



Philosophical Magazine Series 1

ISSN: 1941-5796 (Print) 1941-580X (Online) Journal homepage: <http://www.tandfonline.com/loi/tphm12>

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M. Peron

To cite this article: M. Peron (1805) XXIV. Memoir on some zoological facts applicable to the theory of the earth. Read in the physical and mathematical class of the French National Institute on the 22d of October 1804, Philosophical Magazine Series 1, 22:86, 155-166, DOI: [10.1080/14786440508676761](https://doi.org/10.1080/14786440508676761)

To link to this article: <http://dx.doi.org/10.1080/14786440508676761>



Published online: 18 May 2009.



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conducting such labours may determine the production of very different substances.

In short, it seems probable that some of those substances which in the present state of our knowledge we are obliged to consider as the most simple elements, such as oxygen, hydrogen, and azote, are, in fact, compounds; and if so, the formation of one or more of these may take place under circumstances in which we should not expect them to be present, and may produce such results as those now under consideration.

This subject is extremely interesting, and we hope Mr. Peel and other philosophers will continue to give it that attention which its importance seems to demand.—A. T.

XXIV. *Memoir on some zoological Facts applicable to the Theory of the Earth. Read in the Physical and Mathematical Class of the French National Institute on the 22d of October 1804. By M. PERON, Naturalist to the Expedition for making Discoveries in Australasia*.*

————— Colles exire videntur;
Surget humus; crescent loca, decrescentibus undis.
Ovid. Met. lib. i. ver. 342.

IF excursions confined to the countries of Europe can furnish matter for so many useful works and for so many valuable comparisons, and if slight differences in the physical constitution of the soil, in its temperature, and in its productions, could give rise in all ages to grand ideas and important theories, how fertile in the most valuable results of every kind must be distant navigations!

The traveller in voyages of this kind, transported, as we may say, on the wings of the wind, traverses in a few months the most different climates; distances vanish, and small differences disappear along with them. The large masses alone can strike him; and they are every where reproduced with an opposition, and contrasts so great and so numerous, that the coldest imagination cannot fail to be interested in such a spectacle. In one place, the summit of the Peak of Teneriffe, which has been rendered celebrated by the valuable researches of M. Humboldt, seems to unfold before him the history of the grand catastrophes of nature, and of their effects; while in another he sees rising at

* From the *Journal de Physique*, Frimaire, an 13.

he extremities of the Austral world those bulwarks of granite which she seems desirous of opposing to the fury of the boundless ocean. He soon arrives on the barren coasts of the west and north-west side of New Holland, where the phænomenon of the acquisitions made by the land presents itself with all the interest of which it is susceptible. In vain does he pass along coasts of two or three hundred leagues in extent; he every where observes eternal downs of white sand, which extend into the country as far as one can penetrate. The numerous islands he meets with exhibit to him a similar constitution; and the banks of sand, so frequent in these dangerous seas, have no other. But the fertile mountains of Timor already begin to appear; an eternal vegetation every where covers them with its rich productions: they are continued in large gradations, which rise more and more towards the interior of the land. Every thing is new in its aspect: he no longer sees those lacerated forms, those blackened peaks, and those threatening craters of Teneriffe, and of the Isles of France and of Bourbon; those striking and majestic masses of South Cape, Cape Pelé, and Cape Frederick-Henderick in Van Diemen's Land; much less that monotonous and tiresome aspect of the sandy coasts of New Holland. None of these pictures are applicable to the mountains of Timor. Their forms, though large, are softened; their prolongations are regular; their summits are broad, and sink down gradually by slight undulations, which disappear on the sea shore: in a word, every thing announces here the tranquillity of the tropics, and the peaceful action of nature and of time.

