Account of the Pitch Lake of the Island of Trinidad.

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Being desirous to visit the celebrated Lake of Pitch, previously to my departure from the Island of Trinidad, I embarked with that intention in the month of October, 1807, in a small vessel at Port Spain. After a pleasant sail of about thirty miles down the Gulph of Paria, we arrived at the point la Braye, so called by the French from its characteristic feature. It is a considerable headland, about eighty feet above the level of the sea, and perhaps two miles long and two broad. We landed on the southern side of the point, at the plantation of Mr. Vessigny: as the boat drew near the shore, I was struck with the appearance of a rocky bluff or small promontory of a reddish brown colour, very different from the pitch which I had expected to find on the whole shore. Upon examining this spot, I found it composed of a substance corresponding to the porcelain jasper of mineralogists, generally of a red colour, where it had been exposed to the weather, but of light slate blue in the interior; it is a very hard stone with a conchoidal fracture, some degree of lustre, and is perfectly opaque even at the edges; in some places, from the action of the air, it was of a reddish or yellowish brown, and an earthy appearance. I wished to have devoted more time to the investigation of what in the language of the Wernerian school is termed the geognostic relations of this spot, but my companions...
were anxious to proceed. We ascended the hill, which was entirely composed of this rock, to the plantation, where we procured a negro guide, who conducted us through a wood about three quarters of a mile. We now perceived a strong sulphureous and pitchy smell, like that of burning coal, and soon after had a view of the lake, which at first sight appeared to be an expanse of still water, frequently interrupted by clumps of dwarf trees or islets of rushes and shrubs: but on a nearer approach we found it to be in reality an extensive plain of mineral pitch, with frequent crevices and chasms filled with water. The singularity of the scene was altogether so great, that it was sometime before I could recover from my surprize so as to investigate it minutely. The surface of the lake is of the colour of ashes, and at this season was not polished or smooth so as to be slippery; the hardness or consistence was such as to bear any weight, and it was not adhesive, though it partially received the impression of the foot; it bore us without any tremulous motion whatever, and several head of cattle were browsing on it in perfect security. In the dry season however the surface is much more yielding, and must be in a state approaching to fluidity, as is shewn by pieces of recent wood and other substances being enveloped in it. Even large branches of trees which were a foot above the level, had in some way become enveloped in the bituminous matter. The interstices or chasms are very numerous, ramifying and joining in every direction, and in the wet season being filled with water, present the only obstacle to walking over the surface; these cavities are generally deep in proportion to their width, some being only a few inches in depth, others several feet, and many almost unfathomable: the water in them is good and uncontaminated by the pitch; the people of the neighbourhood derive their supply from this source, and refresh themselves by bathing in it;
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Fish are caught in it, and particularly a very good species of mullet. The arrangement of the chasms is very singular, the sides, which of course are formed of the pitch, are invariably shelving from the surface, so as nearly to meet at the bottom, but then they bulge out towards each other, with a considerable degree of convexity. This may be supposed to arise from the tendency in the pitch slowly to coalesce, whenever softened by the intensity of the sun's rays. These crevices are known occasionally to close up entirely, and we saw many marks or seams from this cause. How these crevices originate it may not be so easy to explain. One of our party suggested that the whole mass of pitch might be supported by the water which made its way through accidental rents, but in the solid state it is of greater specific gravity than water, for several bits thrown into one of the pools immediately sunk.* The lake, (I call it so, because I think the common name appropriate enough) contains many islets covered with long grass and shrubs, which are the haunts of birds of the most exquisite plumage, as the pools are of snipe and plover. Alligators are also said to abound here, but it was not our lot to encounter any of these animals. It is not easy to state precisely the extent of this great collection of pitch; the line between it and the neighbouring soil is not always well defined, and indeed it appears to form the substratum of the surrounding tract of land. We may say, however, that it is bounded on the north and west sides by the sea, on the south by the rocky eminence of porcelain jasper, before

