

Himalayan Journals (Complete)

J. D. Hooker

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NOTES OF A NATURALIST

IN BENGAL, THE SIKKIM AND NEPAL HIMALAYAS,
THE KHASIA MOUNTAINS, etc.

JOSEPH DALTON HOOKER, M.D., R.N., F.R.S.

Volume I

First published 1854

To CHARLES DARWIN, F.R.S., etc.

These volumes are dedicated,

by his affectionate friend,

J.D. HOOKER

Kew, Jan. 12th, 1854

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PREFACE

HAVING accompanied Sir James Boss on his voyage of discovery to the Antarctic regions, where botany was my chief pursuit, on my return I earnestly desired to add to my acquaintance with the natural history of the temperate zones, more knowledge of that of the tropics than I had hitherto had the opportunity of acquiring. My choice lay between India and the Andes, and I decided upon the former, being principally influenced by Dr. Falconer, who promised me every assistance which his position as Superintendent of the H.E.I.C. Botanic Garden at Calcutta, would enable him to give. He also drew my attention to the fact that we were ignorant even of the geography of the central and eastern parts of these mountains, while all to the north was involved in a mystery equally attractive to the traveller and the naturalist.

On hearing of the kind interest taken by Baron Humboldt in my proposed travels, and at the request of my father (Sir William Hooker), the Earl of Carlisle (then Chief Commissioner of Woods and Forests) undertook to represent to Her Majesty's Government the expediency of securing my collections for the Royal Gardens at Kew; and owing to the generous exertions of that nobleman, and of the late Earl of Auckland (then First Lord of the Admiralty), my journey assumed the character of a Government mission, £400 per annum being granted by the Treasury for two years.

I did not contemplate proceeding beyond the Himalaya and Tibet, when Lord Auckland desired that I should afterwards visit Borneo, for the purpose of reporting on the capabilities of Labuan, with reference to the cultivation of cotton, tobacco, sugar, indigo, spices, guttapercha, etc. To this end a commission in the navy (to which service I was already attached) was given me, such instructions were drawn up as might facilitate my movements in the East, and a suitable sum of money was placed at my disposal.

Soon after leaving England, my plans became, from various causes, altered. The Earl of Auckland* [It is with a melancholy satisfaction that I here record the intentions of that enlightened nobleman. The idea of turning to public account what was intended as a scientific voyage, occurred to his lordship when considering my application for official leave to proceed to India; and from the hour of my accepting the Borneo commission with which he honoured me, he displayed the most active zeal in promoting its fulfilment. He communicated to me his views as to the direction in which I should pursue my researches, furnished me with official and other

information, and provided me with introductions of the most essential use.] was dead; the interest in Borneo had in a great measure subsided; H.M.S. "Maeander," to which I had been attached for service in Labuan, had left the Archipelago; reports of the unhealthy nature of the coast had excited alarm; and the results of my researches in the Himalaya had proved of more interest and advantage than had been anticipated. It was hence thought expedient to cancel the Borneo appointment, and to prolong my services for a third year in India; for which purpose a grant of £300 (originally intended for defraying the expense of collecting only, in Borneo) was transferred as salary for the additional year to be spent in the Himalaya.

The portion of the Himalaya best worth exploring, was selected for me both by Lord Auckland and Dr. Falconer, who independently recommended Sikkim, as being ground untrodden by traveller or naturalist. Its ruler was, moreover, all but a dependant of the British government, and it was supposed, would therefore be glad to facilitate my researches.

No part of the snowy Himalaya eastward of the northwest extremity of the British possessions had been visited since Turner's embassy to Tibet in 1789; and hence it was highly important to explore scientifically a part of the chain which, from its central position, might be presumed to be typical of the whole range. The possibility of visiting Tibet, and of ascertaining particulars respecting the great mountain Chumulari,* [My earliest recollections in reading are of "Turner's Travels in Tibet," and of "Cook's Voyages." The account of Lama worship and of Chumulari in the one, and of Kerguelen's Land in the other, always took a strong hold on my fancy. It is, therefore, singular that Kerguelen's Land should have been the first strange country I ever visited (now fourteen years ago), and that in the first King's ship which has touched there since Cook's voyage, and whilst following the track of that illustrious navigator in south polar discovery. At a later period I have been nearly the first European who has approached Chumulari since Turner's embassy.] which was only known from Turner's account, were additional inducements to a student of physical geography; but it was not then known that Kinchinjunga, the loftiest known mountain on the globe, was situated on my route, and formed a principal feature in the physical geography of Sikkim.

My passage to Egypt was provided by the Admiralty in H.M. steam-vessel "Sidon," destined to convey the Marquis of Dalhousie, Governor-General of India, thus far on his way. On his arrival in Egypt, his Lordship did me the honour of desiring me to consider myself in the position of one of his suite, for the remainder of the voyage, which was performed in the "Moozuffer," a steam frigate belonging to the Indian Navy. My obligations to this nobleman had commenced before leaving England, by his promising me every facility he could command; and he thus took the earliest opportunity of affording it, by giving me such a position near himself as ensured me the best reception everywhere; no other introduction being needed. His Lordship procured my admission into Sikkim, and honoured me throughout my travels with the kindest encouragement.

During the passage out, some days were spent in Egypt, at Aden, Ceylon, and Madras. I have not thought it necessary to give here the observations made in those well-known countries; they are detailed in a series of letters published in the "London Journal of Botany," as

written for my private friends. Arriving at Calcutta in January, I passed the remainder of the cold season in making myself acquainted with the vegetation of the plains and hills of Western Bengal, south of the Ganges, by a journey across the mountains of Birbhoom and Behar to the Soane valley, and thence over the Vindhya range to the Ganges, at Mirzapore, whence I descended that stream to Bhaugulpore; and leaving my boat, struck north to the Sikkim Himalaya. This excursion is detailed in the "London Journal of Botany," and the Asiatic Society of Bengal honoured me by printing the meteorological observations made during its progress.

