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XXI.—Moas and Moa- hunters

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pidae) or to the Shrews (Soricidæ), and no zoologist has ever suggested the union of these families. The supposed close relationship depends therefore on faulty estimation of the natural affinities of these animals.

Two species of bats, *Vesperugo noctivagans* and *Atalapha cinerea*, inhabit the Bermudas, while one only, *Vesperugo Leisleri*, is known in the Azores, and its presence there is less remarkable, seeing that the latter islands are distant about 550 miles from Madeira, where this species is also found, while the former are nearly 700 miles from the American coast. The presence of these animals in both groups of islands has been attributed to violent storms; and it is worthy of notice, as tending to bear out the correctness of this theory, that the Azorean species resembles the American species inhabiting the Bermudas in the robustness of its bodily structure and in the hairiness of its wing and interfemoral membranes—qualities which would endow the animals possessing them with greater powers of resisting fatigue and of enduring the chilling effects of high winds at probably a great elevation.

XXI.—*Moas and Moa-hunters.* By A. DE QUATREFAGES.

[Concluded from page 141.]

IV.

AT the same time that he clearly distinguished the *Moa-hunters* from the *Maoris*, Dr. Haast asserted that the former confined themselves to roughly chipping their stone implements, while the latter knew how to give them a polish, of which we can judge from numerous specimens*. He added that the Moa-hunters did not possess weapons in nephrite, that is to say, fabricated out of a kind of stone often confounded with jade, to which the islanders found in New Zealand by European navigators attached a special value†.

These two propositions were of very great importance in connexion with the theory maintained by the New-Zealand naturalist. They tended to establish a further agreement with what took place in Europe. It is well known that the *chipped hache* and the *polished hache* are among the characteristic traits which, among us, distinguish two epochs. It is also well known that the populations of these two epochs belonged

* Sixth proposition, p. 140.

† Second proposition, p. 140.

to different races, and that the one which was more advanced in civilization attacked and conquered that which preceded it. To find in New Zealand our two Palæolithic and Neolithic ages, characterized in the same way by instruments indicating a difference in social condition, was to introduce an important argument in favour of the ethnological distinctness of the Moa-hunters and the Maoris. But, by excavations in the Sumner cave and the neighbouring dunes, Dr. Haast himself discovered, at various times, fragments of haches and other instruments perfectly polished; and further, some uninjured specimens, similar in every respect to those which are known to be the work of the Maoris. Among these objects some were in nephrite. All of them were found under conditions which attested their contemporaneity with the men who hunted and ate the great brevipennate birds. I shall only cite a hache which was placed immediately beneath the stones forming an oven which had served for cooking Moas*. In presence of these material proofs, furnished by himself, Dr. Haast, with the most honourable candour, did not hesitate to admit that the Moa-hunters had attained a degree of civilization equal to that presented by the Maoris when Europeans first visited New Zealand†.

It is, I think, permissible to think that this equality of social development, manifested by similar characteristic industries, ought to have inspired Dr. Haast with some doubts as to the soundness of his theory. Nevertheless he has not given up any of his general ideas. He has persisted in denying the ethnical identity of the Moa-hunters and the Maoris, and in throwing back the epoch of the destruction of the Moas into a past time which he seems to regard as geological‡.

I find no one except Mr. Colenso who has accepted this doctrine as absolute§. I have already stated that Mr. Stack

* "Researches in Sumner Moa-Cave" ('Transactions' &c. vol. vii. p. 77).

† *Ibid.* p. 80. Before Dr. Haast had given up this particular point, numerous discoveries of instruments and weapons in polished stone mixed with remains of Moas had been made in many places. I have already stated how Dr. Haast had endeavoured to explain or interpret facts of this nature, and I need not revert to this matter. The loyal and distinct declaration of the eminent geologist frees me from the necessity of entering here into any details.

‡ Haast, 'Geology of the Provinces of Canterbury and Westland, New Zealand.' See especially the thirteen propositions formulated at p. 430, and chap. xvi. (c) p. 437.

