

IX. *Some Account of the Vegetable and Mineral Productions of Boutan and Thibet. By Mr. Robert Saunders, Surgeon at Boglepoor in Bengal; communicated by Sir Joseph Banks, Bart. P. R. S.*

Read February 26 and March 5, 1789.

**R**OAD to Buxaduar, May 11 and 12, 1783. The tract of country from Bahar to the foot of the hills contains but few plants that are not common to Bengal. Pine-apples, mango-tree, jack and faul timber, are frequently to be met with in the forests and jungles. Find many orange-trees towards the foot of the hills, of a very good sort, and bearing much fruit. Saw a few lime-trees, and found three different species of the fenfitive plant. One species is used medicinally by the natives of Bengal in fevers; it is a powerful astringent and bitter; another is the species from which Terra Japonica is made, a medicine the history of which we are but lately made acquainted with. The third species is well known as the fenfitive plant, and common in Bengal.

The country, from Bahar to the foot of the mountains, to which we approach without any ascent, is rendered one of the most unhealthy parts of India, from a variety of causes.

The whole, a perfect flat, is at all times wet and swampy, with a luxuriant growth of reeds, long grass, and underwood, in the midst of stagnated water, numerous frogs and insects. The exhalations from such a surface of vegetable matter and swamps, increased by an additional degree of heat from the reflection

reflection of the hills, affect the air to a considerable extent, and render it highly injurious to strangers and European constitutions.

The thermometer at the foot of the hill, mid-day  $86^{\circ}$ , fell to  $78^{\circ}$  at two o'clock, the time we reached Buxaduar, and that hour of the day when it is generally highest.

The soil and appearance of the ground in ascending the hill are materially changed. See many loose sparry stones and rock containing iron. Two springs, conducted from a distant height by spouts, are very pure and good water, without any mineral impregnation. The mountains in view covered with forests of trees, rendered useless from their inaccessibility. Those peculiar to the country are known to the natives by the names Boumbshi, Toubmbshi and Sindeshi, besides saul timber, bamboo, and plantains.

Buxaduar, May 12 to 21. Many of the plants peculiar to Bengal require nursing at Buxaduar. There is one very good banian tree. In the jungles, met with the ginger, and a very good sort of yam; saw some pomegranate-trees in good preservation; shallots in great perfection; a species of the *Lychnis*, *Arum*, and *Asclepias*, natives of more northern situations, and of little use; a bad sort of raspberry, and a species of the *Gloriosa*. The plantains in use below do not thrive here. In the jungles they have a plantain-tree producing a very broad leaf, with which they cover their huts; but the fruit is not eaten. See many weeds and long grass more common to Bengal than any other parts of Boutan.

From the 15th to the 22d, the rains were almost incessant at Buxaduar. Our People became unhealthy, and were attacked with fevers, which, if neglected in the beginning, proved obstinate quartans. This was the case with several of  
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the natives whom I had an opportunity of seeing. They scarcely, however, admit that Buxaduar is unhealthy at any season of the year. After allowing for their prejudice, and the possibility of the natives suffering but little from the bad seasons, I cannot help thinking, that Buxaduar must be unhealthy, at least to strangers, from the month of May till towards the end of September. It lies high, but is overtopped by the surrounding mountains, covered with forests of trees and underwood. In all climates, where the influence of the sun is great, this is a never-failing cause of bad air. The exhalation that takes place from so great a surface in the day-time falls after sunset in the form of dew, rendering the air raw, damp, and chilly, even in the most sultry climates.

The thermometer at Buxaduar was never, at two o'clock in the afternoon, above  $82^{\circ}$ , or below  $73^{\circ}$ .

In the neighbourhood of Buxaduar there are several excellent springs of water, some of them with less impregnation of any sort than I ever met with; the nicest test scarcely produced the separation of a sensible quantity of earthy matter. Such waters are generally to be distinguished by the taste, which is insipid and unpleasant. When these springs could be traced to their source, they sunk the thermometer eight or ten degrees below the temperature of the atmosphere.

Road to Murishong, May 22 and 23. In ascending the hill from Buxaduar there is to be seen much of an imperfect quartz, of various forms and colour, having in some places the appearance of marble; but from chemical experiments, it was found to possess very different properties. This sort of quartz, when of a pure white, and free from any metallic colouring matter, is used as an ingredient in porcelain. I have not seen any that promises to answer that purpose better than what is to be met with in the mountains near

Buxaduar. It is known to mineralists in that state by the name of quartz gritstone. The rock which forms the basis of these mountains dips in almost every direction, and is covered with a rich and fertile soil, but in no place level enough to be cultivated. Many European plants are met with on the road to Murishong; many different sorts of mosses, fern, wild thyme, peaches, willow, chickweed, and grasses common to the more southern parts of Europe, nettles, thistles, dock, strawberry, raspberry, and many destructive creepers, some peculiar to Europe.

Murishong is the first pleasant and healthy spot to be met with on this side of Boutan. It lies high, and much of the ground about it is cleared and cultivated; the soil, rich and fertile, produces good crops. The only plant now under culture is a species of the *Polygonum* of LINNÆUS, producing a triangular seed, nearly the size of barley, and the common food of the inhabitants. It was now the beginning of their harvest; and the ground yields them, as in other parts of Boutan, a second crop of rice. Here are to be found in the Jungles two species of the *Laurus* of LINNÆUS; one known by the name of the bastard cinnamon. The bark of the root of this plant, when dried, has very much the taste and flavour of cinnamon; it is used medicinally by the natives. The *Chenopodium*, producing the semen fantonicum, or worm-feed, a medicine formerly in great character, and used in those diseases from which it is named, is common here.

Found in the neighbourhood of this place all the European plants we had met with on the road. The ascent from Buxaduar to Murishong is upon the whole great, with a sensible change in the state of the air.

