In pursuing this, I left Cape Town behind me, and having the Lion's Rump on my right, and Table Mountain on my left, I advanced on a road which soon became rugged from the action of the innumerable streamlets, which, during the rainy season, cut it up in every direction. On first leaving the town, my way was over sand-stone, appearing to be rather the debris of that which covers the tops of the surrounding mountains than any regular formation, being composed of large fragments loosely held together by an ochreous cement, or entirely free; or, where a more regular appearance presented itself, the deep ravines by which I occasionally passed, brought no strata to view. Advancing onwards, I found the way covered with a loose soil of various hues, composed partly of sand, containing rounded fragments of quartz, and partly of a reddish clay, which seemed to be the product of decomposed felspar. When about a mile from the town, and at about two-thirds of the ascent up the ridge which separates Table Mountain from the Lion's Head, I encountered a scene which arrests the steps of every admirer of nature, and has irresistible claims to the deliberate examination of the geologist. The former delights in the fine contrast afforded by the verdant slope of the Lion's Hill, and the silvery foliage of its dazzling *Proteas*, when compared with the cavernous sides, shelving rocks, and gloomy shades of the Table Mountain. The latter dwells with curious eye and deep speculation on the evidences of stupendous power and endless time every where surrounding him; and equally exhibited by the unfathomable chasms worn in the solid rock and by the hill-like masses of the mountains, which, separated from their parent seat, threaten to sink with ruinous effect from their elevated site. On recovering from the first impression, his eye is attracted by the heavy grandeur of the Table Mountain; and having slowly traversed the wide and sloping surfaces of granite which deck its sides, pauses on the horizontal strata which compose its summit. Whilst occupied in observing their exact adjustment and even seams, he traces their direction towards his right, till he finds them abruptly broken at that part where the great

chasm forming the kloof commences. Their appearance here so much resembles an immense wall, a part of which has been suddenly thrown down, that his eye necessarily wanders in search of its opposite part; and it does not wander in vain. The Lion's Head, similar in structure and appearance, instantly presents itself, and forces the belief that at some period it has been continuous with the Table Mountain, and that at another they have been violently and at once disjoined.

Passing onwards, I soon reached the summit of the ridge separating the Lion's Head from Table Mountain, and forming the highest part of the road through the kloof, and obtained a magnificent view of the sea. From this point the road turns suddenly round the Lion's Head, and runs parallel to the Lion's Rump qwards the town. In this course it is for some way bounded on one side by the granite which forms the base of the Lion's Head, and on the other looks towards the sea, to which there is a rapid declivity of some hundred feet.

Soon after commencing the descent from the ridge, I encountered a singular appearance in the wall of granite which limits the road on the right hand. It was a large vein or dyke passing through the very heart of the rock. Both the granite and the vein were much decomposed, and it was difficult at first to determine the nature of the latter. I afterwards found it to consist of rounded masses of basaltic rock imbedded in a soft yielding matter, resembling decomposed granite. It has suffered the shift represented by No. III. of the Geological Views at the Cape of Good Hope. Near the spot where this occurred, an immense cleft in the mountain exhibited a stratum of sandstone resting on a shelving surface of granite, in an unconformable position and in so even a manner as evidently to have been undisturbed since its formation. Both rocks were so decomposed as not to afford good specimens, but appeared to have no intervening bed between them, and to be distinctly separate.

As I pursued my road, other and equally interesting appearances

presented themselves on the slope of the Lion's Head, over which large masses of granite are piled one upon another, are grouped side by side, or are scattered about in no definite manner. Some are evidently unconnected with the rock beneath, but many appear to be continuous with it. These rocks frequently exhibit large caverns, formed either by the action of water on their surfaces, or by their separation into different portions. Like the granite forming the base of the Lion's Head, they are frequently traversed by large veins of quartz. Beyond these, and near the margin of the sea, I observed immense ridges of rock apparently of different colours, mingled together. I hastened to visit them, in the hope of meeting with an example of those *instantiæ crucis* on which different geological theories are supposed to turn. In the descent leading to them I traced a vein of small-grained red granite for upwards of thirty feet running through the very large-grained granite which enters into the composition of the neighbouring mountains. Passing over this, I walked upon large-grained granite till I reached the sea. Then turning on my right, and proceeding in a line with the Lion's Rump towards Cape Town, I found masses of black rock buried in fields of granite. Still advancing, I gained a spot in which there was an extraordinary junction of granite and black rock, mixing together in such equal proportions that it was impossible to say which predominated. A little beyond, the black rock lay up in ridges from the sea into the granite; and at length the granite disappearing, nothing but black rock was traced lining the coast for a considerable distance. The range of coast where these facts are visible, is known under the name of Green Point.

In re-examining these appearances with greater closeness, I found the black rock, which I shall call schistus, uniformly in vertical strata. On a diligent examination, a large vein appeared passing through it, which, whether examined in its entire state or in hand specimens, seemed to be made up of curved layers, and much resembled fine-grained gneiss. This vein was very near a junction of the schistus with the granite, which is encountered when the Lion's Head bears about south by east. The granite was here

of a very small grain, and of a red colour, and full of vertical seams filled with quartz, giving it the appearance of vertical stratification. Immediately beyond, the schistus was so mixed up with the granite, that it was difficult to determine whether the granite entered the schistus or the schistus the granite; large veins of the former appearing occasionally to enter the latter, and the contrary. Passing on, I reached a spot in which the small-grained granite spread in an extensive but thin sheet over the schistus; and I should certainly have considered it as a rock of an indefinite thickness if a large portion of it had not been broken away, and discovered the schistus beneath it. This appearance is well represented in No. I. of the Geological Views at the Cape of Good Hope.

The small-grained granite, from this interruption of its surface, extended several yards, when I again came upon schistus studded all over with large crystals of felspar. This porphyritic rock formed an intervening body several feet in extent between the small-grained granite and the commencement of another rock formed by an intimate mixture of the large-grained granite with the schistus. The wood cut very accurately represents a mass of this compound rock, which was also several feet in extent.

Beyond it I still found the schistus mingling with the granite in a large proportion, but not in the same confused manner. It rose up from the sea and passed into the granite in large beds. These were occasionally curved, and were most numerous near the sea, and became narrower as I receded from it, and at length terminated abruptly in the granite. Their appearance is faithfully shown in the second number of the Geological Views of the Cape of Good Hope. These beds were in some places traversed by veins of large-grained, and in others, but less generally, by veins of the red small-grained granite.

In proportion as I advanced along the shore over the granite, the schistus diminished in quantity, its beds becoming less wide and less frequent, and taking the form of veins. At length it was only to be seen in small detached masses buried in fields of granite. Pure large-grained granite was afterwards alone visible.

Similar appearances to these having been seen by Captain Basil Hall in Table Mountain, and described by him in the seventh volume of the Edinburgh Philosophical Transactions, I took the earliest opportunity, in the company of many friends, of ascending it, following the path pursued by that gentlemen.

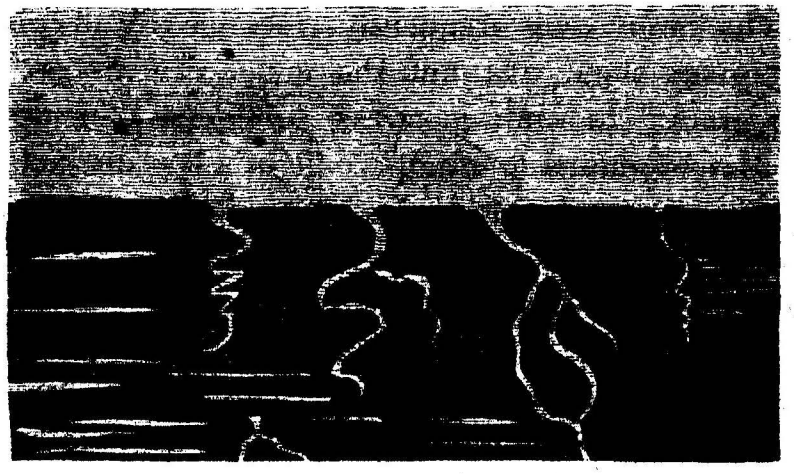
Besides the examination of the mixture of schistus and granite, I had two other objects in view; the one, to discover, if possible, the mass of native iron which has so often been stated to exist on the top of the mountain; the other to trace the junction of the granite with the sandstone which rests upon it.

The first part of my road up Table Mountain was very easy, being over a cart-way to a mill placed on a stream which flows down a ravine in the face of the mountain which is opposite to Table Bay. My way to this spot, about a mile and a quarter from the town, was over a dark red sandstone deeply impregnated with iron. Leaving the mill, I continued my ascent up the ravine by the side of a torrent, whose course was interrupted by large fragments of the different rocks which compose Table Mountain. The path soon became difficult and steep, but the increasing interest of the scene

prevented the sense of fatigue. At not more than one hundred yards from the mill, I first encountered any schistus which could be considered as forming a component part of the mountain. It was so much decomposed and so covered with the fragments of other rocks, that I could determine little else about it than that even, at its very commencement, it had an intermixture of granite. Passing onward, I found the bed of the torrent widening and less choked with fragments, and exposing here and there large surfaces of schistus through which granite was ramifying in every possible direction, and in the most irregular shapes.