During the two years' residence in Sikkim which succeeded, I was laid under obligations of no ordinary nature to Brian H. Hodgson, Esq., B.C.S., for many years Resident at the Nepal Court; whose guest I became for several months. Mr. Hodgson's high position as a man of science requires no mention here; but the difficulties he overcame, and the sacrifices he made, in attaining that position, are known to few. He entered the wilds of Nepal when very young, and in indifferent health; and finding time to spare, cast about for the best method of employing it: he had no one to recommend or direct a pursuit, no example to follow, no rival to equal or surpass; he had never been acquainted with a scientific man, and knew nothing of science except the name. The natural history of men and animals, in its most comprehensive sense, attracted his attention; he sent to Europe for books, and commenced the study of ethnology and zoology. His labours have now extended over upwards of twenty-five years' residence in the Himalaya. During this period he has seldom had a staff of less than ten to twenty persons (often many more), of various tongues and races, employed as translators and collectors, artists, shooters, and stuffers. By unceasing exertions and a princely liberality, Mr. Hodgson has unveiled the mysteries of the Boodhist religion, chronicled the affinities, languages, customs, and faiths of the Himalayan tribes; and completed a natural history of the animals and birds of these regions. His collections of specimens are immense, and are illustrated by drawings and descriptions taken from life, with remarks on the anatomy,* [In this department he availed himself of the services of Dr. Campbell, who was also attached to the Residency at Nepal, as surgeon and assistant political agent.] habits, and localities of the animals themselves. Twenty volumes of the Journals, and the Museum of the Asiatic Society of Bengal, teem with the proofs of his indefatigable zeal; and throughout the cabinets of the bird and quadruped departments of our national museum, Mr. Hodgson's name stands pre-eminent. A seat in the Institute of France, and the cross of the Legion of Honour, prove the estimation in which his Boodhist studies are held on the continent of Europe. To be welcomed to the Himalaya by such a person, and to be allowed the most unreserved intercourse, and the advantage of all his information and library, exercised a material influence on the progress I made in my studies, and on my travels. When I add that many of the subjects treated of in these volumes were discussed between us, it will be evident that it is impossible for me to divest much of the information thus insensibly obtained, of the appearance of being the fruits of my own research.

Dr. Campbell, the Superintendent of Dorjiling, is likewise the Governor-General's agent, or medium of communication between the British Government and the Sikkim Rajah; and as such, invested with many discretionary powers. In the course of this narrative, I shall give a sketch of the rise, progress, and prospects of the Sanatarium,

or Health-station of Dorjiling, and of the anomalous position held by the Sikkim Rajah. The latter circumstance led indirectly to the detention of Dr. Campbell (who joined me in one of my journeys) and myself, by a faction of the Sikkim court, for the purpose of obtaining from the Indian Government a more favourable treaty than that then existing. This mode of enforcing a request by _i_ douce violence _i_ and detention, is common with the turbulent tribes east of Nepal, but was in this instance aggravated by violence towards my fellow-prisoner, through the ill will of the persons who executed the orders of their superiors, and who had been punished by Dr. Campbell for crimes committed against both the British and Nepalese governments. The circumstances of this outrage were misunderstood at the time; its instigators were supposed to be Chinese; its perpetrators Tibetans; and we the offenders were assumed to have thrust ourselves into the country, without authority from our own government, and contrary to the will of the Sikkim Rajah; who was imagined to be a tributary of China, and protected by that nation, and to be under no obligation to the East Indian government.

With regard to the obligations I owe to Dr. Campbell, I confine myself to saying that his whole aim was to promote my comfort, and to secure my success, in all possible ways. Every object I had in view was as sedulously cared for by him as by myself: I am indebted to his influence with Jung Bahadoor* [It was in Nepal that Dr. Campbell gained the friendship of Jung Bahadoor, the most remarkable proof of which is the acceding to his request, and granting me leave to visit the eastern parts of his dominions; no European that I am aware of, having been allowed, either before or since, to travel anywhere except to and from the plains of India and valley of Katmandu, in which the capital city and British residency are situated.] for the permission to traverse his dominions, and to visit the Tibetan passes of Nepal. His prudence and patience in negotiating with the Sikkim court, enabled me to pursue my investigations in that country. My journal is largely indebted to his varied and extensive knowledge of the people and productions of these regions.

In all numerical calculations connected with my observations, I received most essential aid from John Muller, Esq., Accountant of the Calcutta Mint, and from his brother, Charles Muller, Esq., of Patna, both ardent amateurs in scientific pursuits, and who employed themselves in making meteorological observations at Dorjiling, where they were recruiting constitutions impaired by the performance of arduous duties in the climate of the plains. I cannot sufficiently thank these gentlemen for the handsome manner in which they volunteered me their assistance in these laborious operations. Mr. J. Muller resided at Dorjiling during eighteen months of my stay in Sikkim, over the whole of which period his generous zeal in my service never relaxed; he assisted me in the reduction of many hundreds of my observations for latitude, time, and elevation, besides adjusting and rating my instruments; and I can recall no more pleasant days than those thus spent with these hospitable friends.

Thanks to Dr. Falconer's indefatigable exertions, such of my collections as reached Calcutta were forwarded to England in excellent order; and they were temporarily deposited in Kew Gardens until their destination should be determined. On my return home, my scientific friends interested themselves in procuring from the Government such aid as might enable me to devote the necessary time to the arrangement, naming, and distributing of my collections, the

publication of my manuscripts, etc. I am in this most deeply indebted to the disinterested and generous exertions of Mr. L. Horner, Sir Charles Lyell, Dr. Lindley, Professor E. Forbes, and many others; and most especially to the Presidents of the Royal Society (the Earl of Rosse), of the Linnean (Mr. R. Brown), and Geological (Mr. Hopkins), who in their official capacities memorialized in person the Chief Commissioner of Woods and Forests on this subject; Sir William Hooker at the same time bringing it under the notice of the First Lord of the Treasury. The result was a grant of £400 annually for three years.

Dr. T. Thomson joined me in Dorjiling in the end of 1849, after the completion of his arduous journeys in the North-West Himalaya and Tibet, and we spent the year 1850 in travelling and collecting, returning to England together in 1851. Having obtained permission from the Indian Government to distribute his botanical collections, which equal my own in extent and value, we were advised by all our botanical friends to incorporate, and thus to distribute them. The whole constitute an Herbarium of from 6000 to 7000 species of Indian plants, including an immense number of duplicates; and it is now in process of being arranged and named, by Dr. Thomson and myself, preparatory to its distribution amongst sixty of the principal public and private herbaria in Europe, India, and the United States of America.

For the information of future travellers, I may state that the total expense of my Indian journey, including outfit, three years and a half travelling, and the sending of my collections to Calcutta, was under £2000 (of which £1200 were defrayed by government), but would have come to much more, had I not enjoyed the great advantages I have detailed. This sum does not include the purchase of books and instruments, with which I supplied myself, and which cost about £200, nor the freight of the collections to England, which was paid by Government. Owing to the kind services of Mr. J. C. Melvill, Secretary of the India House, many small parcels of seeds, etc., were conveyed to England, free of cost; and I have to record my great obligations and sincere thanks to the Peninsular and Oriental Steam Navigation Company, for conveying, without charge, all small parcels of books, instruments and specimens, addressed to or by myself.