Amidst objects so grand, with terms of comparison so prodigious, the study of nature then more striking, is also more easy: all the petty objects of detail, the modern effects of a multitude of secondary causes, disappear, as we may say, before the grand ensemble of nature, and cease to occupy in our annals the too important part which they have been so many times made to perform. But we may safely affirm, that we shall have no real theory of the earth till the glorious period when the sciences can reckon among their votaries men desirous of emulating Humboldt. What he has done in regard to America ought to be done in regard to many distant countries and so many archipelagos still unknown. At the head of the latter appears New Holland, an immense country, hitherto little explored, but worthy of the attention of the governments much more than the naturalists of Europe.

SECTION I.

Zoological Observations which may excite Doubts in regard to the primitive Union of New Holland and Van Diemen's Land.

Of all the observations which may be made in proceeding from Van Diemen's Land to New Holland, the easiest, no doubt the most important, and perhaps also the most inexplicable, is, the absolute difference of the two races who inhabit these two lands. If we except, indeed, the meagreness of the extremities, which is observed equally among both people, they have scarcely any thing common in their manners and customs, in their rude arts, in their implements for hunting or fishing, in their habitations or piroguas, in their arms or language, in the whole of their physical constitution, in the form of the cranium, or in the proportions of the face. This absolute dissimilarity appears also in the colour: the inhabitants of Van Diemen's Land being browner than those of New Holland; it appears also in a character hitherto considered as exclusive, namely, the nature of the hair. That of the inhabitants of Van Diemen's Land is short, woolly, and curled; that of the New Hollanders straight, lank, and stiff.

Now how can it be conceived that an island of 60 leagues in extent at most, so near to an immense continent, situated also at the extremities of the Austral world, and separated from every other known land by the enormous distances of five, eight, twelve, and even fifteen hundred leagues, should have a race of men altogether different from that of the neighbouring continent? How can we conceive this exclusion of all relation, so contrary to our ideas in regard to the communication and transmigration of nations? How can we account for the darker colour, and curled woolly hair, in a country much colder? It appears to me difficult, I confess, to assign a satisfactory reason for these anomalies. All these curious facts, which will be detailed in the general account of our long voyage, will be new proofs of the imperfection of our theories, which are always suited to the state of the knowledge of the age which gave birth to them. At present I must be contented with deducing from this first part of my observations the important consequence, that the separation of Van Diemen's Land from New Holland is not one of the modern operations of nature; for it is probable that if these two countries had been formerly joined they would have had the same race for inhabitants, and it would no doubt have been that which occupies,

occupies, with its ferocious tribes, the whole of the immense coasts of New Holland, from Cape Wilson to the burning coasts of the land of Arnheim and the great gulf of Carpentaria.

Another zoological fact tends still further to confirm this distinction, if not primitive at least very old, between New Holland and Van Diemen's Land. The dog, that animal so valuable to man, the faithful companion of his misfortunes, his travels, and dangers, the indefatigable instrument of his distant hunting excursions, every where so common on the continent, and which we found on all its coasts with the different hordes we had an opportunity of seeing, does not exist in Van Diemen's Land; at least we could observe no traces of this animal. We never saw any of them with the inhabitants, notwithstanding our daily intercourse with them. The case was the same with M. Labillardiere during Dentrecaesteaux's voyage; and it does not appear that any other traveller ever saw any. The English whale fishers, whom I consulted on the subject, confirmed this circumstance, that the dog is not found in Van Diemen's Land.

SECTION II.

Zoological Observations which seem to indicate that the Summits of the Mountains of Van Diemen's Land, New Holland, and Timor, were formerly covered by the Sea.

One of the noblest and at the same time most incontestable results of modern geological researches is, the certainty of the sea having once stood at very considerable elevations above its present level. In almost every point of the old continent the proofs of this fact are as numerous as they are evident. They appear with interest in different parts of the new world; and M. Humboldt has lately communicated to us a very curious circumstance of this kind. In this point of view, as well as in many others, New Holland and Van Diemen's Land remained to be examined; as they might have formed an exception of sufficient importance to induce a very rigorous philosopher to deny the universality of the ancient domination of the ocean, however favourable reasoning and analogy might be to it. Fortunately this deficiency was one of those which, depending only on the existence of a fact, could be easily supplied: it appears to me that it is completely so at present. On Van Diemen's Land indeed, on several points of New Holland, and on the summits of the mountains of Timor, I every where met with those valuable remains, which may be considered as irrefragable testimonies of the revolutions of nature.