In one place I observed a broad vein of equal dimensions throughout, traversing the whole exposed surface of schistus; in another, a vein of equal breadth sending out large lateral branches, sometimes straight, frequently very tortuous, and even twisted in their course. Sometimes a vein commenced of great breadth, but suddenly contracted in width, or dissipated in innumerable streamlets. Similar appearances were visible in the wall of the ravine, to the right hand of the spot where I now stood, my face being towards the mountain. In this wall I observed broad perpendicular veins of granite passing through schistus, in the manner represented by No. V. of the Geological Views of the Cape. Advancing higher up,

the proportion of the schistus to the granite increased, the latter penetrating the former in less quantity, and frequently only in narrow streaks. But the schistus occasionally changed its dark grey colour for a lighter hue, and in these places, when fractured, resembled gneiss. Still advancing, I reached the spot where the granite seemed to rest on the schistus; the line of separation being very distinct, but interrupted by zig-zag streams of granite which passed from the great body of granite into the schistus.



Below the line of junction, a singular appearance was pointed out to me by one of my companions. In a part of the schistus, of a lighter colour than its principal mass, appeared two distinct portions of their natural dark colour, at some distance from each other, but having their opposite edges exactly corresponding. I discovered a much more palpable phenomenon, of the same character, in a ravine to the left of that in which I observed what I have just described. Here a mass of schistus was divided by a vein of granite into two portions, the vein passing through it in such a manner as to represent the legs of a right angle, the apex of which was in the centre of the schistus. In this instance also the two portions of schistus exactly corresponded.

Looking up from a point rather below the principal line of junction of the large body of the granite with the schistus, to the wall of the ravine on my right, I observed large masses of schistus imbedded in granite, and permeated by veins of the surrounding rock, in the manner displayed by the fourth number of the Geological Views at the Cape of Good Hope. These appearances, as well as that before mentioned of the perpendicular veins of granite, are better seen at some distance from the opposite side of the ravine, as they are on too large a scale to be viewed nearly with advantage.

The veins of granite vary much in the size of their component crystals. The large veins frequently resemble in all respects the rock which gives them off; but the smaller veins are generally of a smaller grain. In some instances veins commencing with the characters of large-grained granite become of a less distinct character, having at their termination a very small proportion of mica. Those veins which are small-grained, and still more so those that are narrow and twisted, are much harder than the surrounding granite. Their surface rises above the level of the schistus, and is therefore less acted upon by the water which flows over both, whilst the body of granite appears to be more decomposable. They are also more refractory to the hammer than the principal body of granite.

Leaving the line where the schistus communicates with the granite, I continued my ascent over a great extent of the latter, presenting a broad even slope, over which the water flowed in a clear current. No schistus was now visible; nor did the fragments of any other rock for several yards rest on the granite. At length the ravine became more narrow; large masses of a very crystalline sandstone began to appear, and I hoped soon to trace the junction of its principal strata with the granite. But the channel of the torrent still contracted, the fragments of sandstone became more frequent, and at length so entirely hid the granite, that I could only conjecture respecting their point of union. During my progress from this spot to the summit of the mountain, I met with little that interested me at the time, or that is worth relating. From the termination

of the granite, sandstone of different colours, first reddish, and afterwards beautifully white, and in exact horizontal strata, continued to the top of the mountain. The most striking fact regarding this sandstone formation is, that it contains, even when most highly crystalline, rounded masses of quartz, from the size of a pea to that of a small pear.

On reaching the top of the mountain, I was much gratified by the strangeness of the scene that expanded around me. On my left spread a plain covered with small fragments of rocks and a great variety of hardy flowering plants. On my right its surface was more unequal; the sandstone having yielded in some parts more than in others to the action of the elements, had assumed the most grotesque forms, exhibiting the appearance of ruined buildings, amidst which were growing numbers of beautiful and interesting ferns. Having recovered from the fatigue of the ascent, I commenced a search for the mass of iron, in which I was seconded by several friends, but our endeavours were fruitless; and although repeated a few days afterwards, had no better success.

I may here observe, that there can be no doubt that a mass of iron has existed on Table Mountain; I have conversed with several persons at the Cape, who have either seen it themselves, or have heard others mention it who have. But it is there generally believed to be the fluke of an anchor, as mentioned by Mr. Barrow*, and was described to me as such by the late Mr. Gothorpe, master of the Alceste, who had examined it. An elderly gentleman, who resides at Simon's Town, stated to Captain Maxwell that he was one of a large party who many years ago carried it up, with what motive it is perhaps not easy to imagine. It does not, however, I apprehend, exist on the top of Table Mountain at this time. A mass of iron, answering its description in every respect, has lately been seen at some distance below, and is probably

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* Travels in Southern Africa.

tumbled further down by every succeeding person who finds it. The only iron which I met with in any part of Table Mountain was in the form of red oxide, a vein of which I saw passing through the sandstone when about two-thirds up the mountain.

My disappointment in not finding the union of the sandstone and granite on Table Mountain was forgotten in the examination of a very extensive junction pointed out to me by Captain Wauchope in a mountain that faces the sea, in the neighbourhood of Simon's Bay. I shall describe it in this place for the sake of connecting those phenomena from which I shall attempt any conclusions respecting the formation of the Cape mountains. The sandstone forming the upper part of the mountain is of a reddish colour, very crystalline in its structure, and approaching in some specimens to quartz rock. Immediately beneath the sandstone is a bed of compact dark red argillaceous sandstone, passing in many places into slate of the same colour. This bed rests upon another of very coarse loosely combined sandstone, resembling gravel. Under this is another layer of dark red sandstone, terminating in a conglomerate, consisting of decomposed crystals of felspar, and of rounded and angular fragments of quartz from the size of a millet-seed to that of a plover's egg, imbedded in a red sandstone base. Beneath the conglomerate commences a bed, which I at first mistook for granite, and which is composed of the constituents of granite in a decomposed state, intermixed with green steatite, and a sufficient quantity of the dark red sandstone to give it a reddish hue. The felspar of this bed is decomposed, and exactly resembles that in the conglomerate above it. The mica seems in a good measure to have passed into steatite. The quartz is in small crystals, frequently having their angles rounded. This bed is several feet in thickness, and gradually terminates in granite, but the precise line of junction I was unable to trace. The appearances then were in the following order:

1. Horizontally stratified sandstone.

2. A bed of compact dark red sandstone passing into slate.

3. A bed of coarser sandstone, resembling gravel.

4. A second layer of compact dark red sandstone passing,

5thly, into a conglomerate, consisting of decomposed crystals of felspar and fragments of quartz in a sandstone base.

6. A bed composed of the decomposed constituents of granite and red sandstone, passing,

7thly, into granite.

But although the above is the general, it is not the universal order of the appearances presented by the mountain. It sometimes happens that one, sometimes two, and even more of the series are wanting. In one place I found the horizontally stratified sandstone resting on the coarser gravelly sandstone; in another on the conglomerate; and in another on the bed below it. In fact, in different places it came in contact with each of the series.

The beds of sandstone which pass into slate are altogether different, both in colour and structure, from the sandstone forming the top of the mountain: they are of a dark red colour, and very earthy in their fracture; the other is of a reddish gray colour, and crystalline in its fracture. Fragments of dark red slate containing minute plates of mica, are imbedded in the coarse gravelly sandstone.

The bed of coarse gravelly sandstone in some places exactly resembles what has been called the old red sandstone conglomerate: in it are found large and round fragments of quartz surrounded by crystals of shorl.

I have now described, with all the accuracy of which I am capable, the more general and important geological appearances which presented themselves to my observation during my two visits to the Cape of Good Hope. I have described them without attempting to deduce conclusions from them whilst occupied in detailing them, that I might give my reader an opportunity of forming his own opinions respecting them unembarrassed by any theoretical observ-

ations. I shall now, however, venture to state the explanation which occurred to me of some of the principal phenomena; in doing which I shall be found to coincide in inferences already drawn from the same class of facts. I may previously remark, that the same structure which is found to belong to the mountains accessible from their immediate vicinity to Cape Town, in all probability characterizes those of the great ranges of Southern Africa. In an excursion to a ridge of mountains, called the Jungerhook, about forty miles north of Cape Town, I found the same general constituents of sandstone, granite, and schistus, entering into their composition, wherever I could examine them closely; and I saw no mountain whose summit was not formed of horizontally stratified sandstone, and whose base was not covered with fragments of schistus and granite. The observations of Barrow and other travellers also show, that the general structure of the mountains in the interior of Southern Africa is the same as that of those in the neighbourhood of Cape Town.

My description of the appearances in Table Mountain will be found to agree in most respects with that of Captain Basil Hall, published and reasoned upon by Mr. Playfair in the seventh volume of the Edinburgh Philosophical Transactions. The black rock which I have called schistus, is there indifferently denominated killas and grawacky. Without attempting to give it a definite appellation, I shall describe such of its characters as I have been able to determine. The Devil's Hill, which is distinctly stratified, affords, perhaps, the best specimens for ascertaining its nature; as this mountain is intermediate between a coarse-grained rock on the one hand, and slate on the other. The colour of the rock is a smoke gray, with a reddish tint, which becomes deeper in proportion as the rock is exposed to the weather. To the naked eye the rock has a very fine granular appearance, with a glimmering lustre arising from minute scales of mica. Under a lens a sandstone structure becomes more distinct, and when the rock has been subjected to the heat of a common stove, the quartz sand becomes predominant and the conglomerate character unquestionable: this effect is probably

the consequence of the contraction of a clay base. The schistus with these characters has two extremes, one near its junction with the granite, the other when most remote from it. Near the granite it is distinctly granular to the naked eye; when most remote it passes into slate. The slate which is to be seen in quarries in Lion's Hill is intersected by narrow veins of quartz, and might be taken at first sight for primitive clay slate, but is of a dark gray colour, and contains scales of mica which, under a strong magnifier, give it the appearance of mica slate: it is, however, thus viewed, distinctly granular, and more so after exposure to heat. These are the leading characters and gradations of the schistus of the Cape; I call it schistus, because it is always distinctly stratified and has more or less of a slaty fracture.