Road to Chooka, May 25. On the road to Chooka find all the Murishong plants, cinnamon-tree, willow, and one or two firs;

firs; strawberries every where, and very good, and a few bilberry plants.

Much sparry flint, and a sort of granite with which the road is paved. There is a great deal of talc in the stones and soil, but in too small pieces to be useful. Frequent beds of clay and pure sand. Find two mineral wells, slightly impregnated with iron, with much appearance of that metal in this part of the country; and they are not unacquainted with the method of extracting it from the stones, but still despise its use in building. Towards Chooka there are many well cultivated fields of wheat and barley.

Road to Punukha, May 26. From Chooka the country opens, and presents to view many well cultivated fields and distant villages; a rapid change in climate, the vegetable productions, and general appearance of the country. Towards Punukha, pines and firs are the only trees to be met with; but they do not yet seem in their proper climate, being dwarfish and ill-shaped; peaches, raspberries, and strawberries, thriving every where; scarce a plant to be seen that is not of European growth. In addition to the many I have already mentioned, saw two species of the *Cratægus*, one not yet described. Saw two ash-trees in a very thriving state, the star-thistle, and many other weeds, in general natives of the Alps and Switzerland.

Much of the rock to-day is, I find on examination, pure limestone; a valuable acquisition if they did not either despise its use, or were unacquainted with its properties. It was most advantageously situated for being worked, and the purest perhaps to be met with. There is likewise abundance of fire-wood in this part of the country. In building they would derive great benefit from the use of it. Their houses are lofty, the timbers substantial, and nothing wanting

to make them durable, but their being acquainted with the use of lime. As a manure it might probably be used to great advantage. Many fields of barley in this part of the country; now the beginning of their harvest. The thermometer here fell, at four o'clock in the afternoon, to  $60^{\circ}$ : cold and chilly.

Road to Chepta, May 27. On the road to Chepta, the rock in general dips to the northward and eastward, in about an angle of sixty degrees. Much of limestone, and some veins of quartz, and loose pieces of sparry flint striking fire with steel.

Several springs, and one slightly impregnated with iron.

In addition to the plants of yesterday, find the *Coriandrum testiculatum*, *Inula montana*, and *Rhododendrum magnum*.

At Chepta met with a few turneps, one maple-tree, wormwood, goose-grass (*Galium aparine*), and many other European weeds; the first walnut-tree we had yet seen.

Chepta lies high, and not above six miles from the mountain of Lomya, now covered with snow. The wind from that quarter, S.E. made it cold and chilly, and sunk the thermometer at mid-day to  $57^{\circ}$ . Here are some fields of wheat and barley not yet ripe.

Road to Pagha, May 29. Soon after leaving Chepta find a mineral well, which, on a chemical examination, gave marks of a strong impregnation from iron. I traced it to its source, where the thermometer, on being immersed, fell from  $68^{\circ}$  to  $56^{\circ}$ .

A little before we reach Pagha, met with some limestone, and a bed of chalk, which, near the surface, contained a great proportion of sand, but some feet under was much purer.

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The forests of firs of an inferior growth, several ash-trees, dog-rose, and bramble.

Road to Tasséfudon, May 30 and 31, June 1. The road from here to Tasséfudon presents us with little that we have not met with; fewer strawberries, and no raspberries; some very good orchards of peaches, apricots, apples, and pears. The fruit formed, and will be ripe in August and September. Met with two sorts of cranberry, one very good. Saw the *Fragaria sterilis*, and a few poppies. At Wanakha found a few turneps, shallots, cucumbers, and gourds. Near to Tasséfudon the road is lined with many different species of the rose, and a few jessamine plants. The soil is light, and the hills in many places barren, rocky, and with very little verdure. The rock in general laminated and rotten, with many small particles of talc in every part of the country incorporated with the stones and soil. Some limestone, and appearance of good chalk. Several good and pure springs of water.

Tasséfudon and its neighbourhood abound with all the plants we have already mentioned. The hills are chiefly wood, with firs and aspen. I have not yet been able to find an oak-tree, and the ash is very seldom to be met with. The elder, holly, bramble, and dog-rose, are common. Found the birch-tree, cypress, yew, and delphinium. Many different species of the vaccinium, of which the bilberry is one, and the cranberry another. Towards the top of the adjacent mountains met with two plants of the *Arbutus uva ursi*, which is a native of the Alps, the most mountainous parts of Scotland, and Canada.

I have likewise seen a species of the rhubarb plant (*Rheum undulatum*) brought from a distance, and only to be met with near the summits of hills covered with snow, and where the  
soil

foil is rocky. The true rhubarb (*Rheum palmatum*) is likewise the native of a cold climate; and though China supplies us with much of this drug, it is known to be the growth of its more northern provinces, Tartary, and part of the Russian dominions. The great difficulty is in drying the root. People versant in that business say, that one hundred pounds of the fresh root should not weigh above six pounds and a half, if properly dried, and it certainly has been reduced to that. I have seen eighty pounds of fresh root produced from one plant; but, after drying it with much care and attention, the weight of the dried root could not be made less than twelve pounds. It was suspended in an oven, with an equal and moderate degree of heat. Little more than the same quantity of this powder produced a similar effect with the best foreign rhubarb.

The other plants common here are the service-tree, blessed thistle, mock orange, *Spiræa filipendula*, *Arum*, *Echites*, *Punica*, *Ferula communis*, *Erica*, and *Viola*. Of the rose-bush I have met with the five following species; *Rosa alpina*, *centifolia*, *cannina*, *Indica*, *spinossissima*.

The culture of pot-herbs is every where neglected; turneps, a few onions and shallots, were the best we could procure. Mr. BOGLE left potatoes, cabbage, and lettuce-plants, all which we found neglected and dispersed. They had very improperly (from an idea most probably of their being natives of Bengal) planted them in a situation and climate which approaches very near to that of Bengal at all seasons, as we shall find afterwards. Melons, gourds, brinjals, and cucumbers, are occasionally to be met with. The country is fitted for the production of every fruit and vegetable common without the tropics, and in some situations will bring to perfection many of the tropical fruits.