In the rapid view which I am going to take of my results in this respect, I shall treat in succession of what relates to fossil shells and zoophites. One of the principal reasons of this distinction, the importance of which I shall soon have occasion to prove, is the almost absolute exclusion of every large kind of solid zoophites after the 34th degree of south latitude, beyond which I observed only the difficult and orbicole tribes of the sponges, the alcyons, flustres, and some millepores.

A. Petrified Shells.

It would be too tedious and useless to enter here into the details of all my observations on this subject: it will be sufficient for me to give an account only of the principal results.

At Van Diemen's Land, towards the bottom of the North River, I observed, at the height of six or seven hundred feet above the level of the sea, large masses of petrified shells, all belonging to the *lime* genus of Lamarck, and constituting a species to which I could find none living analogous in the same places.

On several points of the east coast of the island Maria there are seen regular horizontal strata, consisting of a kind of whitish shelly freestone resting on granitic rocks, at the height of four or five hundred feet above the level of the sea.

At Kangaroo Island, those of St. Peter and St. Francis, and that portion of the continent situated behind them, I made similar observations: I found always some remains of petrified shells, at a greater or less distance, in the interior of the country, and at heights more or less considerable.

Vancouver and Mainzies had before observed some in Port King George, and in that point also I myself collected several specimens.

During the interesting excursion which my friend M. Bailly made into the interior of New Holland, ascending Swan's River for about twenty leagues, he found every where, as he told me, the ground covered with quartzý sand mixed with the remains of shells.

At the Bay of Seals this phænomenon occurs with more decisive characters. The whole substance of the barren isles of Dorré and that of Dirk-Hartog consist of freestone, sometimes reddish and sometimes whitish, filled with shells of different kinds.

This composition becomes still more striking at Timor.

On the summit of those mountains, already mentioned; there is found, at the height of more than 15 or 1800 feet above the level of the sea, a great number of shells incrustated in the middle of the madreporic masses which they form. The most of these shells are in the siliceous state: some of them, still in the calcareous state, are more or less altered and friable. There are some monstrous ones among them. I have seen several individuals, and every person belonging to the expedition might have seen them also, which were not less than four or five feet in length. All these large shells evidently belonged to the genera *hippope* and *tridacne* of Lamarck; and, what is more important, the fossil individuals have such a resemblance to those of the same genus found alive on the sea shore at the bottom of the mountains, that I have thought proper to consider them as the same in my General Topography of the Bay of Coupang. Even the gigantic proportions of the fossil *tridacnes* are found in the living ones. I myself saw a valve which served daily as a trough to five or six hogs. In the Dutch fort there is another in which the soldiers of the garrison wash their linen. The absolute want of colour, common to the fossil and living *tridacnes*, is another reason for their identity. The case was the same with several kinds of zoophites, which, existing still on the coasts, seem to be so identic with some of those forming the mountains of that part of the island, that I made no hesitation in considering them as such. Since my return to Europe, however, having had occasion, in examining the beautiful collection of M. DeFrance, to remark how easy it is to be mistaken in this respect, I must freely confess that I can no longer venture to warrant this identity, however probable it may appear, as my observations were not made with that minute attention which the subject deserves, and as whole specimens are not to be found in our collections. While I regret that I suffered so valuable an observation to escape me, I must mark Timor as the place most proper for determining the delicate and interesting question in regard to analogous living individuals, at least in the last classes of the animal kingdom.

Before I terminate what relates to petrified shells, it seems to me indispensably necessary to say a word of incrustated shells, which are too often confounded with the former.