It remains to say something of the illustrations of this work. The maps are from surveys of my own, made chiefly with my own instruments, but partly with some valuable ones for the use of which I am indebted to my friend Captain H. Thuillier, Deputy Surveyor-General of India, who placed at my disposal the resources of the magnificent establishment under his control, and to whose innumerable good offices I am very greatly beholden.

The landscapes, etc. have been prepared chiefly from my own drawings, and will, I hope, be found to be tolerably faithful representations of the scenes. I have always endeavoured to overcome that tendency to exaggerate heights, and increase the angle of slopes, which is I believe the besetting sin, not of amateurs only, but of our most accomplished artists. As, however, I did not use instruments in projecting the outlines, I do not pretend to have wholly avoided this snare; nor, I regret to say; has the lithographer, in all cases, been content to abide by his copy. My drawings will be considered tame compared with most mountain landscapes, though the subjects comprise some of the grandest scenes in nature. Considering how conventional the treatment of such subjects is, and how unanimous artists seem to

be as to the propriety of exaggerating those features which should predominate in the landscape, it may fairly be doubted whether the total effect of steepness and elevation, especially in a mountain view, can, on a small scale, be conveyed by a strict adherence to truth. I need hardly add, that if such is attainable, it is only by those who have a power of colouring that few pretend to. In the list of plates and woodcuts I have mentioned the obligations I am under to several friends for the use of drawings, etc.

With regard to the spelling of native names, after much anxious discussion I have adopted that which assimilates most to the English pronunciation. For great assistance in this, for a careful revision of the sheets as they passed through the press, and for numerous valuable suggestions throughout, I am indebted to my fellow-traveller, Dr. Thomas Thomson.

HIMALAYAN JOURNALS.

CHAPTER I.

Sunderbunds vegetation--Calcutta Botanic Garden--Leave for Burdwan--Rajah's gardens and menagerie--Coal-beds, geology, and plants of--Lac insect and plant--Camels--Kunker--Cowage--Effloresced soda on soil--Glass, manufacture of--Atmospheric vapours--Temperature, etc.--Mahowa oil and spirits--Maddaobund--Jains--Ascent of Paras-nath--Vegetation of that mountain.

I left England on the 11th of November, 1847, and performed the voyage to India under circumstances which have been detailed in the Introduction. On the 12th of January, 1848, the "Moozuffer" was steaming amongst the low swampy islands of the Sunderbunds. These exhibit no tropical luxuriance, and are, in this respect, exceedingly disappointing. A low vegetation covers them, chiefly made up of a dwarf-palm (*Phoenix paludosa*) and small mangroves, with a few scattered trees on the higher bank that runs along the water's edge, consisting of fan-palm, toddy-palm, and *Terminalia*. Every now and then, the paddles of the steamer tossed up the large fruits of *Nipa fruticans*, a low stemless palm that grows in the tidal waters of the Indian ocean, and bears a large head of nuts. It is a plant of no interest to the common observer, but of much to the geologist, from the nuts of a similar plant abounding in the tertiary formations at the mouth of the Thames, and having floated about there in as great profusion as here, till buried deep in the silt and mud that now forms the island of Sheppey.* [Bowerbank "On the Fossil Fruits and Seeds of the Isle of Sheppey," and Lyell's "Elements of Geology," 3rd ed. p. 201.]

Higher up, the river Hoogly is entered, and large trees, with villages and cultivation, replace the sandy spits and marshy jungles of the great Gangetic delta. A few miles below Calcutta, the scenery becomes beautiful, beginning with the Botanic Garden, once the residence of Roxburgh and Wallich, and now of Falconer,--classical ground to the naturalist. Opposite are the gardens of Sir Lawrence Peel; unrivalled in India for their beauty and cultivation, and fairly entitled to be called the Chatsworth of Bengal. A little higher up, Calcutta opened out, with the batteries of Fort William in the foreground, thundering forth a salute, and in a few minutes more all other thoughts were absorbed in watching the splendour of the

arrangements made for the reception of the Governor-General of India.

During my short stay in Calcutta, I was principally occupied in preparing for an excursion with Mr. Williams of the Geological Survey, who was about to move his camp from the Damooda valley coal-fields, near Burdwan, to Beejaghur on the banks of the Soane, where coal was reported to exist, in the immediate vicinity of water-carriage, the great desideratum of the Burdwan fields.

My time was spent partly at Government-House, and partly at Sir Lawrence Peel's residence. The former I was kindly invited to consider as my Indian home, an honour which I appreciate the more highly, as the invitation was accompanied with the assurance that I should have entire freedom to follow my own pursuits; and the advantages which such a position afforded me, were, I need not say, of no ordinary kind.

At the Botanic Gardens I received every assistance from Dr. McLelland,* [Dr. Falconer's _locum tenens,_ then in temporary charge of the establishment.] who was very busy, superintending the publication of the botanical papers and drawings of his friend, the late Dr. Griffith, for which native artists were preparing copies on lithographic paper.

Of the Gardens themselves it is exceedingly difficult to speak; the changes had been so very great, and from a state with which I had no acquaintance. There had been a great want of judgment in the alterations made since Dr. Wallich's time, when they were celebrated as the most beautiful gardens in the east, and were the great object of attraction to strangers and townspeople. I found instead an unsightly wilderness, without shade (the first requirement of every tropical garden) or other beauties than some isolated grand trees, which had survived the indiscriminate destruction of the useful and ornamental which had attended the well-meant but ill-judged attempt to render a garden a botanical class-book. It is impossible to praise too highly Dr. Griffith's abilities and acquirements as a botanist, his perseverance and success as a traveller, or his matchless industry in the field and in the closet; and it is not wonderful, that, with so many and varied talents, he should have wanted the eye of a landscape-gardener, or the education of a horticulturist. I should, however, be wanting in my duty to his predecessor, and to his no less illustrious successor, were these remarks withheld, proceeding, as they do, from an unbiassed observer, who had the honour of standing in an equally friendly relation to all parties. Before leaving India, I saw great improvements, but many years must elapse before the gardens can resume their once proud pre-eminence.