There are two plants which I have to regret the not having had as yet an opportunity of seeing; one is the tree from the bark of which their paper is made; and the other is employed by them in poisoning their arrows. This last is said to come from a very remote part of the country. They describe it as growing to the height of three or four feet, with a hollow stalk. The juice is inspissated, and laid as a paste on their arrows. Fortunately for them, it has not all the bad effects they dread from it. I had an opportunity of seeing several who were wounded with these arrows, and they all did well, though under the greatest apprehension. The cleaning and enlarging some of the wounds was the most that I found necessary to be done. The paste is pungent and acrid, will increase inflammation, and may make a bad or neglected wound mortal; but it certainly does not possess any specific quality as a poison.

The fir, so common in this country, is perhaps the only tree they could convert to a useful and profitable purpose. What I have seen would not, from their situation, be employed as timber. The largest I have yet met with were near Wandepore; they measured from eight to ten feet in circumference, were tall and straight. Such near the Burampooter, or any navigable river, might certainly be transported to an advantageous market. I am convinced that any quantity of tar, pitch, turpentine, and resin, might be made in this country, much to the emolument of the natives. Firs, which from their size and situation are unfit for timber, would answer the purpose equally well. The process for procuring tar and turpentine is simple, and does not require the construction of expensive works. This great object has been so little attended to, that they are supplied from Bengal with what they want of these articles.

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The country about Tasséfudon contains great variety of soil, and much rock of many different forms, but still an unpromising field for a mineralist. I have not found in Boutan a fossil that had the least appearance of containing any other metal than iron, and a small portion of copper. From information, and the reports of travellers, I believe it is otherwise to the northward. The banks of the Ticushu, admitting of cultivation for several miles above and below Tasséfudon, yield them two crops in the year. The first of wheat and barley is cut down in June; and the rice, planted immediately after, enjoys the benefit of the rains. This country is not without its hot wells, as well as many numerous springs, some of which I have taken notice of. One hot well, near Wandepore, is so close to the banks of the river as to be overflowed in the rains, and we found it impossible to get to it: the heat of this well is great; but I could not learn that the ground about it was much different from the general aspect of the country. Another, several days journey from hence, is on the brow of a hill perpetually covered with snow. This hot well is held in great estimation by the people of the country, and resorted to by valetudinarians of every description. I gained but little satisfactory information respecting the degree of heat, or appearance of the ground about it, that could lead me to form a just opinion of either.

Tasséfudon to Paraghon, Sept. 8 and 9. Left Tasséfudon, and arrived next day at Paraghon. Much good rich soil, with more pasture, where the ground is not cultivated, than we had yet met with. Many fields of turneps in great perfection; a plant they seem better acquainted with the cultivation of than any other. Find on the road many large and well-thriving birch, willows, pines, and firs, some walnut-trees, the

Arbutus

*Arbutus uva ursi*, abundance of strawberry, elderberry, bilberry, *Chrysanthemum* or greater daisy, and many European grasses. See the *Datura ferox* or thorn-apple, a plant common in China and some parts of Thibet, where it is used medicinally. They find it a powerful narcotic, and give the seeds where they wish that effect to be produced. It has been used as a medicine in Europe, and is known to possess these qualities in a high degree. See holly, dog-rose, and aspen. The present crop near Paraghon, on the banks of the Pachu, is rice, but not so far advanced as at Tasséfudon; the same may be said of their fruits. They say it is colder here at all seasons than at Tasséfudon, which is certainly below the level of this place.

Towards the summit of the mountain we crossed, found some rock of a curious appearance, forming in front six or seven angular semi-pillars, of a great circumference, and some hundred feet high. This natural curiosity was detached in part from the mountain, and projected over a considerable fall of water, which added much to the beautiful and picturesque appearance of the whole. Numerous springs, some degrees colder than the surrounding atmosphere, gushing from the rock on the most elevated part of the mountain, furnish a very ample and seasonable supply of excellent water to the traveller. The rock, in many places laminated, might be formed into very tolerable slate. Near to Paraghon iron stones are found, and one spring highly impregnated with this mineral.

Road to Dukaigun, Sept. 11. Our road to Dukaigun, nearly due north, is a continued ascent for eight miles, along the banks of the Pachu, falling over numerous rocks, precipices,

pices, and huge stones. Here we begin to experience a very considerable change in the temperature of the atmosphere; the surrounding hills were covered with snow in the morning, which had fallen the preceding night, but disappeared soon after sunrise. The thermometer fell to  $54^{\circ}$  in the afternoon, and did not rise above  $62^{\circ}$  at noon.

The face of the mountains, in some places bare, with projecting rock of many different forms; quartz, flint, and a bad sort of freestone, common. Many very good springs, slightly impregnated with a felenitic earth.

The soil is rich, and near to the river in great cultivation. Many horses, the staple article of their trade, are bred in this part of the country. Found walnut-trees, peaches, apples, and pears.

Road to Sanha, Sept. 12. The road still ascending to Sanha, and near to the river for ten miles.

The thermometer falling some degrees, we found it cold and chilly. The bed of the river is full of large stones, probably washed down from the mountains by the rapidity of its stream; they are chiefly quartz and granite. Here is excellent pasture for numerous herds of goats.

Road to Chichakumboo. From Sanha the ascent is much greater, and, after keeping for ten miles along the banks of the Pachu, still a considerable stream, we reach its source (from three distinct rivulets, all in view, ramified and supplied by numerous springs), and soon after arrive at the most elevated part of our road.