B. Of Incrustations of different Kinds, and particularly the incrustated Shells found in different Parts of New Holland.

One of the particular advantages of extensive navigations and long voyages is, that the theatre of observation is so much varied, and objects so multiplied, that nothing is often wanting but a sound judgment to make the most difficult comparisons, and to deduce from them important consequences. What man, for example, can see, with indifference, around him that succession of beautiful incrustations so frequent on the shores of Kangaroo Island, on those of the Archipelago, of St. Peter and St. Francis, and on the shores of the immense Bay of Seals? In one place whole trunks of shrubs are entirely covered with a mixed stratum of freestone and calcareous matter, and in others are accumulated branches of trees, roots, shells, zoophites, the bones of animals, and excrements of quadrupeds, concealed under the same covering. "One might be tempted to believe," said the unfortunate Riche, "that a new Perseus carried the head of Medusa over these distant coasts."

On the sight of so many striking singularities, how can we forbear inquiring into the cause, and how is it possible that it should not be discovered in the particular nature of the sand on these shores? The numerous shells, indeed, produced in these seas being continually rolled by the action of the waves on the neighbouring shore, are thus reduced to very small fragments, which being afterwards mixed with the quartz sand, soon form with it a calcareous cement of a superior quality. In carefully examining its materials one might be tempted to believe that Dr. Higgins, in his ingenious Essay on Calcareous Cements, had stolen the secret of nature. The proportions, indeed, which he indicates as susceptible of forming the most solid combination, that is, one part of lime and seven of quartz sand, are those which nature seems to have adopted for her cement. But whatever this composition may be, it is the only agent of those remarkable incrustations of which I have spoken. On the shore it soon incrusts every body thrown upon it; testacea, zoophites, galets, are all agglutinated by it. The observer sees, as we say, formed before his eyes, the breches and puddingstones of which the neighbouring rocks are composed. Transported by the winds, this active matter deposits itself on the nearest shrubs. At first it is only a light kind of dust, which soon becomes solid around the stem which it embraces. From that mo-

ment the mode of the nutrition of the vegetable becomes changed; it soon languishes, and, though still alive, it seems to have undergone a kind of general petrification. I have brought home a great many fine specimens of this sort, and the difficulty of transporting them alone prevented me from bringing back a more considerable number.

What is most singular in this operation of nature is, the speed with which this kind of metamorphosis is effected. I have reason, indeed, to believe, from my own observations, that a shell, a month after its being cast on the shore, can no longer be distinguished. The force of the solar rays, the vivacity of the light reflected by the white sand of the coast, are sufficient in a few days, with the sea water, to deprive it of its colour, and to disorganize it in such a manner, that in the middle of the calcareous stratum which has already seized it, the most experienced eye might mistake it, and range it in the class of the oldest petrified shells. One may judge of these alterations by the different specimens—how easily this mistake may be committed, and how impossible it would be to assign to the most of these shells a character proper to distinguish them from real fossils.

C. Of Zoophites observed at great Heights above the present Level of the Sea.

I have now concluded what relates to petrified shells, or those merely incrustated: it is seen, that from the most southern extremity of the eastern hemisphere to the middle of the equatorial regions they are found in greater or less numbers, and at greater or less heights. The case is not the same with solid zoophites: as already said, I could not find large species beyond the 34th degree of south latitude; and it does not appear that any other traveller observed any considerable number of these animals beyond the same point, either in the northern or the southern hemisphere. Driven, as we may say, from the one extremity of the world to the other, it is in the bosom of the warmest seas that this innumerable family of animals seem to have fixed their habitation and their empire: it is the latter zone in particular which gives birth exclusively to those formidable reefs, those numerous islands, those vast archipelagos, prodigious monuments of their power. All the Society Isles, Maitea, Tongataboo, Eona, Anamooka, Turtle Island in the Pacific Ocean, New Caledonia, Chain Islands, Tethuroa, Tioukea, Palliser's Isles, Tupai, Moopehea, the Isle of Cocos and that of Pines, Norfolk Island, How's Island, Palmerston Isles, several of the New Hebrides, Mallicolo, the