I was surprised to find the Botanical Gardens looked upon by many of the Indian public, and even by some of the better informed official men, as rather an extravagant establishment, more ornamental than useful. These persons seemed astonished to learn that its name was renowned throughout Europe, and that during the first twenty years especially of Dr. Wallich's superintendence, it had contributed more useful and ornamental tropical plants to the public and private gardens of the world than any other establishment before or since.* [As an illustration of this, I may refer to a Report presented to the government of Bengal, from which it appears that between January, 1836, and December, 1840, 189,932 plants were distributed gratis to nearly 2000 different gardens.] I speak from a personal knowledge of

the contents of our English gardens, and our colonial ones at the Cape, and in Australia, and from an inspection of the ponderous volumes of distribution lists, to which Dr. Falconer is daily adding. The botanical public of Europe and India is no less indebted than the horticultural to the liberality of the Hon. East India Company, and to the energy of the several eminent men who have carried their views into execution.* [I here allude to the great Indian herbarium, chiefly formed by the staff of the Botanic Gardens under the direction of Dr. Wallich, and distributed in 1829 to the principal museums of Europe. This is the most valuable contribution of the kind ever made to science, and it is a lasting memorial: of the princely liberality of the enlightened men who ruled the counsels of India in those days. No botanical work of importance has been published since 1829, without recording its sense of the obligation, and I was once commissioned by a foreign government, to purchase for its national museum, at whatever cost, one set of these collections, which was brought to the hammer on the death of its possessor. I have heard it remarked that the expense attending the distribution was enormous, and I have reason to know that this erroneous impression has had an unfavourable influence upon the destination of scarcely less valuable collections, which have for years been lying untouched in the cellars of the India House. I may add that officers who have exposed their lives and impaired their health in forming similar ones at the orders and expense of the Indian government, are at home, and thrown upon their own resources, or the assistance of their scientific brethren, for the means of publishing and distributing the fruits of their labours.] The Indian government, itself, has already profited largely by these gardens, directly and indirectly, and might have done so still more, had its efforts been better seconded either by the European or native population of the country. Amongst its greatest triumphs may be considered the introduction of the tea-plant from China, a fact I allude to, as many of my English readers may not be aware that the establishment of the tea-trade in the Himalaya and Assam is almost entirely the work of the superintendents of the gardens of Calcutta and Seharunpore.

From no one did I receive more kindness than from Sir James Colville, President of the Asiatic Society, who not only took care that I should be provided with every comfort, but presented me with a completely equipped palkee, which, for strength and excellence of construction, was everything that a traveller could desire. Often _en route_ did I mentally thank him when I saw other palkees breaking down, and travellers bewailing the loss of those forgotten necessaries, with which his kind attention had furnished me.

I left Calcutta to join Mr. Williams' camp on the 28th of January, driving to Hoogly on the river of that name, and thence following the grand trunk-road westward towards Burdwan. The novelty of palkee-travelling at first renders it pleasant; the neatness with which every thing is packed, the good-humour of the bearers, their merry pace, and the many more comforts enjoyed than could be expected in a conveyance _horsed by men_, the warmth when the sliding doors are shut, and the breeze when they are open, are all fully appreciated on first starting, but soon the novelty wears off, and the discomforts are so numerous, that it is pronounced, at best, a barbarous conveyance. The greedy cry and gestures of the bearers, when, on changing, they break a fitful sleep by poking a torch in your face, and vociferating "Bucksheesh, Sahib;" their discontent at

the most liberal largesse, and the sluggishness of the next set who want bribes, put the traveller out of patience with the natives. The dust when the slides are open, and the stifling heat when shut during a shower, are conclusive against the vehicle, and on getting out with aching bones and giddy head at the journey's end, I shook the dust from my person, and wished never to see a palkee again.

On the following morning I was passing through the straggling villages close to Burdwan, consisting of native hovels by the road side, with mangos and figs planted near them, and palms waving over their roofs. Crossing the nearly dry bed of the Damooda, I was set down at Mr. M'Intosh's (the magistrate of the district), and never more thoroughly enjoyed a hearty welcome and a breakfast.

In the evening we visited the Rajah of Burdwan's palace and pleasure-grounds, where I had the first glimpse of oriental gardening: the roads were generally raised, running through rice fields, now dry and hard, and bordered with trees of Jack, Bamboo, Melia, Casuarina, etc. Tanks were the prominent features: chains of them, full of Indian water-lilies, being fringed with rows of the fan-palm, and occasionally the Indian date. Close to the house was a rather good menagerie, where I saw, amongst other animals, a pair of kangaroos in high health and condition, the female with young in her pouch. Before dark I was again in my palkee, and hurrying onwards. The night was cool and clear, very different from the damp and foggy atmosphere I had left at Calcutta. On the following morning I was travelling over a flat and apparently rising country, along an excellent road, with groves of bamboos and stunted trees on either hand, few villages or palms, a sterile soil, with stunted grass and but little cultivation; altogether a country as unlike what I had expected to find in India as well might be. All around was a dead flat or table-land, out of which a few conical hills rose in the west, about 1000 feet high, covered with a low forest of dusky green or yellow, from the prevalence of bamboo. The lark was singing merrily at sunrise, and the accessories of a fresh air and dewy grass more reminded me of some moorland in the north of England than of the torrid regions of the east.

At 10 p.m. I arrived at Mr. Williams' camp, at Taldangah, a dawk station near the western limit of the coal basin of the Damooda valley. His operations being finished, he was prepared to start, having kindly waited a couple of days for my arrival.

Early on the morning of the last day of January, a motley group of natives were busy striking the tents, and loading the bullocks, bullock-carts and elephants: these proceeded on the march, occupying in straggling groups nearly three miles of road, whilst we remained to breakfast with Mr. F. Watkins, Superintendent of the East India Coal and Coke Company, who were working the seams.