The theory of the igneous origin of granite adopted by Captain Hall and Mr. Playfair to explain the phenomena visible in Table Mountain, very happily meets the facts, and must appear, I apprehend, to one standing on the spot where they occur, as incontestible.* They are indeed of that nature which strikes the conviction at the first glance. Carry to the spot one who never heard of geological theories, and ask him what he infers from the appearances before him, and he will exclaim, "The white rock has broken the black in pieces." Whatever may be the true explanation of the appearances, this I apprehend must be the first impression that affects the mind of any person visiting Table Mountain. A

* "The penetration of the killas, or grawacky, by veins from the mass of granite which it surrounds, proves that the killas, though the superior rock, is of older formation than the granite. The granite, therefore, is a mineral that has come up from below into the situation it now occupies, and is not one of which the materials have been deposited by the sea in any shape, either mechanical or chemical. It is a species therefore of subterraneous lava, and the progeny of that active and powerful element which we know, from the history both of the present and the past, has always existed in the bowels of the earth." Account of the Structure of the Table Mountain, and other Parts of the Peninsula at the Cape, drawn up by Professor Playfair from Observations by Captain Basil Hall.—Edinburgh Philosophical Transactions, vol. 7.

more deliberate investigation, by a more cautious observer, would also, I think, lead to similar conclusions. If he were one desirous to explain all geological phenomena by the agency of water, and be therefore disposed to consider the mixture of schistus and granite as resulting from cotemporaneous formation, he would hesitate over the imbedded masses of the former uncontaminated by their matrix, and would be still more perplexed by the fact that they can be separated without mixture. He would in vain seek in them those instances of the wedging of one rock into the other, which has been supposed confirmative of this opinion.* In looking at the principal line of junction between the granite and the schistus, he would see no gradual gradation of one into the other, but a distinct, though interrupted line of separation. This interruption he would find to be occasioned by veins of granite passing directly from the principal mass of granite into the schistus; in other words, the subjacent rock shooting into the superincumbent one.† Below this line he would indeed find an intimate mixture of the two rocks, occasioning a compound of a lighter colour than the schistus; such an appearance as might in itself be explained on the supposition of coeval formation. But he would meet a fact exceedingly unfavourable to this conclusion on a closer view; he would see here, as in the granite, two pieces of schistus of

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* "The substance of the vein is to be observed mixed with and passing into that of the rock; and it wedges out in every direction in the mass of the rock, thus showing that it has not been filled from above or below, but is, as it were, a secretion from the rock itself. Such veins are denominated *cotemporaneous*, because they appear to have been formed almost at the same time with the rock in which they occur."—Elements of Geognosy, p. 236.

† "It is an incontrovertible fact, that no veins of the substance of a subjacent rock ever shoot into a superincumbent one; because the structure of the crust of the globe, from the oldest granite to the newest alluvial deposit, shows that veins are composed either of the finer substance of the rock in which they are contained, as is the case with those veins denominated cotemporaneous, or of substances more or less different from the rock, and which are frequently connected with mountain-masses or beds that *lie over* those rocks by which these veins are traversed. Thus no veins of granite are ever observed shooting from the oldest granite formation into the superincumbent gneiss; but veins of gneiss traverse through granite."—Elements of Geognosy, p. 237.

the natural dark colour imbedded in the mixed mass, and if he subjected them to the most accurate measurement, he would find their edge and angles corresponding. If he should leave the Table Mountain and visit Green Point, where the mixture of the two rocks is more intimate, he would still have to contend with facts scarcely explicable on the Neptunian theory. The appearance most likely to arrest his attention, would be the intimate intermingling of the two rocks in the large field, a portion of which is represented in page 289., and which he would probably consider, on a first view, not only explicable on the theory of aqueous formation, but as favourable to it. Here he could see that intermingling, and wedging, and gradation of one rock into the other, which his opinions require. But this conclusion would perhaps give way to a wider view of the phenomena around him. The leading feature stamped on all the facts at Green Point is exceeding commotion at the period of the mixture of the two formations. To conceive that they were deposited from a fluid in a state of rest, seems to me impossible for any one crediting the evidence of sense. Although it might perhaps be said, that their intimate mixture was the consequence of the agitation of the fluid whilst they were crystallizing. But supposing a Neptunian to have formed this inference, he must, I apprehend, yield it to one of the conditions of his own theory, and one of the laws of crystallization.* Bodies of a perfect crystalline structure can only be formed as a chemical deposit from a fluid in a state of rest. Rocks of an earthy fracture are formed from a fluid more or less agitated. What then are the characters of the rocks at the point of

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" We know the conditions necessary for the formation of a crystalline structure, and that rest and motion are the agents which assist or prevent its regular formation. Hence we may very fairly infer that the solution or ocean when it stood high over the earth was calm and undisturbed. During succeeding periods the solution appears to have become more and more agitated; yet at first it only prevented the perfection of the crystallization. As the water diminished in height its motions increased; its destroying powers reached to the surface of the earth and the crystalline shoots were destroyed, and thus the first mechanical productions were formed." Elements of Geognosy, p. 90.

junction? Certainly not those which would result from a deposit more or less mechanical. Their fracture is highly crystalline, and more so in proportion to the vicinity of the granite.

On the other hand, one who adopts the theory of the igneous origin of granite would find no difficulty in explaining all the phenomena which present themselves; he would consider them, indeed, as a beautiful illustration and a powerful confirmation of his doctrine. Those instances, so puzzling to a Neptunist, of the detached fragments of the rock which overlies, and its penetration by veins from below, and the crystalline fracture of the two rocks when compounded, would appear to him necessary to the verification of his opinions. That granite in fusion bursting through a superincumbent rock should split it into an infinite variety of fissures, and fill them, like melted metal poured into a mould, and should dislodge and insulate fragments, is an inference too obvious to be much dwelt upon in this place.

The beds of schistus represented in Plate N° 2., as rising into the granite, have on a first view so much the appearance of having pushed through the granite, that it might be imagined that the schistus had dislocated the granite rather than the granite the schistus, if a more extended research did not show the latter insulated in the former, and its strata vertical. But that the granite overspreads the schistus near their point of junction, and that the latter is not conformably deposited upon it, cannot, I think, be doubted by any one who traces the appearances in their successive order. In walking down to the sea, in the line of the principal junction of the two rocks, you first cross over granite of a very large grain unmixed with schistus for some distance, except that you occasionally observe a small imbedded mass of the latter rock. On approaching the beach you gradually find the granite altering its colour, from mixture with schistus, and at length including large beds; and when you reach the shore where the rocks are exposed to all the power of the ocean, and more battered away, the schistus becomes less and less mixed, and is at length entirely pure. At this spot,

on my first visit, I felt the fullest conviction that I distinctly traced the main body of the schistus sweeping under the granite along the margin of the sea; but on a second visit I could not verify my first observation. On my first visit the day was cloudy and the sea quiet; on my second, the sun shone bright, and was reflected by the breakers of a troubled sea dashing against the rocks. This important fact, therefore, still requires to be substantiated by other observations.

It is at the junction of the large-grained granite with the schistus that any doubts can be felt by the sceptical whether the granite overlies the schistus. No doubt can exist of the small-grained granite being spread in a thin but extensive sheet over it, as the breaking away of portions of this near its centre has exposed the schistus beneath. But as small-grained granite has been considered of later formation than the large-grained, this fact may be considered of little importance. I would venture to observe, however, respecting the formation of the small-grained granite at Green Point, that it is impossible to avoid the belief that it is coeval with the large-grained; it passes so gradually into it in some places, and is so indeterminately mixed with it in others, that the mind seeks in vain for any other conclusion respecting it. Granting their formation to have been cotemporaneous, it would not perhaps be very difficult to explain their difference of character on the Huttonian theory. It is, I believe, one of the acknowledged laws regarding the crystallization of bodies from a state of fusion, that their forms are more or less definite in proportion as the rate of cooling is slow. If the granite in fusion burst through the schistus, the greatest heat must have been at the point of junction near the great body of granite; and here, therefore, the more perfect crystalline forms should occur. The fact is consistent with the theory. The component parts of the large-grained granite, when they intermix with the schistus, retain their crystalline character, giving rise to the porphyritic rock before described.

The sheet of granite, on the contrary, spreading in a thin layer over the schistus, would cool with great rapidity and become a gra-

nite of less distinct crystalline characters; in other words, a granite of smaller grain. In this view the small-grained granite at Green Point might be considered in the condition of a vein from the large-grained. The same explanation will go far to explain the different charaters of the veins in Table Mountain. Those of the greatest width, in some places entirely, and in all much resemble the rock which gives them off. Those of a smaller or of a gradually diminishing width, are of a large grain at their origin, but become of a smaller grain as they recede from it; that is, they are of a less definite character where, according to the theory of the igneous origin of granite, they cooled with the greatest quickness.

But however well the condition of these rocks may be explained by the agency of fire, the operation of water is no less plainly pointed out by the horizontal strata of sandstone, and the appearances attending its junction with the granite. Yet whilst the general fact of the aqueous deposit of the great sandstone strata forming the summits of the Cape mountains, and their undisturbed rest since, cannot escape observation, it is a task of some difficulty to unravel all the phenomena attending their junction with the granite. Having endeavoured to point out their general order, I shall here venture to suggest those consequences to which they seem to lead.