§ "An Account of some enormous Fossil Bones of an unknown Species of the Class Aves, lately discovered in New Zealand," in *Ann. & Mag. Nat. Hist.*, 1844.

refuses to admit a very great antiquity for the destruction of the Moas. He also recognizes that the Maori traditions contain some allusions to these birds. In his childhood he heard talk of Moa-feathers found upon a rock where the last of these Brevipennes had concealed itself. However, he also thinks that this may perhaps have referred to feathers of Cassowaries brought to New Zealand by the ancestors of the Maoris*. We see that Mr. Stack does not regard the latter as descendants of the autochthonous Moa-hunters supposed by Dr. Haast.

Upon this latter point, moreover, the ideas of the New-Zealand geologist do not appear to be by any means fixed. I have reproduced above the terms employed by him in the conclusion of his third memoir, and have cursorily indicated how vague and contradictory they are, notwithstanding their apparent precision†. In another memoir he expresses a very different idea, and regards the Melanesian negroes as having preceded the Maoris in New Zealand, and ascribes to them the extermination of the Moas‡. Moreover, in support of his new opinion he invokes only those very traditions which we have seen him reject in the most formal manner. Still, he only knows them from the Rev. Richard Taylor's book. It is from this that he borrows a quotation from Sir George Grey, whose classical work§ he does not seem to have read. Lastly, in his geology of the province of Canterbury, he formally adopts Mr. Colenso's views, and repeatedly speaks of the predecessors of the Maoris as *autochthonous* inhabitants who lived in the Quaternary epoch. At the same time he supposes that these children of the soil of New Zealand had more or less close affinities with the Melanesians||.

I have too often contended against this old idea of autochthonism, to render it necessary for me to revert to it here. But this conception being got rid of, I am glad to agree with Dr. Haast. The opinions maintained by the learned geologist as to the existence of two races inhabiting New Zealand before the arrival of Europeans, and as to the nature of those

* "Notes on Moas and Moa-hunters" ('Transactions' &c. vol. iv. p. 108).

† See the notes at foot of p. 140.

‡ "Notes on an Ancient Native Burial-place" ('Transactions' &c. vol. vii. p. 91). Dr. Haast has subsequently insisted upon this idea, and sought to show, by what takes place in Australia, that very inferior black tribes may very well know the processes of polishing stone ('Geology of the Provinces of Canterbury and Westland,' chap. xvi. p. 411).

§ Polynesian Mythology.

|| 'Geology,' &c., first proposition, p. 430.

two races, are perfectly well founded. Melanesian negroes really occupied New Zealand before the Maoris. Upon this point craniological investigations have confirmed what I wrote eleven years before the publication of Dr. Haast's memoir*. But this ethnical duality of the New-Zealand populations by no means implies as its consequence the destruction of the Moas by the first occupants. In Europe the Palæolithic men did not exterminate the reindeer and the chamois, nor even the urus.

To support his views and to throw back the extinction of the Moas to a past which, he says, cannot be calculated even by centuries †, Dr. Haast no less invokes the results of his excavations in the Sumner cave. He describes it as containing two layers, which, according to him, were distinctly separated. In the lower one were found ovens and numerous Moa-bones; this was formed of the remains of the repasts of the Melanesians. The upper layer, he states, presented only the shells of various Mollusca, formerly eaten by other natives who were the forefathers of the existing Maoris. Mr. MacKay, a member of the Geological Survey, who assisted Dr. Haast in his researches, has also published a note, in which he puts forward nearly the same opinions as his chief‡.

But the clearly marked distinction, upon which MM. Haast and MacKay insist, does not occur elsewhere. At several points a mixture of shells and Moa-bones has been met with. And, further, the locality first investigated by those geologists was afterwards explored by Capt. Hutton and Mr. Booth, both of them familiar by long practice with researches of this kind. Now the facts ascertained by them contradict formally and upon several points the statements of the first explorers. Among other things, MM. Hutton and Booth most frequently found the Moa-bones associated with beds of shells; and they

* A. de Quatrefages, "Les Polynésiens et leurs Migrations" ('Revue des Deux-Mondes,' February 1864). These articles, enlarged and furnished with notes and with four maps, were afterwards collected into a volume, which appeared under the same title.