The coal crops out at the surface; but the shafts worked are sunk through thick beds of alluvium. The age of these coal-fields is quite unknown, and I regret to say that my examination of their fossil plants throws no material light on the subject. Upwards of thirty species of fossil plants have been procured from them, and of these the majority are referred by Dr. McLelland* [Reports of the Geological Survey of India. Calcutta, 1850.] to the inferior oolite epoch of England, from the prevalence of species of Zamia, Glossopteris, and Taeniopteris. Some of these genera,

together with *Vertebraria* (a very remarkable Indian fossil), are also recognised in the coal-fields of Sind and of Australia. I cannot, however, think that botanical evidence of such a nature is sufficient to warrant a satisfactory reference of these Indian coal-fields to the same epoch as those of England or of Australia; in the first place the outlines of the fronds of ferns and their nervation are frail characters if employed alone for the determination of existing genera, and much more so of fossil fragments: in the second place recent ferns are so widely distributed, that an inspection of the majority affords little clue to the region or locality they come from: and in the third place, considering the wide difference in latitude and longitude of Yorkshire, India, and Australia, the natural conclusion is that they could not have supported a similar vegetation at the same epoch. In fact, finding similar fossil plants at places widely different in latitude, and hence in climate, is, in the present state of our knowledge, rather an argument against than for their having existed contemporaneously. The *Cycadeae*, especially, whose fossil remains afford so much ground for geological speculations, are far from yielding such precise data as is supposed. Species of the order are found in Mexico, South Africa, Australia, and India, some inhabiting the hottest and dampest, and others the driest climates on the surface of the globe; and it appears to me rash to argue much from the presence of the order in the coal of Yorkshire and India, when we reflect that the geologist of some future epoch may find as good reasons for referring the present Cape, Australian, or Mexican Flora to the same period as that of the Lias and Oolites, when the *Cycadeae* now living in the former countries shall be fossilised.

Specific identity of their contained fossils may be considered as fair evidence of the contemporaneous origin of beds, but amongst the many collections of fossil plants that I have examined, there is hardly a specimen, belonging to any epoch, sufficiently perfect to warrant the assumption that the species to which it belonged can be again recognised. The botanical evidences which geologists too often accept as proofs of specific identity are such as no botanist would attach any importance to in the investigation of existing plants. The faintest traces assumed to be of vegetable origin are habitually made into genera and species by naturalists ignorant of the structure, affinities and distribution of living plants, and of such materials the bulk of so-called systems of fossil plants is composed.

A number of women were here employed in making gunpowder, grinding the usual materials on a stone, with the addition of water from the Hookah; a custom for which they have an obstinate prejudice. The charcoal here used is made from an *Acacia*: the Seiks, I believe, employ *Justicia Adhatoda*, which is also in use all over India: at Aden the Arabs prefer the *Calotropis*, probably because it is most easily procured. The grain of all these plants is open, whereas in England, closer-grained and more woody trees, especially willows, are preferred.

The jungle I found to consist chiefly of thorny bushes, Jujube of two species, an *Acacia* and *Butea frondosa*, the twigs of the latter often covered with lurid red tears of Lac, which is here collected in abundance. As it occurs on the plants and is collected by the natives it is called Stick-lac, but after preparation Shell-lac. In Mirzapore, a species of *Celtis* yields it, and

the Peepul very commonly in various parts of India. The elaboration of this dye, whether by the same species of insect, or by many from plants so widely different in habit and characters, is a very curious fact; since none have red juice, but some have milky and others limpid.

After breakfast, Mr. Williams and I started on an elephant, following the camp to Gyra, twelve miles distant. The docility of these animals is an old story, but it loses so much in the telling, that their gentleness, obedience, and sagacity seemed as strange to me as if I had never heard or read of these attributes. The swinging motion, under a hot sun, is very oppressive, but compensated for by being so high above the dust. The Mahout, or driver, guides by poking his great toes under either ear, enforcing obedience with an iron goad, with which he hammers the animal's head with quite as much force as would break a cocoa-nut, or drives it through his thick skin down to the quick. A most disagreeable sight it is, to see the blood and yellow fat oozing out in the broiling sun from these great punctures! Our elephant was an excellent one, when he did not take obstinate fits, and so docile as to pick up pieces of stone when desired, and with a jerk of the trunk throw them over his head for the rider to catch, thus saving the trouble of dismounting to geologise!

Of sights on the road, unfrequented though this noble line is, there were plenty for a stranger; chiefly pilgrims to Juggernath, most on foot, and a few in carts or pony gigs of rude construction. The vehicles from the upper country are distinguished by a far superior build, their horses are caparisoned with jingling bells, and the wheels and other parts are bound with brass. The kindness of the people towards animals, and in some cases towards their suffering relations, is very remarkable, and may in part have given origin to the prevalent idea that they are less cruel and stern than the majority of mankind; but that the "mild" Hindoo, however gentle on occasion, is cruel and vindictive to his brother man and to animals, when his indolent temper is roused or his avarice stimulated, no one can doubt who reads the accounts of Thuggee, Dacoitee, and poisoning, and witnesses the cruelty with which beasts of burthen are treated. A child carrying a bird, kid, or lamb, is not an uncommon sight, and a woman with a dog in her arms is still more frequently seen. Occasionally too, a group will bear an old man to see Juggernath before he dies, or a poor creature with elephantiasis, who hopes to be allowed to hurry himself to his paradise, in preference to lingering in helpless inactivity, and at last crawling up to the second heaven only. The costumes are as various as the religious castes, and the many countries to which the travellers belong. Next in wealth to the merchants, the most thriving-looking wanderer is the bearer of Ganges' holy water, who drives a profitable trade, his gains increasing as his load lightens, for the further he wanders from the sacred stream, the more he gets for the contents of his jar.

Of merchandise we passed very little, the Ganges being still the high road between north-west India and Bengal. Occasionally a string of camels was seen, but, owing to the damp climate, these are rare, and unknown east of the meridian of Calcutta. A little cotton, clumsily packed in ragged bags, dirty, and deteriorating every day, even at this dry season, proves in how bad a state it must arrive at the market during the rains, when the low wagons are dragged through the streams.

The roads here are all mended with a curious stone, called Kunker, which is a nodular concretionary deposit of limestone, abundantly imbedded in the alluvial soil of a great part of India.* [Often occurring in strata, like flints.] It resembles a coarse gravel, each pebble being often as large as a walnut, and tuberculated on the surface: it binds admirably, and forms excellent roads, but pulverises into a most disagreeable impalpable dust.

A few miles beyond Taldangah we passed from the sandstone, in which the coal lies, to a very barren country of gneiss and granite rocks, upon which the former rests; the country still rising, more hills appear, and towering far above all is Paras-nath, the culminant point, and a mountain whose botany I was most anxious to explore.

The vegetation of this part of the country is very poor, no good-sized trees are to be seen, all is a low stunted jungle. The grasses were few, and dried up, except in the beds of the rivulets. On the low jungly hills the same plants appear, with a few figs, bamboo in great abundance, several handsome *Acanthaceae*; a few *Asclepiadeae* climbing up the bushes; and the Cowage plant, now with over-ripe pods, by shaking which, in passing, there often falls such a shower of its irritating microscopic hairs, as to make the skin tingle for an hour.