The appearance which, from its universality, especially presses upon the notice, is the decomposed state of the constituents of granite, whether forming the bed immediately resting upon granite, or a part of the porphyritic conglomerate, resulting from their mixture with red sandstone. Three principal conclusions may, I think, be drawn respecting it. First, that the decomposition has not arisen from any late action of the elements; secondly, that it occurred before the deposition of the great sandstone formation; and, thirdly, that it happened when the surface of the granite, in a greater or less degree, formed the surface of the land.

That "the decomposition has not arisen from any late action of the elements," is proved by the great compactness and toughness of the rocks in which it occurs, and by the fact that granite in their

immediate vicinity, under equal or greater exposure, has suffered no decomposition.

That "the decomposition occurred before the deposition of the great sandstone formation," is the necessary consequence of the first conclusion; for if the sandstone was deposited on the granite before the decomposition of its constituents, whence could that decomposition subsequently arise; how especially could crystals of quartz become rounded, and how can be explained the formation of the conglomerate? The appearance indeed speaks for itself; it is self-evident that the surface of the granite was in a decomposed and disintegrated state, when its constituents mixed up with dark red sandstone.

But if this decomposition and disintegration of the rocks happened before the deposition of the sandstone, the hypothesis of Capt. Hall and Mr. Playfair*, that the sandstone was deposited upon the granite whilst at the bottom of the sea, and that it was subsequently raised in so gradual a manner as to have kept its relative situation with respect to the rocks on which it rests, can scarcely be admitted. For the granite, according to this supposition, must have been at that great depth, at which it belongs to no theory to suppose that such changes on the surfaces of rocks can occur. On the other hand, they are precisely those which we continually see rocks undergoing that are exposed to the weather and the action of torrents. Therefore the third conclusion respecting the appearances I have described may perhaps be safely drawn; namely, that the decomposition and disintegration of the granite occurred "when its surface formed, to a greater or less extent, the surface of the earth." And from this a necessary corollary follows; that the sand-

* "The introduction of the granite into the situation it now occupies must have taken place while the whole was deep under the level of the sea: this is evident from the covering of sandstone which lies on the granite to the thickness of 1500 feet; for there can be no doubt whatever that this last was deposited by water. After this deposition the whole must have been lifted up, as Capt. Hall supposes, with such quietness and regularity, and in so great a body, as not to disturb or alter the relative position of the parts." Account of the Structure of the Table Mountain in the Edinburgh Philosophical Transactions.

stone was deposited by the sea rising to an incalculable height above the granite. The phenomena attending the junction of the sandstone with the granite agrees with this view of the subject, and can be as satisfactorily explained on the Wernerian, as those attending the junction of the granite and schistus can on the Huttonian theory. The intermediate beds between the sandstone and granite are of a coarse earthy fracture. The superincumbent sandstone, on the contrary, becomes of a more crystalline structure in proportion as it recedes from them. These two facts are obviously conformable to the laws before quoted respecting the causes which modify crystallization, or which are necessary to the formation of rocks, by a deposit more or less mechanical. For the motion of the sea, being greater near its surface than at a great depth, would be chiefly influential in preventing any tendency to crystallization when it first flowed over the granite; but as it rose much above it, the subsequent deposits would be less agitated and acquire a more crystalline character. One more remark respecting the decomposed state of the constituents of granite may be made in this place; namely, that from whatever cause they acquired this state, they have not reassumed their crystalline forms, although subjected to enormous pressure for an incalculable period.

The appearances, then, which I have described, and the conclusions that I have ventured to draw, seem to point out four different eras, corresponding to as many separate conditions of the rocks constituting the peninsula of the Cape. The first, indefinite as to its commencement, continued whilst the schistus reposed at the bottom of the sea, and terminated when the granite in fusion burst through it and formed dry land. The second commencing at this epoch, terminated when the water rose above the granite. The third had its duration whilst the water stood high above the earth and deposited the sandstone. The fourth commenced with the retrocession of the water and the appearance of the present dry land, and will terminate with the existing order of things. Another consequence of the fact that I have cited appears to be, that the mountains at the Cape of

Good Hope exhibit phenomena illustrative and confirmative of certain positions both of the Huttonian and Wernerian theories, but only to be entirely explained by the agency of both the elements on which the respective systems are founded.

I shall now mention one or two other mineralogical facts which I noticed at the Cape, rather because any information respecting the geology of a part of the world so little explored is desirable, than because of their importance.

An excursion to Huyt's Bay was recommended to me for the purpose of examining some curious stalactical formations. In the company of Mr. Voicy, a gentleman to whom I owed many of the opportunities that I obtained of seeing the geological facts which I have described, I set out for the mountain where they occur, and in my way visited Great Constantia, interesting from being one of the two farms producing the wine bearing its name. We were received with much politeness by the manager of the estate, and conducted through the vineyards, which at that season of the year (June) exhibited only the bare trunks and branches of the vine, resembling leafless gooseberry bushes. From the vineyard we were led into the cellars, which had nothing extraordinary in their appearance, unless it was their extreme cleanliness and exact arrangement. From the cellars we were conducted into the house to examine a very fine specimen of stalactite which had been brought from the neighbourhood of Cape Hanglip. It was about ten feet high, tapering rapidly from its base, which measured about thirty inches in circumference. The cave whence it was brought abounds, it is said, in specimens of equal magnificence. From Constantia it was necessary to pass over a ridge of mountains, called the Steinberg, to reach Huyt's Bay. Our host took some pains to persuade us of the impracticability of passing it on horseback; but as he did not speak from his own experience, could not persuade us to forbear the attempt. We found the road sufficiently difficult, and were perhaps the first equestrians who attempted it, and would scarcely recommend any body to follow our example. The Steinberg consists, like all the other Cape

mountains, of horizontal strata of sandstone resting on granite. In passing over it, our attention was arrested by an immense vein of red oxyde of iron, six feet wide, and which we traced for upwards of one hundred feet.

Having crossed the Steinberg, we came within view of the mountain which was the object of our visit; and when about a quarter of a mile from it, reached a broad creek, formed by the sea; and were on the point of entering its shallowest part, when we were stopped by a man running towards us in great haste, and calling out to us not to stir. On coming up, he told us that we were on the verge of a quicksand, and directed us to take the deepest part of the rivulet close to the sea, where, he said, is always the firmest ground. Our friendly informant proved to be one of the Dutch boors, and invited us to his house close by, on our return from the mountain. Having crossed the creek, we were much gratified with the appearances which the mountain exhibited; but were prevented, by the apprehension of the flowing of the tide, from examining them with all the attention that I wished.

The face of the mountain fronting the sea, had all the appearance of a limestone rock; but when broken, proved a sandstone precisely similar to that which forms the horizontal strata of the rocks near Simon's Town, but was cased with a stalactical deposition by water which constantly overflows it. We also found in a deep ravine some beautiful examples of stalactite, formed by a calcareous deposit on the fibrils of roots, penetrating the roofs of small caverns worn in the rock. A floor of tabular stalactite also covered the ground for several yards about the base of the mountain, and beautiful imitations of moss produced by the splashing of water falling from a great height, were also abundant.

I was unable to account for these appearances at the period of my visit, as I could discover no limestone from which the water could derive its calcareous impregnation. I have been since assured that the top of the mountain is covered with a bed of com-

minuted shell and sand: if this be the fact, their explanation is obvious.

Other appearances of somewhat more difficult explanation were discovered and pointed out to me by Captain Maxwell near Simon's Town. Somewhat to the eastward of the town is a large bank, which rises from the sea to the height probably of a hundred feet, and seems to have been formed by an accumulation of shell and sand brought up by the south-east wind. That such is the origin of the bank, is probable from its being exposed to the direct influence of this wind, and from its very loose structure. I at first thought it possible that it might have resulted from the decomposition of sandstone; but relinquished this opinion on finding the fragments of shell extending much below the surface. On this bank a great number of calcareous cylindrical bodies lie scattered about, and at first sight resemble the bones of animals bleached and disorganized by exposure to the air. On a closer examination many of them are found to be branched; and others are discovered rising through the soil, and ramifying from a stem beneath thicker than themselves. Their vegetable origin immediately suggests itself, and is confirmed by a further enquiry. They are seldom solid, their centres being either hollow or filled with a blackish granular substance, which in many specimens, except in colour, much resembles the substance called roastone by mineralogists. Their outer crust is chiefly composed of a large proportion of sand, and a small proportion of calcareous matter, and in many specimens contains fragments of ironstone, and quartz an inch square. That they are really incrustations formed on vegetables which have afterwards decayed, is proved by the different degrees of change which the internal parts of different specimens have undergone. In some the organization of the plant sufficiently remains to leave its nature unequivocal, and near the sea the very commencement of the process of incrustation may be witnessed on the large *Fuci* which strew the shore.