the archipelago of the Low Friendly Isles, Bougainville's Island, several points of New Guinea, all the islands scattered on the eastern side of New Holland, and in particular the formidable labyrinth which had like to have proved so fatal to the vessels of Bougainville and captain Cook; in a word, almost all those innumerable islands dispersed throughout the great equinoctial ocean, seem some of them entirely, and others only in part, to be the work of these feeble animals. The accounts of all the navigators who have traversed these seas are filled with expressions of the terror inspired by their labours. All of them, almost, were exposed to the greatest dangers in the midst of the reefs which they raise up from the bottom of the ocean to its surface, and no doubt the unfortunate navigator, the loss of whom France as well as all Europe deplores, was one of their numerous victims. . . .

"The danger they present," says M. Labillardiere with great reason, "is the more to be apprehended as they form rugged rocks covered by the waves, and which cannot be perceived but at very short distances. If a calm comes on, and the ship is driven towards them by a current, her loss is almost inevitable: in vain would the crew attempt to save her by dropping their anchor; it would not reach the bottom even quite close to these walls of coral, which rise in a perpendicular direction from the bottom of the waters. These polypiers, the continual increase of which obstructs more and more the basin of the seas, are capable of frightening navigators; and many shallows, which at present afford a passage, will soon form shoals exceedingly dangerous."

Though less common in the seas which we traversed, these animals furnished me nevertheless with subject of observations the more valuable, as the general consequences deduced from them may be applied with more interest and more evidence to the history of the revolutions of our planet.

Thus, as I have said, from the 44th to the 34th degree south, no large species of solid zoophytes are found. It is at Port King George, in Nuyts Land, that these animals appear, for the first time, with those grand characters which they affect in the midst of the equinoctial regions. My particular observations, indeed, are reduced in this point to mere fragments, found here and there in the interior parts of the earth. The case is not the same with those of Mainzies and Vancouver. The details, for which we are indebted to these navigators, are too valuable of themselves, and particularly

ticularly on account of the consequences with which they will furnish us, that I cannot here forbear transcribing what Vancouver has said on the subject.

“The country,” says he, “is formed chiefly of coral, and it seems that its elevation above the level of the sea is of modern date; for not only the shores and banks which extend along the coast are in general composed of coral, since our lead always brought up some of it, but it was found also on the highest hills we ascended, and in particular on the summit of Bald Head, which is at such a height above the level of the sea, that it is seen at the distance of twelve or fourteen leagues. The coral here was in its primitive state, and especially on a level field of about eight acres, which did not produce the least blade of grass amidst the white sand with which it was covered, but from which arose branches of coral exactly similar to those exhibited by beds of the same substance above the surface of the sea, with ramifications of different sizes, some half an inch at least, and others four or five inches in circumference. Many of these coral fields, if I may use that expression, are to be met with: a large quantity of sea shells, some perfect and still adhering to the coral, and others at different degrees of dissolution, are observed in them. The coral itself was more or less friable; the extremity of the branches, some of which rose more than four feet above the sand, was easily reduced to powder. In regard to the parts which were near or below the surface, a certain degree of force was necessary to detach them from the foundation of rock from which they seemed to arise. I have seen coral in many places at a considerable distance from the sea, but I never saw it any where else so high and so perfect*.”

This, no doubt, is one of the most curious facts of this kind, as well as one of the most important to be verified and to be examined. Will it now be believed that the two vessels belonging to our expedition, the *Geographe* and the *Casuarina*, remained for nearly a month at anchor in Port King George, at the foot, as we may say, of this Bald Head, so valuable to be visited, without any of the three naturalists, who still remained on board these vessels, being permitted to go thither?