On the 1st of February, we moved on to Gyra, another insignificant village. The air was cool, and the atmosphere clear. The temperature, at three in the morning, was 65 degrees, with no dew, the grass only 61 degrees. As the sun rose, Parasnath appeared against the clear grey sky, in the form of a beautiful broad cone, with a rugged peak, of a deeper grey than the sky. It is a remarkably handsome mountain, sufficiently lofty to be imposing, rising out of an elevated country, the slope of which, upward to the base of the mountain, though imperceptible, is really considerable; and it is surrounded by lesser hills of just sufficient elevation to set it off. The atmosphere, too, of these regions is peculiarly favourable for views: it is very dry at this season; but still the hills are clearly defined, without the harsh outlines so characteristic of a moist air. The skies are bright, the sun powerful; and there is an almost imperceptible haze that seems to soften the landscape, and keep every object in true perspective.

Our route led towards the picturesque hills and valleys in front. The rocks were all hornblende and micaceous schist, cut through by trap-dykes, while great crumbling masses (or bosses) of quartz protruded through the soil. The stratified rocks were often exposed, pitched up at various inclinations: they were frequently white with effloresced salts, which entering largely into the composition tended to hasten their decomposition, and being obnoxious to vegetation, rendered the sterile soil more hungry still. There was little cultivation, and that little of the most wretched kind; even rice-fields were few and scattered; there was no corn, or gram (*Ervum Lens*), no Castor-oil, no Poppy, Cotton, Safflower, or other crops of the richer soils that flank the Ganges and Hoogly; a very little Sugar-cane, Dhal (*Cajana*), Mustard, Linseed, and Rape, the latter three cultivated for their oil. Hardly a Palm was to be seen; and it was seldom that the cottages could boast of a Banana, Tamarind, Orange, Cocoa-nut or Date. The Mahowa (*Bassia latifolia*) and Mango were the commonest trees. There being no Kunker in the soil here, the roads were mended with angular quartz, much to the

elephants' annoyance.

We dismounted where some very micaceous stratified rock cropped out, powdered with a saline efflorescence.* [An impure carbonate of soda. This earth is thrown into clay vessels with water, which after dissolving the soda, is allowed to evaporate, when the remainder is collected, and found to contain so much silica, as to be capable of being fused into glass. Dr. Boyle mentions this curious fact (Essay on the Arts and Manufactures of India, read before the Society of Arts, February 18, 1852), in illustration of the probably early epoch at which the natives of British India were acquainted with the art of making glass. More complicated processes are employed, and have been from a very early period, in other parts of the continent.] Jujubes (*Zizyphus*) prevailed, with the *Carissa carandas* (in fruit), a shrub belonging to the usually poisonous family of Dog-banes (*Apocynae*); its berries make good tarts, and the plant itself forms tolerable hedges.

The country around Fitcoree is rather pretty, the hills covered with bamboo and brushwood, and as usual, rising rather suddenly from the elevated plains. The jungle affords shelter to a few bears and tigers, jackals in abundance, and occasionally foxes; the birds seen are chiefly pigeons. Insects are very scarce; those of the locust tribe being most prevalent, indicative of a dry climate.

The temperature at 3 a.m. was 65 degrees; at 3 p.m. 82 degrees; and at 10 p.m., 68 degrees, from which there was no great variation during the whole time we spent at these elevations. The clouds were rare, and always light and high, except a little fleecy spot of vapour condensed close to the summit of Paras-nath. Though the nights were clear and starlight, no dew was deposited, owing to the great dryness of the air. On one occasion, this drought was so great during the passage of a hot wind, that at night I observed the wet-bulb thermometer to stand 20.5 degrees below the temperature of the air, which was 66 degrees; this indicated a dew-point of 11.5 degrees, or 54.5 degrees below the air, and a saturation-point of 0.146; there being only 0.102 grains of vapour per cubic foot of air, which latter was loaded with dust. The little moisture suspended in the atmosphere is often seen to be condensed in a thin belt of vapour, at a considerable distance above the dry surface of the earth, thus intercepting the radiation of heat from the latter to the clear sky above. Such strata may be observed, crossing the hills in ribbonlike masses, though not so clearly on this elevated region as on the plains bounding the lower course of the Soane, where the vapour is more dense, the hills more scattered, and the whole atmosphere more humid. During the ten days I spent amongst the hills I saw but one cloudy sunrise, whereas below, whether at Calcutta, or on the banks of the Soane, the sun always rose behind a dense fog-bank.

At 9.30 a.m. the black-bulb thermometer rose in the sun to 130 degrees. The morning observation before 10 or 11 a.m. always gives a higher result than at noon, though the sun's declination is so considerably less, and in the hottest part of the day it is lower still (3.30 p.m. 109 degrees), an effect no doubt due to the vapours raised by the sun, and which equally interfere with the photometer observations. The N.W. winds invariably rise at about 9 a.m. and blow with increasing strength till sunset; they are due to the rarefaction of the air over the heated ground, and being loaded with dust, the temperature of the atmosphere is hence raised by the heated

particles. The increased temperature of the afternoon is therefore not so much due to the accumulation of caloric from the sun's rays, as to the passage of a heated current of air derived from the much hotter regions to the westward. It would be interesting to know how far this N.W. diurnal tide extends; also the rate at which it gathers moisture in its progress over the damp regions of the Sunderbunds. Its excessive dryness in N.W. India approaches that of the African and Australian deserts; and I shall give an abstract of my own observations, both in the vallies of the Soane and Ganges, and on the elevated plateaus of Behar and of Mirzapore.* [See Appendix A.]

On the 2nd of February we proceeded to Tofe-Choney, the hills increasing in height to nearly 1000 feet, and the country becoming more picturesque. We passed some tanks covered with *Villarsia*, and frequented by flocks of white egrets. The existence of artificial tanks so near a lofty mountain, from whose sides innumerable water-courses descend, indicates the great natural dryness of the country during one season of the year. The hills and vallies were richer than I expected, though far from luxuriant. A fine *Nauclea* is a common shady tree, and *Bignonia indica*, now leafless, but with immense pods hanging from the branches. *Acanthaceae* is the prevalent natural order, consisting of gay-flowered *Eranthemums*, *Ruellias*, *Barlerias*, and such hothouse favourites.* [Other plants gathered here, and very typical of the Flora of this dry region, were *Linum trigynum*, *Feronia elephantum*, *Aegle marmelos*, *Helicteres Asoca*, *Abrus precatorius*, *Flemingia*; various *Desmodia*, *Rhynchosiae*, *Glycine*, and *Grislea tomentosa* very abundant, *Conocarpus latifolius*, *Loranthus longiflorus*, and another species; *Phyllanthus Emblica*, various *Convolvuli*, *Cuscuta*, and several herbaceous *Compositae*.]