Similar bodies have been found by Vancouver, Flinders, and Péron * on the shores of New Holland, at considerable elevations. The two first-named travellers considered them all as coral, and as proofs of the land having been lately withdrawn from the dominion of the waters. The last has described two kinds of substances; the one he considers coral, and the other as incrustations on vegetables. Of the latter he gives ample descriptions, and explains the formation in a manner which appears to be satisfactory, and to apply to the substances found by Captain Maxwell near Simon's Town. He supposes that the shells cast on the shore and submitted to the double influence of an ardent sun and penetrating moisture, undergo a species of chemical decomposition; and having lost a portion of their carbonic acid, approach to the state of the lime used in some calcareous cements, and in this state unite into a compost with quartz sand, and form incrustations on the surfaces of plants. In another passage he illustrates the steps of the process by a description of the appearances of several specimens. "In breaking," he remarks, "the branches of these species of Lythophytes, when the incrustation is recent, we observe the woody texture contained in a solid case, and without any remarkable alteration; but in proportion as the calcareous envelope increases, the wood becomes disorganized, and changes insensibly into a dry and black powder." From this state he supposes the centre gradually to increase in solidity till the whole mass becomes a mere sandstone, and nothing but an arborescent form indicates the ancient state of vegetation. †

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* Vancouver's Voyages. Vol. i. p. 48 et 49. Voyage to Terra Australis, by Captain Flinders. Vol. i. p. 63. Voyages aux Terres Australes. Vol. ii. p. 169.

† Les nombreux coquillages qui pullulent dans ces mers, rejetés par millions sur la grève, soumis à la double influence d'un soleil ardent et d'une humidité pénétrante, ne tardent pas à subir une espèce de décomposition chimique dans leur substance. En perdant une portion plus ou moins considérable de leur acide carbonique, ils tendent à se rapprocher de cet état où est la chaux quand nous l'employons pour servir de base à nos cimens; et ce n'est pas en ce seul point que les procédés de la nature se rapprochent

I have assumed that the incrustations near Simon's Town are of a similar nature to those found in New Holland, because the descriptions of authors correspond with the appearances I have witnessed, and because I have compared a specimen from New Holland with those I obtained at the Cape, and can trace no essential difference either in their external characters or chemical composition. Péron appears to have been the only one who has supposed any of the New Holland specimens of vegetable origin; and even he considers the calcareous bodies discovered on Bald Head and on the island of Timor, in which they occur in large quantities at considerable elevations, as really corals, but has not stated any reasons for his opinion, beyond their general resemblance to those bodies. On Bald Head, however, Captain Flinders discovered "two broken columns of stone, three or four feet high, formed like stumps of trees, and of a thickness superior to the body of a man;" appearances elsewhere found by Péron, and described by him as being of vegetable origin.

In the hope of obtaining more precise information respecting the nature of the Cape specimens than could be derived from their external characters, I submitted them to the analysis used by Mr. Hatchett* to determine the composition of different madrepores,

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de ceux dont l'industrie humaine fait usage: de même que, dans nos ateliers, c'est en mêlant avec le sable du rivage ces débris calcaires pulvérisés par l'action des flots, qu'elle parvient à former un véritable ciment calcaréo-quartzeux, d'une qualité supérieure, il est vrai, mais très-analogue d'ailleurs à ceux que l'art produit. Voyages aux Terres Australes. Tom. II. p. 169 et 70.

En brisant les rameaux de ces espèces de lithophytes lorsque l'incrustation est récente, on apperçoit le tissu ligneux engagé dans un étui solide, et sans aucune altération remarquable; mais à mesure que l'enveloppe calcaire augmente, le bois se désorganise et se change insensiblement en un de détritus acide et noirâtre: alors l'intérieur du tube est encore vide, et conserve un diamètre à-peu-près égal à celui de la branche qui lui a servi de moule; enfin le tube finit par s'obstruer et se remplir de parties quartzeuses et calcaires: quelques années s'écoulent et tout est converti en une masse de grès. A cette dernière époque, la forme arborescente seule peut rappeler l'état ancien de végétation. Ibid. p. 171.

with the following results: When put into dilute nitric acid, a portion of them dissolved with great effervescence, leaving a residuum of fine sand of a white colour at the bottom of the vessel, covered by a layer of brown flocculent matter. The supernatant liquor was quite transparent. On treating this liquor with pure ammonia, no precipitation took place.* Treated with carbonate of ammonia, it threw down a white precipitate, which proved to be carbonate of lime. The layer resting on the sand was dissipated by heat, and burnt with the smell of vegetable smoke. The sand was composed of grains of quartz. These were the general results of the experiments, whether made with the outer coat or the interior part of the substance. When the outer part of the crust was used, the proportion of sand increased; when the inner part was used, the dark-coloured flocculent layer increased. Subjected to the action of the blowpipe in their entire state, these substances, under a gentle heat, first blackened; at a higher heat threw off the smell of a vegetable smoke, and became perfectly white. From these experiments it may, I apprehend, be deduced, that they consist of carbonate of lime, quartz, and vegetable matter; a conclusion that accords with the circumstances under which they are found, and their frequent arborescent character. The New Holland specimen, subjected to a similar analysis, gave precisely similar results. As this specimen, for which I am indebted to Mr. Brown, who brought it from Bald Head, has a remarkable resemblance to coral both in form and closeness of texture, it may perhaps be considered a fair example of those substances considered coral by Vancouver, Flinders, and Péron. If this be admitted, it will follow that the reasoning is incorrect which is founded on their supposed submarine origin.

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* This statement requires to be somewhat modified; for occasionally a little oxide of iron was thrown down, arising from its mixture with the sand forming the crust, and giving the supernatant liquor the colour of brandy.

The Embassy re-embarked on board the Cæsar on the 11th of June. In rounding the Cape we were followed by numbers of the huge albatross. The wings of one of the smallest of these birds that hovered about the ship, and was taken in our outward-bound voyage by Mr. D'Warris, an officer of the Alceste, measured ten feet from one extremity to the other.

setifolia, the *Jatropha elastica*, or India-rubber tree, the *Croton sebiferum*, or tallow-tree, the *Camellia oleifera* and *Japonica*, the tea-plant, and various species of *Cassia* and *Mimosa* grew in this enchanting spot in all their native beauty. In fact, every quarter of the world seemed to have afforded its choicest plants; and every plant to have found a congenial soil and climate. Such a peculiar adaptation of circumstances to the healthy growth of plants from all latitudes is the probable consequence of the equal temperature which prevails at the elevation of Plantation House, where the thermometer seldom rises above 78° or falls below 66°. Thus the productions of hot climates are not blasted by cold, nor those of the temperate zones withered by heat.

The geological facts observable in St. Helena are not many, or of very great importance. Those which generally present themselves are the alternate beds of lava, which seem to constitute whole mountains; and the immense perpendicular ridges of black rock, which traverse like huge walls the whole extent of the island. The beds are often exposed at the waterfalls, and exhibit a very definite, and, as far as I could trace, undeviating order. In a waterfall near the Friar's Ridge I had a good opportunity of examining them. A face of rock about a hundred feet in height was made up of successive beds in the following order: the lowermost was composed of a red ochreous clay of considerable depth; resting upon this, and passing into it, was a bed of light porous lava in fragments; on this rested a bed of compact lava, scarcely at all porous, and passing into a superincumbent bed of very compact dark-coloured rock, not distinguishable from basalt.

The Friar's Ridge owes its name to several masses of rock, which, piled on each other to the height of about twenty feet, rest insulated on its top, and seen from below have the appearance of a monk enveloped in his cowl: a stranger often mistakes them for a man standing on its summit. On a near approach they seem to alter their form, and strikingly represent a gipsey with a child at her back. On a close examination they are found to consist of

rhomboidal masses of the same rock which constitutes the ridge. This rock is basalt, every where divided into columnar distinct concretions. Those which I examined were pentagonal, about a foot long, fitting each other with exact adjustment, and forming by their aggregation very perfect columns. The ridge would perhaps be called an enormous whin dyke. On one side it looks into a valley, which has received the homely but significant appellation of "Break-neck Valley;" and a more frightful uninterrupted precipice of fifteen hundred feet cannot be imagined. The other side, by which it is ascended, is of less abrupt declivity, and not more than five or six hundred feet above the level of the bottom of the ravine formed between it and a ridge of lower elevation. The ravine gradually slopes towards the sea, and often increases in depth in a very abrupt stair-like manner. Perpendicular faces thus appear, which exhibit the successive beds of clay and lava which I have already described.

Of our interview with Napoleon I have little to tell. Excepting Lord Amherst and Mr. Ellis, who were admitted to separate audiences, the members of the Embassy were not in his presence more than a quarter of an hour. Our reception was as stately as circumstances admitted. A servant in the livery of Napoleon when in the zenith of glory, stood like the phantom of former splendour to receive us at the door of the outer apartment. Conducted by Bertrand, we were received in an anti-room by Count Montholon and General Gourgaud, both young men of interesting appearance. Lord Amherst was immediately ushered by Bertrand into an inner apartment to the presence of Buonaparte. An hour having elapsed, Mr. Ellis was introduced, and in less than half an hour afterwards the remainder of the party was admitted. A circle being formed about Napoleon, he walked round, addressing successively each person on some subject connected with his particular pursuit or situation in the Embassy, and gave a neat and complimentary turn to all his remarks. His object was evidently to please as much as possible, and he certainly succeeded. But had we left the island without

knowing that he had obtained a list of the persons of the Embassy, and of their particular situations in it, previously to our introduction to him, we should have gone away with a much higher opinion of his address in conforming the subject of his conversation to individual characters.