* Pieces of asphaltum are, I believe, frequently found floating on the Dead Sea in Palestine, but this arises probably from the extraordinary specific gravity of the waters of that lake which Dr. Marcet found to be 1.211. Mr. Hatchett states the specific gravity of ordinary asphaltum to vary from 1.023 to 1.165, but in two varieties of that of Trinidad it was as great as 1.336 and 1.744, which led Mr. Hatchett to form a conjecture which I shall afterwards notice.
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mentioned, and on the east by the usual argillaceous soil of the country; the main body may perhaps be estimated at three miles in circumference; the depth cannot be ascertained, and no subjacent rock or soil can be discovered. Where the bitumen is slightly covered by soil, there are plantations of cassava, plantains and pineapples, the last of which grow with luxuriance and attain to great perfection. There are three or four French and one English sugar estates in the immediate neighbourhood; our opinion of the soil did not, however, coincide with that of Mr. Anderson, who in the account he gave some years ago, thought it very fertile. It is worthy of remark, that the main body of the pitch, which may properly be called the lake, is situated higher than the adjoining land, and that you descend by a gentle slope to the sea, where the pitch is much contaminated by the sand of the beach. During the dry season, as I have before remarked, this pitch is much softened, so that different bodies have been known slowly to sink into it; if a quantity be cut out, the cavity left will be shortly filled up; and I have heard it related, that when the Spaniards undertook formerly to prepare the pitch for economical purposes, and had imprudently erected their cauldrons on the very lake, they completely sunk in the course of a night, so as to defeat their intentions. Numberless proofs are given of its being at times in this softened state: the negro houses of the vicinage, for instance, built by driving posts in the earth, frequently are twisted or sunk on one side. In many places it seems to have actually overflowed like lava, and presents the wrinkled appearance which a sluggish substance would exhibit in motion.

This substance is generally thought to be the asphaltum of naturalists: in different spots however it presents different appearances. In some parts it is black, with a splintery conchoidal fracture, of con-
siderable specific gravity, with little or no lustre, resembling particular kinds of coal, and so hard as to require a severe blow of the hammer to detach or break it; in other parts, it is so much softer, as to allow one to cut out a piece in any form with a spade or hatchet, and in the interior is vesicular and oily; this is the character of by far the greater portion of the whole mass; in one place, it bubbles up in a perfectly fluid state, so that you may take it up in a cup, and I am informed that in one of the neighbouring plantations there is a spot where it is of a bright colour, shining, transparent, and brittle, like bottle glass or resin. The odour in all these instances is strong and like that of a combination of pitch and sulphur. No sulphur however is any where to be perceived, but from the strong exhalation of that substance and the affinity which is known to exist between the fluid bitumens and it, much is, no doubt, contained in a state of combination; a bit of the pitch held in the candle melts like sealing wax and burns with a light flame which is extinguished whenever it is removed, and on cooling the bitumen hardens again. From this property it is sufficiently evident that this substance may be converted to many useful purposes, and accordingly it is universally used in the country wherever pitch is required; and the reports of the naval officers who have tried it are favourable to its more general adoption; it is requisite merely to prepare it with a proportion of oil, tallow, or common tar, to give it a sufficient degree of fluidity. In this point of view, this lake is of vast national importance, and more especially to a great maritime power. It is indeed singular that the attention of government should not have been more forcibly directed to a subject of such magnitude: the attempts that have hitherto been made to render it extensively useful have for the most part been only feeble and injudicious, and have consequently proved abortive. This vast collection of bitumen
might in all probability afford an inexhaustible supply of an essential article of naval stores, and being situated on the margin of the sea could be wrought and shipped with little inconvenience or expense.* It would however be great injustice to Sir Alexander Cochrane not to state explicitly that he has at various times, during his long and active command on the Leeward Island station, taken considerable pains to insure a proper and fair trial of this mineral production for the highly important uses of which it is generally believed to be capable. But whether it has arisen from certain perverse occurrences or from the prejudice of the mechanical superintendents of the Colonial Dock Yards, or really, as some have pretended, from an absolute unfitness of the substance in question; the views of the gallant admiral have I believe been invariably thwarted, or his exertions rendered altogether fruitless. I was at Antigua in 1809 when a transport arrived laden with this pitch for the use of the dock-yard at English Harbour: it had evidently been hastily collected with little care or zeal from the beach, and was of course much contaminated with sand and other foreign substances. The best way would probably be to have it properly prepared on the spot, and brought to the state in which it may be serviceable, previously to its exportation. I have frequently seen it used to pay the bottoms of small vessels, for which it is particularly well adapted, as it preserves them from the numerous tribe of worms so abundant in tropical countries.† There seems indeed no reason why it should not when duly pre-

* This island contains also a great quantity of valuable timber, and several plants which yield excellent hemp.