This being the most convenient station whence to ascend Paras-nath, we started at 6 a.m. for the village of Maddaobund, at the north base of the mountain, or opposite side from that on which the grand trunk-road runs. After following the latter for a few miles to the west, we took a path through beautifully wooded plains, with scattered trees of the Mahowa (*Bassia latifolia*), resembling good oaks: the natives distil a kind of arrack from its fleshy flowers, which are also eaten raw. The seeds, too, yield a concrete oil, by expression, which is used for lamps and occasionally for frying.

Some villages at the west base of the mountain occupy a better soil, and are surrounded with richer cultivation; palms, mangos, and the tamarind, the first and last rare features in this part of Bengal, appeared to be common, with fields of rice and broad acres of flax and rape, through the latter of which the blue *Orobanche indica* swarmed. The short route to Maddaobund, through narrow rocky vallies, was impracticable for the elephants, and we had to make a very considerable detour, only reaching that village at 2 p.m. All the hill people we observed were a fine-looking athletic race; they disclaimed the tiger being a neighbour, which every palkee-bearer along the road declares to carry off the torch-bearers, torch and all. Bears they said were scarce, and all other wild animals, but a natural jealousy of Europeans often leads the natives to deny the existence of what they know to be an attraction to the proverbially sporting Englishman.

Illustration-OLD TAMARIND TREES.

The site of Maddaobund, elevated 1230 feet, in a clearance of the forest, and the appearance of the snow-white domes and bannerets of its temples through the fine trees by which it is surrounded, are very beautiful. Though several hundred feet above any point we had hitherto reached, the situation is so sheltered that the tamarind, peepul, and banyan trees are superb. A fine specimen of the latter stands at the entrance to the village, not a broadheaded tree, as is usual in the prime of its existence, but a mass of trunks irregularly throwing out immense branches in a most picturesque manner; the original trunk is apparently gone, and the principal mass of root stems is fenced in. This, with two magnificent tamarinds, forms a grand clump. The ascent of the mountain is immediately from the village up a pathway worn by the feet of many a pilgrim from the most remote parts of India.

Paras-nath is a mountain of peculiar sanctity, to which circumstance is to be attributed the flourishing state of Maddaobund. The name is that of the twenty-third incarnation of Jinna (Sanskrit "Conqueror"), who was born at Benares, lived one hundred years, and was buried on this mountain, which is the eastern metropolis of Jain worship, as Mount Aboo is the western (where are their libraries and most splendid temples). The origin of the Jain sect is obscure, though its rise appears to correspond with the wreck of Boodhism throughout India in the eleventh century. The Jains form in some sort a transition-sect between Boodhists and Hindoos, differing from the former in acknowledging castes, and from both in their worship of Paras-nath's foot, instead of that of Munja-gosha of the Boodhs, or Vishnoo's of the Hindoos. As a sect of Boodhists their religion is considered pure, and free from the obscenities so conspicuous in Hindoo worship; whilst, in fact, perhaps the reverse is the case; but the symbols are fewer, and indeed almost confined to the feet of Paras-nath, and the priests jealously conceal their esoteric doctrines.

The temples, though small, are well built, and carefully kept. No persuasion could induce the Brahmins to allow us to proceed beyond the vestibule without taking off our shoes, to which we were not inclined to consent. The bazaar was for so small a village large, and crowded to excess with natives of all castes, colours, and provinces of India, very many from the extreme W. and N.W., Rajpootana, the Madras Presidency, and Central India. Numbers had come in good cars, well attended, and appeared men of wealth and consequence; while the quantities of conveyances of all sorts standing about, rather reminded me of an election, than of anything I had seen in India.

The natives of the place were a more Negro-looking race than the Bengalees to whom I had previously been accustomed; and the curiosity and astonishment they displayed at seeing (probably many of them for the first time) a party of Englishmen, were sufficiently amusing. Our coolies with provisions not having come up, and it being two o'clock in the afternoon, I having had no breakfast, and being ignorant of the exclusively Jain population of the village, sent my servant to the bazaar, for some fowls and eggs; but he was mobbed for asking for these articles, and parched rice, beaten flat, with some coarse sugar, was all I could obtain; together with sweetmeats so odiously flavoured with various herbs, and sullied with such impurities, that we quickly made them over to the elephants.

Not being able to ascend the mountain and return in one day, Mr. Williams and his party went back to the road, leaving Mr. Haddon and myself, who took up our quarters under a tamarind-tree.

In the evening a very gaudy poojah was performed. The car, filled with idols, was covered with gilding and silk, and drawn by noble bulls, festooned and garlanded. A procession was formed in front; and it opened into an avenue, up and down which gaily dressed dancing-boys paced or danced, shaking castanets, the attendant worshippers singing in discordant voices, beating tom-toms, cymbals, etc. Images (of Boodh apparently) abounded on the car, in front of which a child was placed. The throng of natives was very great and perfectly orderly, indeed, sufficiently apathetic: they were remarkably civil in explaining what they understood of their own worship.

At 2 p.m., the thermometer was only 65 degrees, though the day was fine, a strong haze obstructing the sun's rays; at 6 p.m., 58 degrees; at 9 p.m., 56 degrees, and the grass cooled to 49 degrees. Still there was no dew, though the night was starlight.

Having provided doolies, or little bamboo chairs slung on four men's shoulders, in which I put my papers and boxes, we next morning commenced the ascent; at first through woods of the common trees, with large clumps of bamboo, over slaty rocks of gneiss, much inclined and sloping away from the mountain. The view from a ridge 500 feet high was superb, of the village, and its white domes half buried in the forest below, the latter of which continued in sight for many miles to the northward. Descending to a valley some ferns were met with, and a more luxuriant vegetation, especially of *Urticeae*. Wild bananas formed a beautiful, and to me novel feature in the woods.

The conical hills of the white ants were very abundant. The structure appears to me not an independent one, but the debris of clumps of bamboos, or of the trunks of large trees, which these insects have destroyed. As they work up a tree from the ground, they coat the bark with particles of sand glued together, carrying up this artificial sheath or covered way as they ascend. A clump of bamboos is thus speedily killed; when the dead stems fall away, leaving the mass of stumps coated with sand, which the action of the weather soon fashions into a cone of earthy matter.