Buonaparte's person had nothing of that morbid fulness which I had been led to look for. On the contrary, I scarcely recollect to have seen a form more expressive of strength and even of vigour. It is true that he was very large, considering his height, which is about five feet seven inches; but his largeness had nothing of unwieldiness. The fine proportion of his limbs, which has been often noticed, was still preserved. His legs, although very muscular, had the exactest symmetry. His whole form, indeed, was so closely knit, that firmness might be said to be its striking characteristic. His standing posture had a remarkable statue-like fixedness about it, which seemed scarcely to belong to the graceful ease of his step. The most remarkable character of his countenance was, to me, its variableness. Buonaparte has the habit of earnestly gazing for a few seconds upon the person whom he is about to address; and whilst thus occupied holds his features in perfect repose. The character of his countenance in this state, especially when viewed in profile, might be called settled design. But the instant that he enters into conversation his features express any force or kind of emotion with suddenness and ease. His eye, especially, seems not only to alter its expression, but its colour. I am sure, had I only noticed it while the muscles of the face, and particularly of the forehead, were in play, I should have called it a very dark eye; on the contrary, when at rest, I had remarked its light colour and peculiar glary lustre. Nothing, indeed, could better prove its changeable character than the difference of opinion which occurred amongst us respecting its colour. Although each person of the Embassy naturally fixed his attention on Napoleon's countenance, all did not agree on the colour of his eyes.

There was nothing in the appearance of Buonaparte which led us

to think that his health had at all suffered from his captivity. On the contrary, his repletion seemed to be the consequence of active nourishment. His form had all that tone, and his movement all that elasticity, which indicate and spring from powerful health. Indeed, whatever sympathy we felt for the situation of any of the prisoners, received no increase from any commiseration for their bodily sufferings: they were all in excellent plight.

On the morning of the 29th, the day after our interview with Napoleon, we took leave of St. Helena, and on the 7th of July made the island of Ascension.

After leaving St. Helena we imagined that no coast could appear comparatively barren; but found the island of Ascension still more dreary. On approaching the former, a speck of green here and there relieved the prevailing sterility; but the shores of the latter only exhibited hills formed of red volcanic ash, and columnar masses of black lava rising through it.

A half hour's visit to the island was my only opportunity of observing its interesting characters. I landed amidst some large rocks of vesicular lava, which projected from a sandy beach into the sea. Passing on towards one of the red conical hills, I found lava in distinct blocks, and ridges, every where pushing through the surface. The more compact, of a very basaltic character, contained crystals of olivine. The more vesicular had crystals resembling zeolite. The surface of the hill was composed of small masses of a red and very friable cinder, resting on a powder of the same substance. A short distance up its acclivity, two white bodies, not a little puzzling when seen at a distance, seem to rise through the soil. On examination they proved to be tombstones, erected to the memory of two seamen who had died in their vessels off the island. These stones were curious from being sonorous, and having been formed from considerable beds, or rather slabs of stone, found on the beach, and which are formed of the fragments of shells cohering together. They exactly resemble, except in being of a coarser grain, the rock in which the human skeletons of Guadaloupe have been found.

Several varieties of obsidian and pitchstone are found on the island in great quantities, but I could not learn under what circumstances.*

I found only one plant in my walk, a species of *Euphorbia*. On the higher hills plants grow in sufficient abundance to feed many goats.

Turtle frequent the island from February to July, and are of large size. Those taken on board the Cæsar weighed from two to four hundred weight. The chief means of subsistence are goats, turtle, and fish. Attempts have been made to raise vegetables on the hills, but they have had little success in consequence of the rats with which the island abounds.

Since the detention of Buonaparte the island has been fortified by a battery of fourteen guns erected on a projecting rock; and the Spy sloop, at the period of our visit, had been for a long time at anchor to leeward of the island.

The Cæsar made sail early in the afternoon, and continued on her voyage to England.

Our impatience to finish the remainder of our voyage, greater in proportion as we approached its termination, was much lessened by the amusement we derived from watching the habits of our shipmate, the Orang-Outang. This animal, although described by Edwards †, Vosmaer ‡, Buffon §, Camper ‖, F. Cuvier ¶, Tillesius **, and others, has not yet been so distinctly and fully pourtrayed either in his external characters or peculiar habits, as to render all further

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The obsidian, which is most abundant, and of which I obtained specimens from an officer stationed on the island, is of a velvet black colour, and of a perfect vitreous lustre. Under the blowpipe it intumesces greatly, loses its black colour, and passes into a white porous mass. Its specific gravity is 2.312. The pitchstone becomes of a darker colour under the blowpipe, and porous on the surface, but melts into a slag with great difficulty. Its specific gravity is 2.4.

† Gleanings. London, 1758. p. 6.

‡ Description de l'espèce de singe, aussi singulier que très rare, nommé Orang-Outang de l'isle de Borneo par Vosmaer.

§ Buffon, 4to. Suppl. Tom. vii. p. 1. pl. 1.

‖ Natuunkundige verhandelingen van Petrus Camper over der Orang-Outang.

¶ Annales des Museum, tom. xvi. p. 46.

account of him either uninteresting or unnecessary. The causes of the defectiveness of these descriptions have been the youth of the animals which have arrived in Europe alive, and the short time they have survived after reaching the observation of those competent to give a history of their habits. A cause of a similar kind will render my observations of the one now in England less valuable than they would be at a future period, when the animal shall have obtained, beyond dispute, his full stature, and the entire developement of his intellectual powers. But as a description of his external characters, his dimensions, and intellectual manifestations at the present time, will serve as a standard of comparison on a future occasion, and because his actions on board ship were less restrained, and therefore more natural, than since his arrival in England, I shall make no further apology to my reader for introducing in this place a description which may seem to be little connected with the main object of this work.

For the possession of this rare animal the scientific world is indebted to Captain Methuen, who brought him from Banjarmassing on the south coast of Borneo, to Java; and in the hope of aiding the cause of science placed him in my possession, for the purpose of being conveyed to England. The natives informed Captain Methuen that he had been brought from the highlands of the interior, and that he was very rare, and difficult to take; and they evidently considered him a great curiosity, as they flocked in crowds to see him.

It may be necessary to acquaint some of my readers that the Orang-Outang of Borneo has been confounded by many writers with an animal that inhabits Africa, and which has also been called Orang-Outang, but is more correctly known by the name of Pongo. The Pongo, which has been minutely described by Tyson*, differs anatomically from the subject of this description, and in having large ears and black hair.

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* Anatomy of a Pygmy compared with that of a Monkey, an Ape, and a Man, by Edward Tyson, M.D. F.R S. 2nd ed. London, 1751.

Orang-Outang* is a Malay phrase, signifying "wild man," and, should therefore be restricted to the animal, which, according to our present information, is found exclusively on Borneo. The portrait in the next page will give a correct notion of his general characters, and assist the description. It was taken soon after his arrival in this country, when his hair was longer than it now is in consequence of a disease in the skin.

The present height of the animal, judging from his length when laid on a flat surface, and measured from his heel to the crown of his head, is two feet seven inches.

The hair of the Orang-Outang is of a brownish red colour, and covers his back, arms, legs, and outside of his hands and feet. On the back it is in some places six inches long, and on his arms five. It is thinly scattered over the back of his hands and feet, and is very short. It is directed downwards on the back, upper arm and legs, and upwards on the fore arm. It is directed from behind forwards on the head, and inwards on the inside of the thighs. The face has no hair except on its sides, somewhat in the manner of whiskers, and a very thin beard. The middle of the breast and belly was naked on his arrival in England, but has since become hairy. The shoulders, elbows, and knees, have fewer hairs than other parts of the arms and legs. The palms of the hands and feet are quite naked.

The prevailing colour of the animal's skin, when naked or seen through the hair, is a bluish gray. The eyelids and margin of the mouth are of a light copper colour. The inside of his hands and feet are of a deep copper colour. Two copper-coloured stripes pass from the armpits down each side of the body as low as the navel.

The head viewed in front, is pear-shaped, expanding from the chin upwards, the cranium being much the larger end. The eyes are close together, of an oval form, and dark brown colour. The

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* I use this mode of spelling in conformity with general usage, although *Orang-Utan* would, according to the high authority of Mr. Marsden, be more correct orthography. See History of Sumatra, p. 117.

eyelids are fringed with lashes, and the lower ones are saccular and wrinkled. The nose is confluent with the face, except at the nostrils, which are but little elevated: their openings are narrow and oblique. The mouth is very projecting, and of a roundish mammillary form. Its opening is large, but when closed is marked by little more than a narrow seam. The lips are very narrow, and scarcely perceptible when the mouth is shut. The chin projects less than the mouth: below it, a pendulous membrane gives the appearance of a double chin, and swells out when the animal is angry or much pleased. Each of the jaws contains twelve teeth, namely, four incisive teeth, the two middle ones of the upper jaw being twice the width of the lateral; two canine, and six double teeth. The ears are small, closely resemble the human ear, and have their lower margins in the same line with the external angles of the eyes.

The chest is wide compared with .the pelvis: the belly is very protuberant. The arms are long in proportion to the height of the animal, their span measuring full four feet seven inches and a half. The legs are short compared with the arms.

The hands are long, compared with their width, and with the human hand. The fingers are small and tapering: the thumb is very short, scarcely reaching the first joint of the fore finger. All the fingers have very perfect nails of a blackish colour and oval form, and exactly terminating with the extremities of the fingers. The feet are long, resemble hands in the palms, and in having fingers rather than toes, but have heels resembling the human. The great toes are very short, are set on at right angles to the feet close to the heel, and are entirely without nails.*

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* In the month of September, 1817, I took the dimensions of some of the parts of this animal, but under circumstances in which I could not make them very numerous. I have thought it proper to exhibit them, in conjunction with others taken on the 28th of May, 1818:—

HEIGHT.

The orang-outang of Borneo is utterly incapable of walking in a perfectly erect posture. He betrays this in his whole exterior conformation, and never wilfully attempts to counteract its tendency.

