, an ancient civilized hamlet of the Indians whom we call Vilelas, and pursued my journey in the direction E. $\frac{1}{4}$ N.E. though, upon further examination, I found that I ought to have taken my direction E. $\frac{1}{4}$ S.E. both corrected.

The aspect of the country between the river and the mine, distant seventy leagues from the settlement, is curious: it consists of an immense plain, alternately intermixed with thick woods and fertile fields, forming most pleasing landscapes.

The

The latitude of the mine I found, by observation, to be $27^{\circ} 28' S$.

There is not one fixed place of habitation throughout the whole country, owing to a scarcity of running water. That which is drunk by the honey-gatherers, who reside there in small bodies the greatest part of the year, collecting honey in the woods, is rain water, as I have already observed. These, and a few roving tribes of barbarous Indians, who resemble the Tartars in their way of life, and come hither, at a certain season of the year, from the borders of the river Vermejo, in quest of a wild root, which they call Koruu, and which they constantly chew, as a remedy against the pestilential air of their native country, and also as a preservative against the bite of poisonous reptiles, are the only people ever seen in those pleasant and extensive plains.

I arrived the 15th of February at the place called Otumpa, where the mass was found almost buried in pure clay and ashes.

The exterior appearance of it was that of perfectly compact iron; but upon cutting off pieces of it, I found the internal part full of cavities, as if the whole had been formerly in a liquid state. I was confirmed in this idea, by observing on the surface of it the impressions as of human feet and hands of a large size, as well as of the feet of large birds, which are common in this country. Though these impressions seem very perfect, yet I am persuaded that they are either a *lusus naturæ*, or that impressions of this nature were previously upon the ground, and that the liquid mass of iron falling upon it received them. It resembled nothing so much as a mass of dough, which, having been stamped with impressions of hands and feet, and marked with a finger, was afterwards converted into iron.

I began to cut off part of it with chissels; and in separating from the mass twenty-five or thirty pounds, I spoiled all the chissels I had, to the number of seventy.

I ordered my men to dig round it, and found the under surface covered with a coat of scoriæ from four to six inches thick; undoubtedly occasioned by the moisture of the earth, because the upper surface was clean.

Having moved it half round, by means of handspikes, I ordered the ground under its bed to be dug to a considerable depth, and even blew it up in two places with gunpowder; after which, examining the deepest part of the earth, I found it exactly like the upper part, and of the same nature as the earth of all the country, as likewise of two pits, which I had dug at the distance of seventy or one hundred paces E. and W. of the mass. Finding here no root or trace of generation, I reasoned in the following manner.

Either this mass was produced in the spot where it lies, or it was conveyed hither by human art, or cast hither by some operation of nature. It could not be generated here, according to any known process of nature. And whence, by whom, or how, could it be conveyed hither, as there are no iron mines within hundreds of leagues, nor remembrance that any have been worked in the kingdom? It could be of no value, since it could not be used; and why bring it into a country the most uninhabitable of all the Chaco, from the want of water? Besides, how could so heavy a mass be conveyed, the Indians never having known the use of wheel carriages? This mass, therefore, must have been the effect of some volcanic explosion.

Many circumstances induce me to think so. Volcanos frequently leave behind them, after explosion, pits of water,

either hot or cold; and at the distance of about two leagues to the east of this mass, I discovered a brackish mineral spring, the only one to be found in all this country. In the whole district of the Chaco I travelled over, I observed no difference in the level of the ground, except the very spot where I made this discovery; and here only I found a gentle ascent running from N. to S. and which attracted my notice before I had seen the mass of iron. This ascent is between four and six feet above the rest of the country. The earth in every part around this mass, as well as about the brackish spring, is a very light, loose earth, like ashes, even in colour. The grass produced immediately contiguous, called Ahivi, is short, small, and extremely unpalatable to cattle; whereas the grass found in the rest of the country, at a little distance from the mass and salt spring, is long and very grateful to them.

At a little depth in the earth are found stones of quartz, of a beautiful red colour, which the honey-gatherers make use of as flints to light their fires. They had formerly carried some of them away, on account of their peculiar beauty, being spotted and studded as it were with gold. One of these, that weighed about an ounce, came into the hands of the Governor of Santiago del Estero, who told me, that he ground it, and shewed me more than a drachm of gold that he had extracted from it.

It is an undoubted fact, that in these immense forests there exists a mass of pure iron, in the shape of a tree, with its branches. Many of the Indians have seen it; and the inhabitants of the colony of the Avipones, are acquainted with the spot where it lies. A distinguished European of the city

of Salta touched it. The body of this tree extends upon the ground in the direction from E. to W. having left behind to the E. a part which lies in the direction from N. to S. and it is from this that the pieces of metal may have been taken with a chissel. From this account one may venture to form the following hypothesis.

I will suppose, that the volcanic explosion happened in the spot where I discovered the brackish spring; that by the explosion a great quantity of earth was raised, and formed the elevation of this part of the plain above the rest; that it was originally much higher, but the continual rains of the Chaco, which is overflowed a third part of the year, are always acting to bring it to a level with the rest of the country.

The direction of the greatest portion of the mass of iron ejected was from E. to W. and being heavier reached to the distance where it is found. Another portion of the matter smaller, and perhaps more fluid, separated and took another direction, running into several streams, as when water is thrown out of a pail. This small portion of matter having cooled, and the earth which supported it being washed away gradually by the water, must, I apprehend, have formed what is now called the Tree of iron.

The saline and antimonial matters, which usually accompany all minerals, must have been scattered round about in a similar manner, and rendered the ground barren.

In the kingdom of Santa Fe de Bogotà, there is found dust of platina mixed with gold. Almost every body knows the great affinity there is between these two metals, so that it is not surprizing, considering all these reasons, that the fire of the volcano should have melted the platina which lay above the gold, and thrown it up. This principle of volcanos is the

most natural to account for the formation of those famous masses of silver found separate at Guantajaia, about which so many extravagant and ridiculous stories have been told.

The mass of iron, which is the subject of this letter, according to its cubic measure, and allowing it a little more specific gravity than iron, must weigh about 300 quintals.

(Sig.) Chev. MICH. RUBIN DE CELIS.

From the Island of Leon,

June 20, 1786.