† The different kinds of bitumen have always been found particularly obnoxious to the class of insects; there can be little doubt but that they formed ingredients in the Egyptian compost for embalming bodies, and the Arabians are said to avail themselves of them in preserving the trappings of their horses. Vide Jameson’s Mineralogy.
pared and attenuated be applicable to all the purposes of the petroleum of Zante, a well-known article of commerce in the Adriatic, or that of the district in Burmah, where 400,000 hogsheads are said to be collected annually.*

It is observed by Capt. Mallet in his Short Topographical Sketch of the Island, that "near Cape la Brea (la Braye) a little to the south-west, is a gulph or vortex, which in stormy weather gushes out, raising the water five or six feet, and covers the surface for a considerable space with petroleum or tar;" and he adds that "on the east coast in the Bay of Mayaro, there is another gulph or vortex similar to the former, which in the months of March and June produces a detonation like thunder, having some flame with a thick black smoke, which vanishes away immediately; in about twenty-four hours afterwards, is found along the shore of the bay, a quantity of bitumen or pitch, about three or four inches thick, which is employed with success." Capt. Mallet likewise quotes Gumilla, as stating in his Description of the Orinoco, that about seventy years ago, "a spot of land on the western coast of this island, near half way between the capital and Indian village sunk suddenly, and was immediately replaced by a small lake of pitch to the great terror of the inhabitants."

I have had no opportunity of ascertaining personally whether these statements are accurate, though sufficiently probable from what is known to occur in other parts of the world; but I have been informed by several persons that the sea in the neighbourhood of La Braye is occasionally covered with a fluid bitumen, and in the south-eastern part of the island there is certainly a similar collection of this bitumen, though of less extent, and many small detached spots

* Vide Aikin’s Dictionary of Chemistry, quoted from Captain Cox in the Asiatic Researches.
of it are to be met with in the woods: it is even said that an evident line of communication may thus be traced between the two great receptacles. There is every probability, that in all these cases the pitch was originally fluid, and has since become inspissated by exposure to the air, as happens in the Dead Sea and other parts of the east.

It is for geologists to explain the origin of this singular phenomenon, and each sect will doubtless give a solution of the difficulty according to its peculiar tenets. To frame any very satisfactory hypothesis on the subject, would require a more exact investigation of the neighbouring country, and particularly to the southward and eastward, which I had not an opportunity of visiting. And it must be remembered that geological inquiries are not conducted here with that facility which they are in some other parts of the world; the soil is almost universally covered with the thickest and most luxuriant vegetation, and the stranger is soon exhausted and overcome by the scorching rays of a vertical sun. Immediately to the southward, the face of the country as seen from la Braye, is a good deal broken and rugged, which Mr. Anderson attributes to some convulsion of nature from subterranean fires, in which idea he is confirmed by having found in the neighbouring woods several hot springs. He is indeed of opinion that this tract has experienced the effects of the volcanic power, which, as he supposes, elevated the great mountains on the main and the northern side of the island.*

The production of all bituminous substances has certainly with plausibility been attributed to the action of subterranean fires on beds of coal, being separated in a similar manner as when effected by artificial heat, and thus they may be traced through the various trans-

formations of vegetable matter. I was accordingly particular in my inquiries with regard to the existence of beds of coal, but could not learn that there was any certain trace of that substance in the island, and though it may exist at a great depth, I saw no strata that indicate it. A friend indeed gave me specimens of a kind of bituminous shale mixed with sand, which he brought from Point Cedar about twenty miles distant, and I find Mr. Anderson speaks of the soil near the Pitch-lake containing burnt cinders, but I imagine he may have taken for them the small fragments of the bitumen itself.