Here we quit the boundary of Boutan, and enter the territory of Thibet, where nature has drawn the line still more strongly, and affords, perhaps, the most extraordinary contrast

traft that takes place on the face of the earth. From this eminence are to be feen the mountains of Boutan, covered with trees, shrubs, and verdure to their tops, and on the fouth fide of this mountain to within a few feet of the ground on which we tread. On the north fide the eye takes in an extenfive range of hills and plains, but not a tree, shrub, or fcarce a tuft of grafs to be feen. Thus, in the courfe of lefs than a mile, we bid adieu to a moft fertile foil, covered with perpetual verdure, and enter a country where the foil and climate feem inimical to the produktion of every vegetable. The change in the temperature of the air is equally obvious and rapid. The thermometer in the forenoon  $34^{\circ}$ , with froft and fnow in the night-time. Our prefent obfervations on the caufe of this change confirmed us in a former opinion, and incontestably prove, that we are to look for that difference of climate from the fituation of the ground as more or lefs above the general level of the earth. In attending to this caufe of heat or cold, we muft not allow ourfelves to be deceived by a comparifon with that which is immediately in view. We ought to take in a greater range of country, and where the road is near the banks of a river, we cannot well err in forming a judgement of the inclination of the ground. Punukha and Wandepore, both to the northward of Taffesudon, are quite in a Bengal climate. The thermometer at the firft of thefe places, in the months of July and January, was within two degrees of what it had been at Rungpore for the fame periods. They feem in more expofed fituations than Taffesudon; and, were we to draw a comparifon of their heights from the furrounding ground, I fhould fay they were above its level. The road, however, proves the reverfe. From Punukha to

Tassafudon we had a continued and steep ascent for six hours and a half, with a very inconsiderable descent on the Tassafudon side. From the south side of the mountain dividing Boutan from Thibet, the springs and rivulets are tumbling down in cascades and torrents, and have been traced by us near to the foot of the hills, where they empty themselves to the eastward of Buxaduar. On the north side they glide smoothly along, and by passing to the northward as far as Tishoolumboo, prove a descent on that side, which the eye could not detect. This part of the country, being the most elevated, is at all times the coldest; and the snowy mountains, from their heights and bearings, notwithstanding the distance, are certainly those seen from Purnea.

The soil on the Thibet side of the mountain is sandy, with much gravel and many loose stones. On the road found the *Aconitum pyreneum*, and two species of the *Saxifraga*.

See a large flock of chowry tailed cattle; their extensive range of pasture seems to make amends for its poverty.

From Faro to Duina, Sept. 15. From Faro to Duina pass over an extensive plain, bounded by many small hills, oddly arranged; some of them detached and single, and all seem composed of sand collected in that form, having the plain for their general base.

At Duina found a few plots of barley, which they are now cutting down, though green, as despairing of its ripening. The thermometer, at six o'clock in the morning, below the freezing point, and the ground partially covered with snow.

Road to Chalu, Sept. 16. Continue on the plain; find three springs forcing their way through the ground with violence, and giving rise to a lake many miles in extent, stored  
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with millions of water-fowl and excellent fish. Of the first saw the cyrus, solan geese, many kinds of ducks, pintados, cranes, and gulls of different sorts. The springs of this lake are in great reputation for the cure of most diseases. I examined the water, and found it contain a portion of alum with the selenitic earth. On the banks of the lake I found a crystallization, which proves to be an alkaline salt; it is used by the natives for washing, and answers the purpose as well as pot-ash. The pasture which is impregnated with this salt is greedily fought after by sheep and goats, and proves excellent food for them. The hills are chiefly composed of sand incruusted by the inclemency of the weather and violent winds, seeming at first view composed of freestone.

Road to Simadar, Sept. 17. Pass a lake still more considerable than the former, with which it communicates by a narrow stream, about three miles long. There never was a more barren or unpromising soil; little turf, grass, or vegetation of any sort, except near the lake. See a few huts, mostly in ruins and deserted. The only grain in this part of the country is barley, which they are cutting down every where green.

Pass two springs, one of them slightly impregnated with alum. They form the principal source of a river, which empties itself in the Burrampooter near Tissoolumboo.

The wind from the eastward of south is now the coldest and most piercing; passing over the snowy mountains and dry sandy desert before described, it comes divested of all vapour or moisture, and produces the same effect as the hot dry winds in more southerly situations. Mahogany boxes and furniture, that had withstood the Bengal climate for years, were warped  
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with considerable fissures, and rendered useless. The natives say, a direct exposure to these winds occasions the loss of their fore-teeth; and our faithful guide ascribed that defect in himself to this cause. We escaped with loss of the skin from the greatest part of our faces.

Road to Seluh, Sept. 18. Near our road to-day found a hot well, much frequented by people with venereal complaints, rheumatism, and all cutaneous diseases. They do not drink the water, but use it as a bath. The thermometer, when immersed in the water, rose from  $40^{\circ}$  to  $88^{\circ}$ . It has a strong sulphureous smell, and contains a portion of hepar sulphuris. Exposure to air deprives it, as most other mineral wells, of much of its property.

Road to Takui, Sept. 19. Pass some fields of barley and pease, and get into a milder climate. Find to-day a great variety of stone and rock, some containing copper, and others, a very pure rock crystal, regularly crystallized, with six unequal sides. The rock crystal is of different sizes and degrees of purity, but of one form. Find some flint and granite, several springs of water impregnated with iron, and nearly of the same temperature with the atmosphere. See a few ill-thriving willows planted near the habitations, and which are the only trees to be met with.

Road to Tiffolumboo, Sept. 20, 21, and 22. The remaining part of our journey is over a more fertile soil, enjoying a milder climate. Some very good fields of wheat, barley, and pease; many pleasant villages and distant houses, less sand and more rock, part flaty, and much of it a very good sort of flint. The soil in the valley a light-coloured clay and sand. They are every where employed in cutting down their crop. What



a happy climate! The sky serene and clear, without a cloud; and so confident are they of the continuance of this weather, that their crop is thrown together in a convenient part of the field, without any cover, to remain till they can find time to thresh it out,

Before we reached Tiffoolumboo found some elms and ash-trees.