A. de Quatrefages and E. Hamy, 'Crassia ethnica,' p. 291. Among other evidences of the presence of two races in New Zealand, the Museum possesses a dried head of a Maori chief, the tattooing of which attests its origin, while the hair is purely Melanesian. I have had this engraved in a book, of which I have already spoken ('Hommes fossiles et hommes sauvages,' pp. 486, 487, figs. 171, 172).

† *Loc. cit.* ('Transactions' &c. vol. vii. p. 81).

‡ "On the Identity of the Moa-hunters with the present Maori Race" ('Transactions' &c. vol. vii. p. 98).

have further ascertained that the beds with and without bones were often differently superimposed*.

The increasing rarity of the Moas at a given point, the movements of the population which must often have been the consequence of it, the accidental association of the two kinds of food in the same repast, and the necessity of having recourse to a diet previously disdained, explain in the simplest manner the difference in the results furnished by excavations made at very adjacent points by equally competent observers. But we see that in their totality these results are irreconcilable with the interpretations of Dr. Haast.

V.

Among the propositions that Dr. Haast has sustained, those relating to the history of the dog must detain us for a time. We have seen that, in his third memoir, he admits the existence of a wild dog contemporaneously with the Moas, and absolutely denies that the Moa-hunters had domestic dogs†. Upon this latter point the New-Zealand naturalist is far from being in accord with himself. In his first researches he had found only a few bones of the dog among the remains of feasts, and he explained this scarcity by saying that this animal was only exceptionally eaten when its owner was short of provisions‡. Here, then, he accepted the notion that the domestication of the dog was practised by the Moa-hunters. It is true, he added, that perhaps also it was killed in the chase, which supposes that the animal lived in the wild state, and it is to this latter opinion that he seems to have finally come.

But if this hypothesis were true we should have found, from time to time, the bones of the dog side by side with those of the Moas, its contemporaries. Now we have already stated that no fossil terrestrial mammal has yet been met with in New Zealand§. To this statement the dog forms no ex-

* "Moa-bones were never found unassociated with beds of shells, and although shell-beds did occur without Moa-bones, these just as often underlaid beds with Moa-bones as overlaid them" ("Notes on the Maori Cooking-places at the Mouth of the Shag River," by Capt. F. W. Hutton, in 'Transactions' &c. vol. viii. p. 105).

† Fourth and fifth propositions.

‡ "Either when its owner was short of provisions, or perhaps" (Address, *loc. cit.* p. 89).

§ In my first article on the Moas, when speaking of the small number of Mammalia found in New Zealand and the absence of fossils of animals of that class, I forgot to add the epithet *terrestrial* (*aériens*). Readers will, however, I fancy, have filled up this omission. *Aquatic Mammalia*, on the contrary, have repeatedly been found in the strata of New Zealand

ception *. In fact, the bones of that animal have only been found in the ancient ovens, or among the fragments scattered around primitive kitchens. But then, in opposition to what has been said by Dr. Haast, they occur in abundance. I hardly find an excavator who has not indicated their existence, and they are always associated with bones of Moas.

Here, however, we meet with a fact which may appear singular at the first glance, and upon which the New-Zealand naturalist has repeatedly insisted. The bones of all kinds scattered in the vicinity of the ovens are very rarely gnawed †. From this Dr. Haast concludes that the Moa-hunters were not accompanied by dogs; for these, he says, would not have failed to attack the remains of their masters' repasts. But, in speaking thus, he forgets that the canine race introduced into New Zealand was essentially destined to furnish food and clothing ‡. The Maori dog, coming from the Manaia Islands, belonged to that Polynesian race which all travellers represent as living only upon vegetables, and which must have retained its ancient habits in New Zealand §.