An examination of this tract of country could not fail, I think, to be highly gratifying to those who embrace the Huttonian theory of the earth, for they might behold the numerous branches of one of the largest rivers of the world (the Orinoco) bringing down so amazing a quantity of earthy particles as to discolour the sea in a most remarkable manner for many leagues distant,* they might see

* No scene can be more magnificent than that presented on a near approach to the north-western coast of Trinidad. The sea is not only changed from a light green to a deep brown colour, but has in an extraordinary degree, that rippling, confused and whirling motion, which arises from the violence of contending currents, and which prevail here in so remarkable a manner, particularly at those seasons when the Orinoco is swollen by periodical rains, that vessels are not unfrequently several days or weeks in stemming them, or perhaps are irresistibly borne before them far out of their destined track. The dark verdure of lofty mountains, covered with impenetrable woods to the very summits, whence, in the most humid of climates, torrents impetuously rush through deep ravines to the sea; three narrow passages into the Gulph of Paria, between rugged mountains of brown micaceous schist, on whose cavernous sides the eddying surge dashes with fury, and where a vessel must necessarily be for some time embayed, with a depth of water scarcely to be fathomed by the lead, present altogether a scene which may well be conceived to have impressed the mind of the navigator who first beheld it with considerable surprise and awe. Columbus made this land in his third voyage, and gave it the name of the Bocas del Drago. From the wonderful discoloration and turbidity of the water, he sagaciously concluded that a very large river was near, and consequently a great continent.
these earthy particles deposited by the influence of powerful currents on the shores of the gulf of Paria, and particularly on the western side of the island of Trinidad; they might there find vast collections of bituminous substances, beds of porcelain jasper; and such other bodies; as may readily be supposed to arise from the modified action of heat on such vegetable and earthy materials as the waters are known actually to deposit. They would further perceive no very vague traces of subterranean fire, by which these changes may have been effected and the whole tract elevated above the ordinary level of the general loose soil of the country, as for instance, hot springs, the vortices above mentioned, the frequent occurrence of earthquakes, and two singular semi-volcanic mounds at Point Icaque, which, though not very near, throw light on the general character of the country. Without pledging myself to any particular system of geology, I confess an explanation similar to this appears to me sufficiently probable, and consonant with the known phenomena of nature. A vast river, like the Orinoco, must for ages have rolled down great quantities of woody and vegetable bodies, which from certain causes, as the influence of currents and eddies, may have been arrested and accumulated in particular places; they may have undergone those transformations and chemical changes, which various vegetable substances similarly situated have been proved to suffer in other parts of the world. An accidental fire, such as is known frequently to occur in the bowels of the earth, may then have operated in separating and driving off the newly formed bitumen more or less combined with siliceous and argillaceous earths, which forcing its way through the surface, and afterwards becoming inspissated by exposure to the air, may have occasioned such scenes as I have ventured to describe. The only other country accurately resembling this part of Trinidad of which I recollect
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to have read, is that which borders on the Gulph of Taman in Crim Tartary: from the representation of travellers, springs of naptha and petroleum equally abound, and they describe volcanic mounds precisely similar to those of Point Icaque. Pallas’s explanation of their origin seems to me very satisfactory, and I think it not improbable that the River Don and Sea of Azof may have acted the same part in producing these appearances in the one case, as the Orinoco and Gulph of Paria appear to have done in the other.* It may be supposed that the destruction of a forest or perhaps even a great Savanna on the spot, would be a more obvious mode of accounting for this singular phenomenon; but, as I shall immediately state, all this part of the island is of recent alluvial formation, and the land all along this coast is daily receiving a considerable accession from the surrounding water. The Pitch-lake with the circumjacent tract, being now on the margin of the sea, must in like manner have had an origin of no very distant date; besides, according to the above representation of Capt. Mallet, and which has been frequently corroborated, a fluid bitumen oozes up and rises to the surface of the water on both sides of the island, not where the sea has encroached on and overwhelmed the ready-formed land, but where it is obviously in a very rapid manner depositing and forming a new soil.

From a consideration of the great hardness, the specific gravity, and the general external characters of the specimens submitted a few years ago to the examination of Mr. Hatchett, that gentleman was led to suppose that a considerable part of the aggregate mass at Trinidad was not pure mineral pitch or asphaltum, but rather a porous stone of the argillaceous genus much impregnated with bitumen.