Ascending again, the path strikes up the hill, through a thick forest of Sal (*Vateria robusta*) and other trees, spanned with cables of scandent *Bauhinia* stems. At about 3000 feet above the sea, the vegetation becomes more luxuriant, and by a little stream I collected five species of ferns and some mosses,--all in a dry state, however. Still higher, *Clematis*, *Thalictrum*, and an increased number of grasses are seen; with bushes of *Verbenaceae* and *Compositae*. The white ant apparently does not enter this cooler region. At 3500 feet the vegetation again changes, the trees all become gnarled and scattered; and as the dampness also increases, more mosses and ferns appear. We emerged from the forest at the foot of the great ridge of rocky peaks, stretching E. and W. three or four miles. Abundance of a species of berberry and an *Osbeckia* marked the change in the vegetation most decidedly, and were frequent over the whole summit, with coarse grasses, and various bushes.

At noon we reached the saddle of the crest (alt. 4230 feet), where was a small temple, one of five or six which occupy various prominences of the ridge. The wind, N.W., was cold, the temp. 56 degrees. The view was beautiful, but the atmosphere too hazy: to the north were ranges of low wooded hills, and the course of the Barakah and Adji rivers; to the south lay a flatter country, with lower ranges, and the Damooda river, its all but waterless bed snowy-white from the exposed granite blocks with which its course is strewn. East and west the several sharp ridges of the mountain itself are seen; the western considerably the highest. Immediately below, the mountain flanks appear clothed with impenetrable forest, here and there interrupted by rocky eminences; while to the north the grand trunk road shoots across the plains, like a white thread, as straight as an arrow, spanning here and there the beds of the mountain torrents.

On the south side the vegetation was more luxuriant than on the north, though, from the heat of the sun, the reverse might have been expected. This is owing partly to the curve taken by the ridge being open to the south, and partly to the winds from that quarter being the moist ones. Accordingly, trees which I had left 3000 feet below in the north ascent, here ascended to near the summit, such as figs and bananas. A short-stemmed palm (*Phoenix*) was tolerably abundant, and a small tree (*Pterospermum*) on which a species of grass grew epiphytically; forming a curious feature in the landscape.

The situation of the principal temple is very fine, below the saddle in a hollow facing the south, surrounded by jungles of plantain and banyan. It is small, and contains little worthy of notice but the sculptured feet of Paras-nath, and some marble Boodh idols; cross-legged figures with crisp hair and the Brahminical cord. These, a leper covered with ashes in the vestibule, and an officiating priest, were all we saw. Pilgrims were seen on various parts of the mountain in very considerable numbers, passing from one temple to another, and generally leaving a few grains of dry rice at each; the rich and lame were carried in chairs, the poorer walked.

The culminant rocks are very dry, but in the rains may possess many curious plants; a fine *Kalanchoe* was common, with the berberry, a beautiful *Indigofera*, and various other shrubs; a *Bolbophyllum* grew on the rocks, with a small *Begonia*, and some ferns. There were no birds, and very few insects, a beautiful small *Pontia* being the only butterfly. The striped squirrel was very busy amongst the rocks; and I saw a few mice, and the traces of bears.

At 3 p.m., the temperature was 54 degrees, and the air deliciously cool and pleasant. I tried to reach the western peak (perhaps 300 feet above the saddle), by keeping along the ridge, but was cut off by precipices, and ere I could retrace my steps it was time to descend. This I was glad to do in a doolie, and I was carried to the bottom, with only one short rest, in an hour and three quarters. The descent was very steep the whole way, partly down steps of sharp rock, where one of the men cut his foot severely. The pathway at the bottom was lined for nearly a quarter of a mile with sick, halt, maimed, lame, and blind beggars, awaiting our descent. It was truly a fearful sight, especially the lepers, and numerous unhappy victims to elephantiasis.

Though the botany of Paras-nath proved interesting, its elevation was not accompanied by such a change from the flora of its base as I had expected. This is no doubt due to its dry climate and sterile soil; characters which it shares with the extensive elevated area of which it forms a part, and upon which I could not detect above 300 species of plants during my journey. Yet, that the atmosphere at the summit is more damp as well as cooler than at the base, is proved as well by the observations as by the vegetation;* [Of plants eminently typical of a moister atmosphere, I may mention the genera *Bolbophyllum*, *Begonia*, *Aeginetia*, *Disporum*, *Roxburghia*, *Panax*, *Eugenia*, *Myrsine*, *Shorea*, *Millettia*,_ ferns, mosses, and foliaceous lichens; which appeared in strange association with such dry-climate genera as *Kalanchoe*, *Pterospermum*,_ and the dwarf-palm, *Phoenix*._ Add to this list the *Berberis asiatica*, *Clematis nutans*, *Thalictrum glyphocarpum*,_ 27 grasses, *Cardamine*,_ etc., and the mountain top presents a mixture of the plants of a damp hot, a dry hot, and of a temperate climate, in fairly balanced proportions. The prime elements of a tropical flora were however wholly wanting on Paras-nath, where are neither Peppers, *Pothos*, *Arum*,_ tall or climbing palms, tree-ferns, *Guttiferae*,_ vines, or laurels.] and in some respects, as the increased proportion of ferns, additional epiphytal orchideous plants, *Begonias*,_ and other species showed, its top supported a more tropical flora than its base.

CHAPTER II.

Doomree--Vegetation of table-land--Lieutenant Beadle--Birds--Hot springs of Soorujkoond--Plants near them--Shells in them--Cholera-tree--Olibanum--Palms, form of--Dunwah Pass--Trees, native and planted--Wild peacock--Poppy fields--Geography and geology of Behar and Central India--Toddy-palm--Ground, temperature of--Barroon--Temperature of plants--Lizard--Cross the Soane--Sand, ripple marks on--Kymore hills--Ground, temperature of--Limestone--Rotas fort and palace--Nitrate of lime--Change of climate--Lime stalagmites, enclosing leaves--Fall of Soane--Spiders, etc.--Scenery and natural history of upper Soane valley--*Hardwickia binata*--Bhel fruit--Dust-storm--Alligator--Catechu--*Cochlospermum*--Leaf-bellows--Scorpions--Tortoises--Florican--Limestone spheres--Coles--Tiger-hunt--Robbery.

In the evening we returned to our tamarind tree, and the next morning regained the trunk road, following it to the dawk bungalow of Doomree. On the way I found the *Caesalpinia paniculata*,_ a magnificent climber, festooning the trues with its dark glossy foliage and gorgeous racemes of orange blossoms. Receding from the mountain, the country again became barren: at Doomree the hills were of crystalline rocks, chiefly quartz and gneiss;

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