Fortunately the large island of Timor presented a field still wider and more striking for observations on zoophytes. There every thing attests their power, and the revolutions effected by them in nature. They are found on the summits

* Vancouver's Voyage, vol. i.

of the highest mountains of Coupang, and they are easily distinguished: in the deepest caverns, and the widest fissures, they present a tissue, the characters of which cannot escape notice. In the excursion, so painful and so laborious, undertaken by me and my friend Lesueur, to hunt crocodiles at Olinama, we every where observed the same composition; at Oba, Lassiana, Meniki, Noebaki, Oebello, and Olinama. At the last-mentioned point we found ourselves opposite to the grand chain of mountains of Annafoa and Fatelou, the back of which is uninhabitable on account of the prodigious number of crocodiles which live in the marshes of that part of the coast. This broad plateau, which commands all that portion of Timor, is entirely composed of madreporic matters. From Oëana to Pacoula the whole country, according to the inhabitants, is limestone; and this is unanimously confirmed by the Dutch.

It is not only in this state of death and inactivity that the zoophytes of Timor ought to excite admiration and interest: they encumber, in the living state, the bottom of the sea, every where in the Bay of Babao they raise up reefs and islands. Turtle Island (*Rea Poulou*), Birds Island (*Bourou Poulou*), and Monkey Island (*Codé Poulou*), are exclusively their work. Long narrow reefs, which proceed from Point Simao, confine more and more the entrance of the bay in that quarter. They render inaccessible the coasts of Fatoumé and Soulama, and promote the increase of the land gained from the sea in all these points. On the coast of Osapa one may already, at low water, advance to the distance of more than three-fourths of a league on the shore abandoned by the waves: it is there that, with a mixture of astonishment and admiration, one may enjoy at ease the wonderful spectacle of thousands of these animals incessantly employed in the formation of the rocks on which one advances. All the genera are assembled at the same time at the feet of the observer; they press around him; their singular and fantastical forms, the different modifications of their colours, and those of their organization and their structure, attract, in turn, his attention and meditations; and when, provided with a good magnifying glass, he contemplates these beings, so weak he can scarcely conceive how nature, by means so small in appearance, should be able to raise up from the bottom of the sea those vast ridges of mountains which are continued over the face of the island, and which seem to form almost its whole substance. At Timor it would be easy to make a long series of observations on these interesting animals: the profound

calmness of the sea, its high temperature, the nature of the shore, on which one may advance at low water, as already mentioned, to a very great distance, having the water scarcely up to the knee; the great abundance of these animals, and their variety, are all favourable to researches of this kind: they may be observed, described, and drawn in their natural state, as the water does not rise above them to the height of more than a few centimetres, or sometimes only millimetres; they may be seen in their state of contraction or extreme development; one may observe, also, their progressive increase, and its boundaries: in a word, there can be no doubt that a labour of this kind, undertaken by one or more enlightened naturalists, would contribute, in the most effectual manner, to the advancement of this part of natural history so little known, and which deserves so much to be carefully examined.

[To be continued.]

XXV. *Short Account of the Life of the late*
Dr. PRIESTLEY.

JOSEPH PRIESTLEY, LL.D. F.R.S. and member of many foreign literary societies, was born at Field Head, near Leeds, in Yorkshire, on March 13, old style, in the year 1733. His mother died when he was very young; and his father, who was engaged in the cloth manufactory, marrying again, and having a large family, Joseph, when eight years of age, was taken into the house of a near relation, a lady eminent for piety and benevolence, who adopted and educated him as her own son.

He acquired the rudiments of the Latin and Greek languages under the instruction of Mr. Hague, a respectable clergyman, master of a free grammar school in the neighbourhood, and during the vacations he applied to the study of the Hebrew, Chaldee, and other oriental languages. By the assistance of Mr. Haggerston, who had been a pupil of the celebrated Maclaurin, he made a considerable proficiency in geometry, both speculative and practical algebra, and natural philosophy. He acquired also some skill in modern languages, in order to qualify himself for a merchant's counting-house, the delicacy of his constitution rendering it at one time doubtful whether he would be able to pursue his studies for a learned profession.

In his nineteenth year he entered as a student of divinity

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