The hills in Thibet have, from their general appearance, strong marks of containing those fossils that are inimical to vegetation; such are most of the ores of metal and pyritical matter.

The country, properly explored, promises better than any I have seen to gratify the curiosity of a philosopher, and reward the labours of a mineralist. Accident, more than a spirit of enterprise and enquiry, has already discovered the presence of many valuable ores and minerals in Thibet. The first in this list is deservedly gold. They find it in large quantities, and frequently very pure. In the form of gold-dust it is found in the beds of rivers, and at their several bendings, generally attached to small pieces of stone, with every appearance of its having been part of a larger mass. They find it sometimes in large masses, lumps, and irregular veins; the adhering stone is generally flint or quartz, and I have sometimes seen a half-formed, impure sort of precious stone in the mass. By a common process for the purification of gold, I extracted 12 *per cent.* of refuse from some gold-dust, and on examination found it to be sand and filings of iron, which last was not likely to have been with it in its native state, but probably employed for the purpose of adulteration. Two days journey from Tiffoolumboo there is a lead mine. The ore is much the same as that found in Derbyshire, mineralized by sulphur,

fulphur, and the metal obtained by the very simple operation of fusion alone. Most lead contains a portion of silver, and some in the proportion to make it an object to work the lead ore for the sake of the silver. Cinnabar, containing a large proportion of quicksilver, is found in Thibet, and might be advantageously employed for the purpose of extracting this metal. The process is simple, by distillation; but to carry it on in the great would require more fuel than the country can well supply. I have seen ores and loose stones containing copper, and have not a doubt of its being to be found in great abundance in the country. Iron is more frequently to be met with in Boutan than Thibet; and, was it more common, the difficulty of procuring proper fuel for smelting the less valuable ores, must prove an insuperable objection to the working them. The dung of animals is the only substitute they have for fire-wood, and with that alone they will never be able to excite a degree of heat sufficiently intense for such purposes. Thus situated, the most valuable discovery for them would be that of a coal mine. In some parts of China bordering on Thibet, coal is found and used as fuel.

Tincal, the nature and production of which we have only hitherto been able to guess at, is now well known, and Thibet, from whence we are supplied, contains it in inexhaustible quantities. It is a fossil brought to market in the state it is dug out of the lake, and afterwards refined into Borax by ourselves. Rock salt is likewise found in great abundance in Thibet.

The lake, from whence tincal and rock salt are collected, is about fifteen days journey from Tiffoolumboo, and to the northward of it. It is encompassed on all sides by rocky hills, without

without any brooks or rivulets near at hand ; but its waters are supplied by springs, which being saltish to the taste are not used by the natives. The tincal is deposited or formed in the bed of the lake ; and those who go to collect it, dig it up in large masses, which they afterwards break into small pieces for the convenience of carriage, exposing it to the air to dry. Although tincal has been collected from this lake for a great length of time, the quantity is not perceptibly diminished ; and as the cavities made by digging it soon wear out or fill up, it is an opinion with the people, that the formation of fresh tincal is going on. They have never yet met with it in dry ground or high situations, but it is found in the shallowest depths, and the borders of the lake, which deepening gradually from the edges towards the center contains too much water to admit of their searching for the tincal conveniently ; but from the deepest parts they bring up rock salt, which is not to be found in the shallows, or near the bank. The waters of the lake rise and fall very little, being supplied by a constant and unvarying source, neither augmented by the influx of any current, or diminished by any stream running from it. The lake, I am assured, is at least twenty miles in circumference, and standing in a very bleak situation is frozen for a great part of the year. The people employed in collecting these salts are obliged to desert from their labour so early as October, on account of the ice. Tincal is used in Thibet for soldering and to promote the fusion of gold and silver. Rock salt is universally used for all domestic purposes in Thibet, Boutan, and Naphaul.

The thermometer at Tiffoolumboo during the month of October was, on an average, at eight o'clock in the morning  $38^{\circ}$ , at noon  $46^{\circ}$ , and six o'clock in the evening  $42^{\circ}$ . The

weather clear, cool, and pleasant, and the prevailing wind from the southward. During the month of November we had frosts morning and evening, a serene clear sky, not a cloud to be seen. The rays of the sun passing through a medium so little obscured had great influence. The thermometer was often below  $30^{\circ}$  in the morning, and seldom above  $38^{\circ}$  at noon in the shade; wind from the southward.

Of the diseases of this country, the first that attracts our notice, as we approach the foot of the hills, is a glandular swelling in the throat, which is known to prevail in similar situations in some parts of Europe, and generally ascribed to an impregnation of the water from snow. The disease being common at the foot of the Alps, and confined to a tract of country near these mountains, has first given rise to the idea of its being occasioned by snow water. If a general view of the disease, and situations where it is common, had been the subject of enquiry, or awakened the attention of any able practitioner, we should have been long since undeceived in this respect. On the coast of Greenland, the mountainous parts of Wales and Scotland, where melted snow must be continually passing into their rivers and streams, the disease is not known, though it is common in Derbyshire, and some other parts of England. Rungpore is about one hundred miles from the foot of the hills, and much farther from the snow, yet the disease is as frequent there as in Boutan. In Thibet, where snow is never out of view, and the principal source of all their rivers and streams, the disease is not to be met with; but what puts the matter past a doubt, is the frequency of the disease on the coast of Sumatra, where snow is never to be found. On finding the vegetable productions of Boutan the same as those of the Alps in almost every instance, it occurred to me, that the

the disease might arise from an impregnation of the water by these plants, or the soil probably possessing similar qualities, the spontaneous productions of both countries, with very few exceptions, being so nearly alike. It however appears more probable, that the disease is endemial, proceeding from a peculiarity in the air of situations in the vicinity of mountains with such soil and vegetable productions. I am the more inclined to think so, that I have universally found this disease most prevalent amongst the lower class of people, and those who are most exposed to the unguarded influence of the weather, and various changes that take place in the air of such situations. The primary cause in the atmosphere producing this effect is, perhaps, not more inexplicable than what we meet with in the low-lands of Essex and fens of Lincolnshire. An accurate analysis of the water used in common by the natives, where this disease is more or less frequent, and where it is not known in similar exposures, might throw some light on this subject.