		1817. Inches.	1818. Inches.
Height.	Measured from the vertex to the bottom of the heel ..	28	31·5
Span.	Of the arms		55·5
Head.	From between the eyebrows to the junction of the head with the neck	7	7·5
	From the tip of one ear to that of another	7	7·2
	Circumference immediately above the ears	14·3	15
	——— round the chin, close to the neck and over the vertex		32
	From ear to ear, across the forehead		8
	From the lower margin of the ear to the middle of the lower margin of the chin		5·3
	Facial angle, 57°		
Body.	Circumference round the shoulders		30
	Under the arm-pits		25
	Round the most projecting part when sitting		28
	——— when standing with the arms raised above the head		24
	Round the hips		9
	Distance between the nipples		8
	Length, from top of the sternum to the pubis		13·5
	——— of the back, from setting on of the head to the end of the *os coccygis*		16
Arms.	Length from the armpit to the end of the middle finger		25
	——— of the upper arm		9
	——— fore arm		10
	Circumference of the shoulder		10·2
	——— middle of upper arm		8·2
	——— fore arm		9
Hands.	Length from the wrist to the middle finger	6·3	6·7
	——— of the palm		3·9
	——— of middle finger, measured from the knuckle		4·3
	——— of thumb		1·5
	Circumference of the palm		7
Legs.	Length from groin to the instep	11·5	13
	——— to the knee		6·5
	——— from knee to the sole of the foot		7·4
	Greatest circumference of the thigh		12
	——— leg		8
Feet.	Length from heel to the end of middle toe	7·5	8·5
	Circumference close to the great toe		7
	Length of great toe	1	1·2

His head leaning forward, and forming a considerable angle with the back, throws the centre of gravity so far beyond the perpendicular, that his arms, like the fore-legs of other animals, are required to support the body. So difficult indeed is it for him to keep the upright position for a few seconds, under the direction of his keeper, that he is obliged, in the performance of his task, to raise his arms above his head, and throw them behind him to keep his balance. His progressive motion on a flat surface is accomplished by placing his bent fists upon the ground and drawing his body between his arms: moving in this manner, he strongly resembles a person decrepid in the legs, supported on stilts. In a state of nature, he probably seldom moves along the ground; his whole external configuration showing his fitness for climbing trees and clinging to their branches. The length and pliability of his fingers and toes enable him to grasp with facility and steadiness; and the force of his muscles empowers him to support his body for a great length of time by one hand or foot. He can thus pass from one fixed object to another, at the distance of his span from each other, and can obviously pass from one branch of a tree to another, through a much greater interval. In sitting on a flat surface, this animal turns his legs under him in the manner expressed by the engraving. In sitting on the branch of a tree or on a rope, he rests on his heels, his body leaning forward against his thighs. This animal uses his hands like others of the monkey tribe.

It is necessary to remark, that I cannot answer for the precise accuracy of the annexed measurements, as the restlessness of the animal and the fear of injuring him by violent coercion, rendered it very difficult to take them. Those made indeed in May, 1818, were often repeated, and are therefore no doubt close approximations to the truth.

This animal had, on his arrival in England, only ten teeth in each jaw. In December he cut his two hindmost double teeth, making up twelve in each jaw. In December, 1817, he weighed thirty-five pounds and a half; in May, 1818, he weighed forty-three, having increased seven pounds and a half in five months, and having grown, as may be seen by the table, full three inches in height.

The orang-outang, on his arrival in Java from Batavia, was allowed to be entirely at liberty till within a day or two of being put on board the Cæsar to be conveyed to England; and whilst at large, made no attempt to escape; but became violent when put into a large railed bamboo cage for the purpose of being conveyed from the island. As soon as he felt himself in confinement, he took the rails of the cage into his hands, and shaking them violently endeavoured to break them in pieces; but finding that they did not yield generally, he tried them separately, and having discovered one weaker than the rest, worked at it constantly till he had broken it, and made his escape. On board ship an attempt being made to secure him by a chain tied to a strong staple, he instantly unfastened it, and ran off with the chain dragging behind; but finding himself embarrassed by its length, he coiled it once or twice, and threw it over his shoulder. This feat he often repeated, and when he found that it would not remain on his shoulder, he took it into his mouth.

After several abortive attempts to secure him more effectually, he was allowed to wander freely about the ship, and soon became familiar with the sailors, and surpassed them in agility. They often chased him about the rigging, and gave him frequent opportunities of displaying his adroitness in managing an escape. On first starting, he would endeavour to outstrip his pursuers by mere speed, but when much pressed, elude them by seizing a loose rope, and swinging out of their reach. At other times he would patiently wait on the shrouds or at the mast-head till his pursuers almost touched him, and then suddenly lower himself to the deck by any rope that was near him, or bound along the main-stay from one mast to the other, swinging by his hands, and moving them one over the other. The men would often shake the ropes by which he clung with so much violence as to make me fear his falling, but I soon found that the power of his muscles could not be easily overcome. When in a playful humour, he would often swing within arm's length of his pursuer, and having struck him with his hand, throw himself from him.

Whilst in Java, he lodged in a large tamarind-tree near my dwelling; and formed a bed by intertwining the small branches and covering them with leaves. During the day, he would lie with his head projecting beyond his nest, watching whoever might pass under, and when he saw any one with fruit, would descend to obtain a share of it. He always retired for the night at sun-set, or sooner if he had been well fed; and rose with the sun, and visited those from whom he habitually received food.

On board ship he commonly slept at the mast-head, after wrapping himself in a sail. In making his bed, he used the greatest pains to remove every thing out of his way that might render the surface on which he intended to lie uneven; and having satisfied himself with this part of his arrangement, spread out the sail, and lying down upon it on his back, drew it over his body. Sometimes I pre-occupied his bed, and teazed him by refusing to give it up. On these occasions he would endeavour to pull the sail from under me or to force me from it, and would not rest till I had resigned it. If it was large enough for both, he would quietly lie by my side. If all the sails happened to be set, he would hunt about for some other covering, and either steal one of the sailors' jackets or shirts that happened to be drying, or empty a hammock of its blankets. Off the Cape of Good Hope he suffered much from a low temperature, especially early in the morning, when he would descend from the mast, shuddering with cold, and running up to any one of his friends, climb into their arms, and clasping them closely, derive warmth from their persons, screaming violently at any attempt to remove him.

His food in Java was chiefly fruit, especially mangostans, of which he was excessively fond. He also sucked eggs with voracity, and often employed himself in seeking them. On board ship his diet was of no definite kind. He ate readily of all kinds of meat, and especially raw meat; was very fond of bread, but always preferred fruits when he could obtain them.

His beverage in Java was water; on board ship, it was as diver-

sified as his food. He preferred coffee and tea, but would readily take wine, and exemplified his attachment to spirits by stealing the Captain's brandy-bottle: since his arrival in London, he has preferred beer and milk to any thing else, but drinks wine and other liquors.

In his attempts to obtain food, he afforded us many opportunities of judging of his sagacity and disposition. He was always very impatient to seize it when held out to him, and became passionate when it was not soon given up; and would chase a person all over the ship to obtain it. I seldom came on deck without sweetmeats or fruit in my pocket, and could never escape his vigilant eye. Sometimes I endeavoured to evade him by ascending to the mast-head, but was always overtaken or intercepted in my progress. When he came up with me on the shrouds, he would secure himself by one foot to the rattling, and confine my legs with the other, and one of his hands, whilst he rifled my pockets. If he found it impossible to overtake me, he would climb to a considerable height on the loose rigging, and then drop suddenly upon me. Or if, perceiving his intention, I attempted to descend, he would slide down a rope and meet me at the bottom of the shrouds. Sometimes I fastened an orange to the end of a rope, and lowered it to the deck from the mast-head; and as soon as he attempted to seize it, drew it rapidly up. After being several times foiled in endeavouring to obtain it by direct means, he altered his plan. Appearing to care little about it, he would remove to some distance, and ascend the rigging very leisurely for some time, and then by a sudden spring catch the rope which held it. If defeated again by my suddenly jerking the rope, he would at first seem quite in despair, relinquish his effort, and rush about the rigging, screaming violently. But he would always return, and again seizing the rope, disregard the jerk, and allow it to run through his hand till within reach of the orange; but if again foiled, would come to my side, and taking me by the arm, confine it whilst he hauled the orange up.

This animal neither practises the grimace and antics of other

monkeys, nor possesses their perpetual proneness to mischief. Gravity approaching to melancholy, and mildness, were sometimes strongly expressed in his countenance, and seem to be the characteristics of his disposition. When he first came amongst strangers, he would sit for hours with his hand upon his head, looking pensively at all around him; or when much incommoded by their examination, would hide himself beneath any covering that was at hand. His mildness was evinced by his forbearance under injuries, which were grievous before he was excited to revenge; but he always avoided those who often teazed him. He soon became strongly attached to those who kindly used him. By their side he was fond of sitting; and getting as close as possible to their persons, would take their hands between his lips, and fly to them for protection. From the boatswain of the Alceste, who shared his meals with him, and was his chief favourite, although he sometimes purloined the grog and the biscuit of his benefactor, he learned to eat with a spoon; and might be often seen sitting at his cabin-door enjoying his coffee, quite unembarrassed by those who observed him, and with a grotesque and sober air that seemed a burlesque on human nature.

Next to the boatswain, I was perhaps his most intimate acquaintance. He would always follow me to the mast-head, whither I often went for the sake of reading apart from the noise of the ship; and having satisfied himself that my pockets contained no eatables, would lie down by my side, and pulling a topsail entirely over him, peep from it occasionally to watch my movements.