* Vide Universal Mag. for Feb. 1808, Mrs. Guthrie’s Tour in the Tauride, or Voyages de Pallas.
Two specimens of the more compact and earthy sort, analysed by Mr. Hatchett, yielded about 32 and 36 per cent. of pure bitumen: the residuum in the crucible consisted of a spongy, friable and ochraceous stone, and 100 parts of it afforded, as far as could be determined by a single trial, of silica 60, alumina 10, oxide of iron 10, carbonaceous matter by estimation 11; not the smallest traces of lime could be discovered, so that the substance has no similarity to the bituminous limestones which have been noticed in different parts of the world.* I have already remarked, that this mineral production differs considerably in different places. The specimens examined by Mr. Hatchett by no means correspond in character with the great mass of the lake, which, in most cases, would doubtless be found to be infinitely more free from combination with earthy substances; though from the mode of origin which I have assigned to it, this intermixture may be regarded as more or less unavoidable. The analysis of the stone after the separation of the bitumen, as Mr. Hatchett very correctly observes, accords with the prevalent soil of the country; and I may add, with the soil daily deposited by the gulph, and with the composition of the porcelain jasper, in immediate contact with the bituminous mass.

All the country which I have visited in Trinidad is either decidedly primitive or alluvial. The great northern range of mountains which runs from east to west, and is connected with the Highlands of Paria on the continent, by the Islands at the Bocas, consists of gneiss, of mica slate containing great masses of quartz, and in many places approaching so much to the nature of talc, as to render the soil quite unctuous by its decomposition, and of compact bluish grey limestone, with frequent veins of white crystallized carbo-

* Vide Linnean Trans. vol. 8.
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nate of lime. From the foot of these mountains for many leagues to the southward there is little else than a thick, fertile, argillaceous soil, without a stone or a single pebble. This tract of land, which is low and perfectly level, is evidently formed by the detritus of the mountains, and by the copious tribute of the waters of the Orinoco, which being deposited by the influence of currents, gradually accumulates, and in a climate where vegetation is astonishingly rapid, is speedily covered with the mangrove and other woods. It is accordingly observed, that the leeward side of the island constantly encroaches on the gulph, and marine shells are frequently found on the land at a considerable distance from the sea. This is the character of Naparima and the greater part of the country I saw along the coast to la Braye. It is not only in forming and extending the coast of Trinidad, that the Orinoco exerts its powerful agency; co-operating with its mighty sister flood, the Amazons, it has manifestly formed all that line of coast and vast extent of country, included between the extreme branches of each river. To use the language of a writer in the Philosophical Transactions of Edinburgh, "If you cast your eye upon the map you will observe from Cayenne to the bottom of the Gulph of Paria, this immense tract of swamp, formed by the sediment of these rivers, and a similar tract of shallow muddy coast, which their continued operation will one day elevate. The sediment of the Amazons is carried down thus to leeward (the westward) by the constant currents which set along from the southward and the coast of Brazil. That of the Oroonoko is detained and allowed to settle near its mouths by the opposite island of Trinidad, and still more by the mountains on the main, which are only separated from that island by the Bocos del Drago. The coast of Guiana has remained, as it were, the great eddy or resting place for the washings of great part of South America for ages;
"and its own comparatively small streams have but modified here
and there the grand deposit."*

Having been amply gratified with our visit to this singular place,
which to the usual magnificence of the West Indian landscape,
unites the striking peculiarity of the local scene, we re-embarked
in our vessel, and stood along the coast on our return. On the way
we landed, and visited the plantations of several gentlemen, who
received us with hospitality, and made us more fully acquainted
with the state of this island: a colony which may with truth be
described as fortunate in its situation, fertile in its soil, and rich be­
yond measure in the productions of nature; presenting, in short,
by a rare combination, all which can gratify the curiosity of the na­
turalist, or the cupidity of the planter; restrained in the develope­
ment of its astonishing resources, only by the inadequacy of popu­
lation, the tedious and ill-defined forms of Spanish justice, and the
severe, though we may hope transient, pressure of the times.

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* Vide Mr. Lochhead’s Observ. on the Nat. Hist. of Guiana. Edin. Trans. vol. 4.