This very extraordinary disease has been little attended to, from obvious reasons; it is unaccompanied with pain, seldom fatal, and generally confined to the poorer sort of people. The tumor is unsightly, and grows to a troublesome size, being often as large as a person's head. It is certainly not exaggerating to say, that one in six of the Rungpore district, and country of Boutan, has the disease.

As those who labour most, and are the least protected from the changes of weather, are most subject to the disease, we universally find it in Boutan more common with the women than men. It generally appears in Boutan at the age of thirteen or fourteen, and in Bengal at the age of eleven or twelve; so that in both countries the disease shows itself about the age

of puberty. I do not believe this disease has ever been removed, though a mercurial course seemed to check its progress, but did not prevent its advance after intermitting the use of mercury. An attention to the primary cause will first lead to a proper method of treating the disease; a change of situation for a short while, at that particular period when it appears, might be the means of preventing it.

The people of this happy climate are not exempt from the venereal disease, which seems to rage with unremitting fury in all climates, and proves the greatest scourge to the human race. It has been long a matter of doubt, whether this disease has ever been cured by any other specific than mercury and its different preparations. In defence of the opinion of other specifics being in use, it has always been urged, that the disease is frequent in many parts of the world, where it could not be supposed that they were acquainted with quicksilver, and the proper method of preparing it as a medicine. I must own, that I expected to have been able to have added one other specific for this disease to our list in the *Materia medica*, being informed that the disease was common, and their method of treating it successful; nor could I allow myself to think they were acquainted with the method of preparing quicksilver, so as to render it a safe and efficacious medicine. In this, however, I was mistaken.

The disease seems in this country to make a more rapid progress, and rage with more violence, than in any other. This is to be accounted for from the grossness of their food and little attention to cleanliness.

There is one preparation of mercury in common use with them, and made after the following manner. A portion of alum, nitre, vermillion, and quicksilver, are placed in the bottom of an earthen

earthen pot, with a smaller one inverted put over the materials, and well luted to the bottom of the larger pot. Over the small one, and within the large one, the fuel is placed, and the fire continued for about forty minutes. A certain quantity of fuel, carefully weighed out, is what regulates them with respect to the degree of heat, as they cannot see the materials during the operation. When the vessel is cool, the small inverted pot is taken off, and the materials collected for use. I attended the whole of the process, and examined the materials afterwards. The quicksilver had been acted on by the other ingredients, deprived of its metallic form, and rendered a safe and efficacious remedy.

A knowledge of chemistry has taught us a more certain method of rendering this valuable medicine active and efficacious; yet we find this preparation answering every good purpose, and by their guarded manner of exhibiting it perfectly safe. This powder is the basis of their pill, and often used in external application. The whole, when intimately mixed, formed a reddish powder, and was made into the form of pills by the addition of a plum or date. Two or three pills taken twice a day generally bring on, about the fourth or fifth day, a spitting, which is encouraged by continuing the use of the pills for a day or two longer. As the salivation advances, they put a stick across the patient's mouth, in the form of a gag, and make it fast behind. This, they say, is done to promote the spitting, and prevent the loss of their teeth. They keep up the salivation for ten or twelve days, during which time the patient is nourished with congee and other liquids. Part of this powder is often used externally by diffusing it in warm water, and washing sores and buboes. They disperse buboes frequently by poultices of turnip tops, in which they always  
put.

put vermillion, and sometimes musk. Nitre, as a cooler, is very much used internally by them in this disease, and they strictly enjoin warmth and confinement during the slightest mercurial course. Buboes advanced to suppuration are opened by a lancet, with a large incision, which they do not allow to close before the hardness and tumor are gone. In short, I found very little room for improving their practice in this disease. I introduced the method of killing quicksilver with honey, gave them an opportunity of seeing it done, and had the satisfaction of finding it successfully used by themselves before we left the country.

This happy climate presents us with but little variety in their diseases. Coughs, colds, and rheumatism, are more frequent here than in Bengal. Fevers generally arise here from a temporary cause, are easily removed, and seldom prove fatal. The liver disease is occasionally to be met with, and complaints in the bowels are not unfrequent; but the grossness of their food, and uncleanness of their persons, would in any other climate be the source of constant disease and sickness. They are ignorant (as we were, not many years ago) of the proper method of treating diseases of the liver and other viscera; this is, I believe, the cause of the most obstinate and fatal disease to be met with in the country, I mean the dropy. As the Rajah had ever been desirous of my aid and advice, and had directed his doctors to attend to my private instructions and practice, I endeavoured to introduce a more judicious method of treating those diseases by mercurial preparations. I had an opportunity of proving the advantage of this plan to their conviction in several instances, and of seeing them initiated in the practice.

The Rajah favoured me with above seventy specimens of the medicines in use with them. They have many sorts of stones and petrifications



petrifications saponaceous to the touch, which are employed as an external application in swellings and pains of the joints. They often remove such complaints, and violent head-achs, by fumigating the part affected with aromatic plants and flowers. They do not seek for any other means of information respecting the state of a patient than that of feeling the pulse; and they confidently say, that the seat of pain and disease is easily to be discovered, not so much from the frequency of the pulse as its vibratory motion. They feel the pulse at the wrist with their three fore-fingers, first of the right, and then of the left hand; after pressing more or less on the artery, and occasionally removing one or two of the fingers, they determine what the disease is. They do not eat any thing the day on which they take physic, but endeavour to make up the loss afterwards by eating more freely than before, and using such medicines as they think will occasion costiveness.