His favourite amusement in Java was in swinging from the branches of trees, in passing from one tree to another, and in climbing over the roofs of houses; on board, in hanging by his arms from the ropes, and in romping with the boys of the ship. He would entice them into play by striking them with his hand as they passed, and bounding from them, but allowing them to overtake him and engage in a mock scuffle, in which he used his hands, feet, and mouth. If any conjecture could be formed from these frolicks of his mode of attacking an adversary, it would appear to be his first

object to throw him down, then to secure him with his hands and feet, and then wound him with his teeth.

Of some small monkeys on board from Java he took little notice, whilst under the observation of the persons of the ship. Once indeed he openly attempted to throw a small cage, containing three of them, overboard; because, probably, he had seen them receive food of which he could obtain no part. But although he held so little intercourse with them when under our inspection, I had reason to suspect that he was less indifferent to their society when free from our observation; and was one day summoned to the top gallant yard of the mizen-mast to overlook him playing with a young male monkey. Lying on his back, partially covered with the sail, he for some time contemplated, with great gravity, the gambols of the monkey which bounded over him; but at length caught him by the tail, and tried to envelope him in his covering. The monkey seemed to dislike the confinement, and broke from him, but again renewed its gambols, and although frequently caught, always escaped. The intercourse however did not seem to be that of equals, for the orang-outang never condescended to romp with the monkey as he did with the boys of the ship. Yet the monkeys had evidently a great predilection for his company; for whenever they broke loose, they took their way to his resting-place, and were often seen lurking about it, or creeping clandestinely towards him. There appeared to be no gradation in their intimacy; as they appeared as confidently familiar with him when first observed as at the close of their acquaintance.

But although so gentle when not exceedingly irritated, the orang-outang could be excited to violent rage, which he expressed by opening his mouth, showing his teeth, seizing and biting those who were near him. Sometimes indeed he seemed to be almost driven to desperation; and on two or three occasions committed an act, which, in a rational being, would have been called the threatening of suicide. If repeatedly refused an orange when he attempted to take it, he would shriek violently and swing furiously about the ropes; then return and endeavour to obtain it; if again refused,

he would roll for some time like an angry child upon the deck, uttering the most piercing screams; and then suddenly starting up, rush furiously over the side of the ship, and disappear. On first witnessing this act, we thought that he had thrown himself into the sea; but on a search being made, found him concealed under the chains.

I have seen him exhibit violent alarm on two occasions only, when he appeared to seek for safety in gaining as high an elevation as possible. On seeing eight large turtle brought on board, whilst the Cæsar was off the Island of Ascension, he climbed with all possible speed to a higher part of the ship than he had ever before reached; and looking down upon them, projected his long lips into the form of a hog's snout, uttering at the same time a sound which might be described as between the croaking of a frog and the grunting of a pig. After some time he ventured to descend, but with great caution, peeping continually at the turtle, but could not be induced to approach within many yards of them. He ran to the same height and uttered the same sounds on seeing some men bathing and splashing in the sea; and since his arrival in England, has shown nearly the same degree of fear at the sight of a live tortoise.

Such were the actions of this animal, as far as they fell under my notice during our voyage from Java; and they seem to include most of those which have been related of the orang-outang by other observers. I cannot find, since his arrival in England, that he has learnt to perform more than two feats which he did not practise on board ship, although his education has been by no means neglected. One of these is to walk upright, or rather on his feet, unsupported by his hands; the other, to kiss his keeper. I have before remarked with how much difficulty he accomplishes the first, and may add, that a well-trained dancing dog would far surpass him in the imitation of the human posture. I believe that all the figures given of orang-outangs in an unpropped erect posture, are wholly unnatural. Some writer states, that an orang-outang which he describes gave "real kisses;"

and so words his statement, that the reader supposes them the natural act of the animal. This is certainly not the case with the orang-outang which I have described. He imitates the act of kissing by projecting his lips against the face of his keeper, but gives them no impulse. He never attempted this action on board ship, but has been taught it by those who now have him in charge.

I shall enter into no speculation respecting his intellectual powers, compared with those of men; but leave the foregoing account of his actions as a simple record of facts, that may be used by other observers to estimate the rank which he holds in the scale of sagacity. In the Appendix I have made a few observations on the histories given of the orang-outang by different writers.

After leaving Ascension, a favourable wind carried us rapidly to the end of our voyage. We made the Scilly Rocks on the afternoon of the 15th, and the several head-lands of the channel on the following day. Towards the evening the weather becoming hazy, and no pilot appearing, it was deemed unsafe to attempt reaching the anchorage at Spithead before the next morning. During the night the wind suddenly shifted two points, and blew fresh from the westward, and soon increased to a gale that shivered our mainsail and main-top sail, and carried away our mizen topsail yard. At daylight, we found ourselves about ten miles to windward of the Isle of Wight; and being soon after boarded by a pilot, we anchored by eight o'clock at Spithead, and by ten were safely landed on our native shores.

APPENDIX.

The Author trusts that the Table of the Contents of the Appendix in the next page will secure the Reader against any inconvenience arising from their not entirely coinciding with the references given in the text.

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APPENDIX.—A

ADDITIONAL NOTES.

Page 19. — *Ipecacuanha Plants.*

Believing that I may tend to prevent the Ipecacuanha plant of the Brazils from being again confounded with the Ipecacuanha plant of New Spain, by contrasting their descriptions, I shall annex Brotero's description of the former plant, as contained in the 6th volume of the Linnæan Transactions, and a description of the latter formed from that of Mutis, as given by Linnæus in Supplem. Plant. p. 144.; and from one lately published by Humboldt and Bonpland in Plantes Equinoxiales. Livraison 16. p. 142.

Callicocca Ipecacuanha of Brotero : (Ipecacuanha Plant of the Brazils.)

Callicocca caule ascendente, suffruticoso, sarmentoso; foliis ovatis lanceolatis, inferne subpubescentibus, capitulo terminali, pedunculato; involucro tetraphyllo, foliolis subcordatis; corollis quinquefidis.

Radix perennis, simplex aut subramosa, subteres, sæpius perpendicularis, raro leviter obliqua; duas, tres, quatuorve uncias et ultra longa; supernè gracilior, crassitudine et similitudine caulis, sæpius hic illicve brevibus radiculis instructa (quarum una alterave interdum crassescit;) infernè duas tresve lineas crassa, vagè flexa, extus fusca, subannulata, annulis prominentibus, inæqualibus, subrugosis; sapore acri, amaro, odore vix ullo, nisi herbaceo. Dum sicca, cortex crassa, dura, fragilis, extus bruna, intus albicans, gomoso-resinosa, filo percursa lignosa, æquali, albo, ferè insipido,

mucilagineo, a quo facilè in plures annulos fissa contiguos et inæquales, fissuris lævibus, separatur ; sapore primum farinaceo, postea subamaro, subacri, et semper minus acri quàm in statu viridi, seu vivo ; odore vix ullo, sed cum mortario contunditur tenuis ejus pulvis subnaseoso nares odore afficit et usque ad sternutamentum stimulat.

Caulis suffruticosus, ex procumbente erectus, ad basin, qua procumbit, interdum repens, teres crassitudine pennæ gallinaceæ, quinque ad novem uncias altus, infernè glaber, efoliatus, fuscus, nodosus (uti a foliorum casu cicatrices,) internodiis sursum versus apicem indies decrescentibus, ibique villosus, viridis foliatus, in primis plantæ annis simplicissimus aut simplex, postea sarmentosus, sarmentis perpaucis efoliatis, subtortuosis procumbentibus, plus minusve dodrantalibus, nodosis, ad nodas vage radicantibus, ibique unicum alterumve novum caulem, a primo aut alio semipedem et ultra dissitum, producentibus.

Folia inferiora caduca, ita ut in planta florescentia 4, 6, aut 8 solum, rarissime plura, ad apicem caulis persistant ; opposita patentia, ovato-lanceolata, nonnulla interdum ferè obovata, tres ad quatuor uncias longa, unam ad duas fere lata, integerrima ; supernè saturata viridia, punctis scabriusculis aspersa, glabra, rarò vagè subpubescentia, costâ parum elevatâ, venis, lateralibus alternis, subparellelis, ad apicem curvatis : petiolus folii laminâ bevior, 2, 3 — ve lineas longus, canaliculatus, subvillosus.

Stipulæ geminæ, laterifoliæ, appressæ, sessiles sublineares, partito fimbriatæ, lacinulis subulatis, petiolis leviter adnatæ, illorum longitudine aut vix longiores, cum ipsis caulem subvaginantes, marcescentes.

Flores aggregati in capitulum solitarium, subnutans, caulem terminans, pedunculatum ; pedunculo tereti, pubescenti, petiolis longiore, plus minusve semiunciam alto : flosculi sessiles, 15 ad 24 bracteolis distincti ; bracteolæ involucri et flosculorum longitudini, pubescentes, integerrimæ, sessiles virides, formâ sæpe variantes, nunc subovatæ oblongiusculæ, nunc lanceolatæ obtusiusculæ, nunc (quod rarius) forma et magnitudine involucri foliolis similes, et tunc flosculi ipsis numerosiores.

Involucrum tetraphyllum ; folioli subcordati, acuti, integerrimi, subsessiles, leviter undati, hirsuti ; duo externi majores, omnes flosculis paulo longiores.

Cal. Perianthum membranaceum, albidum, brevissimum, quinque-dentatum, dentibus obtusis, superum, persistens.

Cor. Monopetala : tubus cylindraceus, longus, suprà parùm ampliatus,