The many simples in use with them are from the vegetable kingdom, collected chiefly in Boutan. They are in general inoffensive and very mild in their operation. Carminatives and aromatics are given in coughs, colds, and affections of the breast. The centaury, coriander, carraway, and cinnamon, are of this sort. This last is with them the bark of the root of that species of *Laurus* formerly mentioned as a native of this country. The bark from the root is in this plant the only part which partakes of the cinnamon taste; and I doubt very much if it could be distinguished by the best judges from what we call the true cinnamon. The bark, leaves, berries, and stalks of many shrubs and trees, are in use with them, all in decoction. Some have much of the astringent bitter taste of our most valuable medicines, and are generally employed here with the same view, to strengthen the powers of digestion, and mend

the general habit. Their principal purgative medicines are brought by the Chinese to Lassa. They had not any medicine that operated as a vomit, till I gave the Rajah some ipecacuanha, who made the first experiment with it on himself.

In bleeding they have a great opinion of drawing the blood from a particular part. For head-achs they bleed in the neck; for pains in the arm and shoulder, in the cephalic vein; and of the breast or side, in the median; and if in the belly, they bleed in the basilic vein. They think pains of the lower extremity are best removed by bleeding in the ankle. They have a great prejudice against bleeding in cold weather; nor is any urgency or violent symptom thought at that time a sufficient reason for doing it.

They have their lucky and unlucky days for operating or taking any medicine; but I have known them get the better of this prejudice, and be prevailed on.

Cupping is much practised by them; a horn, about the size of a cupping glass, is applied to the part, and by a small aperture at the other end they extract the air with their mouth. The part is afterwards scarified with a lancet. This is often done on the back; and in pain and swelling of the knee it is held as a sovereign remedy. I have often admired their dexterity in operating with bad instruments. Mr. HAMILTON gave them some lancets, and they have since endeavoured, with some success, to make them of that form. They were very thankful for the few I could spare them. In fevers they use the Kuthullea nut, well known in Bengal as an efficacious medicine. They endeavour to cure the dropsy by external applications, and giving a compounded medicine made up of above thirty different ingredients: they seldom or never succeed in effecting a cure of this disease.

I explained to the Rajah the operation of tapping, and shewed him the instrument with which it was done. He very earnestly expressed a desire that I should perform the operation, and wished much for a proper subject; such a one did not occur while I remained, and perhaps it was as well both for the Rajah's patients and my own credit; for after having seen it once done, he would not have hesitated about a repetition of the operation. Gravelish complaints and the stone in the bladder are, I believe, diseases unknown here.

The small-pox, when it appears among them, is a disease that strikes them with too much terror and consternation to admit of their treating it properly. Their attention is not employed in saving the lives of the infected, but in preserving themselves from the disease. All communication with the infected is strictly forbidden, even at the risk of their being starved, and the house or village is afterwards erased. A promiscuous and free intercourse with their neighbours not being allowed, the disease is very seldom to be met with, and its progress always checked by the vigilance and terror of the natives. Few in the country have had the disease. Inoculation, if ever introduced, must be very general to prevent the devastation that would be made by the infection in the natural way; and where there could not be any choice in the subject fit to receive the disease, many must fall a sacrifice to it. The present Rajah of Thibet was inoculated, with some of his followers, when in China with the late Tishoo Lama.

The hot bath is used in many disorders, particularly in complaints of the bowels and cutaneous eruptions. The hot wells of Thibet are resorted to by thousands. In Boutan they substitute water warmed by hot stones thrown into it.

In Thibet the natives are more subject to sore eyes and blindness than in Boutan. The high winds, sandy soil, and glare from the reflection of the sun, both from the snow and sand, account for this.

I have dwelt long on this subject, because I think the knowledge and observations of these people on the diseases of their country, with their medical practice, keep pace with a refinement and state of civilization, which struck me with wonder, and no doubt will give rise to much curious speculation, when known to be the manners of a people holding so little intercourse with what we term civilized nations.

Dec. 1. Left Tishoolumbo, and found the cold increase every day as we advanced to the southward, most of the running waters frozen, and the pools covered with ice strong enough to carry. Our thermometer having only the scale as low as  $16^{\circ}$ , we could not precisely determine the degree of cold, the quicksilver being under that every morning. The frost is certainly never so intense in Great-Britain. On our return to the lakes the 14th, we found them deserted by the water fowl, and were informed that they had been one solid piece of ice since the 10th of November. Here we resumed our amusement of skating, to the great astonishment of the natives and Bengal servants.

On the 17th we re-entered Boutan, and in six days more arrived at Punekha by Paragon. No snow or frost to be met with in Boutan, except towards the tops of their highest mountains; the thermometer rising to  $36^{\circ}$  in the morning, and  $48^{\circ}$  at noon.

Took leave of the Debe Rajah, and on the 12th arrived at Buxaduar.

Calcutta, Feb. 17, 1784.

AS Lac is the produce of, and a staple article of commerce in Assam, a country bordering on and much connected with Thibet, some account of it may not be an improper supplement to the above remarks.

Lac is, strictly speaking, neither a gummy nor resinous substance, though it has some properties in common to both. Gums are soluble in water, and resins in spirits; lac admits of a very difficult union with either, without the mediation of some other agent.

Lac is known in Europe by the different appellations of stick lac, seed lac, and shell lac. The first is the lac in pretty considerable lumps, with much of the woody parts of the branches on which it is formed adhering to it. Seed lac is only the stick lac broke into small pieces, garbled, and appearing in a granulated form. Shell lac is the purified lac, by a very simple process to be mentioned afterward.

Many vague and unauthenticated reports concerning lac have reached the public; and though amongst the multiplicity of accounts the true history of this substance has been nearly hit on, little credit is given in Europe to any description of it hitherto published. My observations, as far as they go, are the result of what I have seen, from the lac on the tree, the progress of the insect now in my custody, and the information of a gentleman residing at Goalpara on the borders of Assam, who is perfectly versant in the method of breeding the insect, inviting it to the tree, collecting the lac from the branches, and forming it into shell lac, in which state much of it is received from Assam, and exported to Europe for various great and useful purposes. The tree on which this fly most commonly generates is known in Bengal by the name of the *Biber* tree, and is a species of

the *Rhamnus*. The fly is nourished by the tree, and there deposits its eggs, which nature has provided it with the means of defending from external injury by a collection of this lac, evidently serving the twofold purpose of a nidus and covering to the ovum and insect in its first stage, and food for the maggot in its more advanced state. The lac is formed into complete cells, finished with as much regularity and art as a honey-comb, but differently arranged. The flies are invited to deposit their eggs on the branches of the tree, by besmearing them with some of the fresh lac steeped in water, which attracts the fly, and gives a better and larger crop.

The lac is collected twice a year, in the months of February and August.

I have examined the egg of the fly with a very good microscope; it is of a very pure red, perfectly transparent, except in the centre, where there were evident marks of the embryo forming, and opaque ramifications passing off from the body of it. The egg is perfectly oval, and about the size of an ant's egg. The maggot is about the one-eighth of an inch long, formed of many rings (ten or twelve) with a small red head; when seen with a microscope, the parts of the head were easily distinguished, with six small specks on the breast, somewhat projecting, which seemed to be the incipient formation of the feet. This maggot is now in my custody, in the form of a nymph or crysalis, its annular coat forming a strong covering, from which it should issue forth a fly. I have never seen the fly, and cannot therefore describe it more fully, or determine its genus and species. I am promised a drawing of the insect in its different stages, and shall be able soon to add to a botanical description of the plant a drawing of the branch, with the different parts of fructification and lac on it.

The gentleman to whom I owe part of my information terms the lac the excrement of the insect. On a more minute investigation, however, we may not find it more so than the wax or honey of the bee, or silk of the silk-worm. Nature has provided most insects with the means of secreting a substance which generally answers the twofold purpose of defending the embryo, and supplying nourishment to the insect from the time of its animation till able to wander abroad in quest of food. The fresh lac contains within its cells a liquid, sweetish to the taste, and of a fine red colour, miscible in water. The natives of Assam use it as a dye, and cotton dipped in this liquid makes afterwards a very good red ink.

The simple operation of purifying lac is practised as follows. It is broken into small pieces, and picked from the branches and sticks, when it is put into a sort of canvas bag of about four feet long, and not above six inches in circumference. Two of these bags are in constant use, and each of them held by two men. The bag is placed over a fire, and frequently turned till the lac is liquid enough to pass through its pores, when it is taken off the fire, and squeezed by two men in different directions, dragging it along the convex part of a plantain-tree prepared for the purpose; while this is doing, the other bag is heating, to be treated in the same way. The mucilaginous and smooth surface of the plantain-tree seems peculiarly well adapted for preventing the adhesion of the heated lac, and giving it the form which enhances its value so much. The degree of pressure on the plantain-tree regulates the thickness of the shell, and the quality of the bag determines its fineness and transparency. They have learned of late, that the lac which is thicker in the shell than it used to be, is most prized in Europe. Assam furnishes us with the greatest quantity

tity of lac in use; and it may not be generally known, that the tree on which they produce the best and largest quantity of lac is not uncommon in Bengal, and might be employed in propagating the fly, and cultivating the lac, to great advantage. The small quantity of lac collected in these provinces affords a precarious and uncertain crop, because not attended to. Some attention at particular seasons is necessary to invite the fly to the tree; and collecting the whole of the lac with too great an avidity, where the insect is not very generally to be met with, may annihilate the breed.

The best method of cultivating the tree, and preserving the insect, being properly understood in Bengal, would secure to the Cofs possessions the benefit arising from the sale of a lucrative article, in great demand and of extensive use.

Stages and distance from Rungpore to Tassésudon and Tiffloolumboo, in computed coffes and miles, two miles to a cof.

			Coffes.	M. F.
1783,	From Rungpore to			
May 6.	Calamaty Plains	- -	5½	11 0
8.	To Mongulhaut	- -	5½	11 4
9.	To Belladinga	- -	7	14 0
10.	To Bahar	- -	4	8 0
11.	To Chichacotta in Boutan	-	13	26 0
12.	To Buxaduar	- -	12	24 0
22.	To Joogagoo	- -	5	10 0
23.	To Murishong	- -	5	10 0
25.	To Chooka	- -	9	18 0
			<hr/>	<hr/>
			66	132 4



*Productions of Boutan and Thibet.*

		Coffes.	M. F.
	Brought over	66	132 4
1783, May 26.	To Punuka - -	7	14 0
27.	To Chepta - -	5	10 0
29.	To Pagha - -	5	10 0
30.	To Numloo - -	4	8 0
31.	To Wanakha - -	4	8 0
June 1.	To Taffesudon, capital of Boutan	3	6 0
		<hr/>	<hr/>
		94	188 4
Sept. 8.	To Pimitung - -	7	14 0
9.	To Paraghon - -	6	12 0
11.	To Dukaigun - -	4	8 0
12.	To Sanha - -	5	10 0
13.	To a tent on Thibet ground -	8	16 0
14.	To Chichakumboo, Thibet -	4	8 0
15.	To Duina - -	10	20 0
16.	To Chalu - -	15	30 0
17.	To Simadar - -	9	18 0
18.	To Selu - -	17	34 0
19.	To Takui - -	9	18 0
20.	To Dequini - -	14	28 0
21.	To Sehundi - -	15	30 0
22.	To Tiffoolumboo, capital of Thibet	7	14 0
		<hr/>	<hr/>
		224	448 4
		<hr/>	<hr/>