Moreover, if some dogs took to eating meat their masters would soon have perceived that this food modified the taste

(Haast, 'Geology of the Provinces of Canterbury and Westland,' chaps. x. & xii.). I have elsewhere referred to the fact that the Cetacea play a part in the traditions of the Maoris ('Les Polynésiens et leurs Migrations,' chap. iv.), and that every animal of this kind thrown upon the shore belonged of right to the *Ariki*, the chief of the territory ('Journal des Savants,' January 1873).

* Capt. Rowan has ascertained the presence of a dog's skeleton in the hollow trunk of a tree buried in the silt of a river near Wellington Harbour. This tree was at a depth of 6 metres (about 20 feet) and beneath a layer of lignite. But beside and behind the bones there were found the hairs of the animal, with some fibres of hemp and a stalk of the same plant. It is evident that the carcass had been carried into this hole by some flood of the river, and that the event was quite recent. This has been well understood by Dr. Hector. That naturalist adds, that the burial of this dog is of earlier date than any other known ("On the Remains of a Dog found by Capt. Rowan near White Cliffs, Taranaki," in 'Transactions' &c. vol. ix. p. 243).

† The only fact of this nature that I have seen mentioned in the various memoirs written by the New-Zealand naturalists has been by Capt. Hutton. Two Moa-bones collected by his *collaborateur*, Mr. Booth, near the weirs of the Shag river had been gnawed by dogs (*loc. cit.* 'Transactions' &c. vol. viii. p. 106).

‡ "They are carrying some dogs with them, as these would be very valuable in the islands they were going to, for supplying by their increase a good article of food and skins for warm cloaks" (Sir George Grey, 'Polynesian Mythology,' p. 214).

§ The dog was called *Kuri* by the Maoris. This local race was of small size, with a brown or yellowish coat, with long ears and a bushy tail. It is now extinct and replaced by our European dogs.

of their flesh in a manner by no means agreeable, and they would not fail to watch that they kept to their habitual diet*. It is therefore quite natural that the dogs of the Maoris did not act in the same way as those which accompanied the old Danes of the kitchen-middens, and that they have not, like the latter, left the traces of their teeth upon the bones thrown away about them.

VI.

There is another very important question with regard to which Dr. Haast is not in agreement with several of his colleagues. The eminent geologist has declared many times that he has never found human bones among the fragments of repasts scattered about near the ovens; and from this negative result he concludes that the Moa-hunters were not cannibals†. But he himself admits that he has not met with them any more in the accumulations of shells incontestably left by the existing Maoris‡. Now the cannibalism of the latter is well known; and nevertheless Dr. Haast's mode of reasoning would lead us to doubt or even to deny it. This simple remark deprives Dr. Haast's argument of all value.

However, in both cases, this absence of human remains is easy to understand. It is not when engaged in the chase or in fishing quietly for shell-fish that the most anthropophagous tribe feeds upon human flesh. For the commission of an act of cannibalism under such conditions as these, leaving on the ground pell-mell bones of man and the Moas, nothing but some absolutely exceptional circumstance would account.

But, notwithstanding Dr. Haast, this fact has occurred repeatedly. Mr. Walter Mantell first ascertained this in the North Island§, and his testimony is one of those that we can the least challenge. This able and persevering investigator discovered in the valley of the Wanganui some hillocks, covered with turf, which the natives declared to be formed by the remains of the feasts of their ancestors. On excavating them he found that they were composed of bones of Moas, dogs, and men confusedly intermixed. All these bones had evidently under-

* The flesh of our European dogs, all of which eat more or less meat, has a peculiar taste, reminding one of the odour of an ill-kept kennel. With this the siege of Paris made us only too well acquainted.

† Seventh proposition.

‡ *Loc. cit.* 'Transactions' &c. vol. viii. p. 74.

§ "These consisted of Moas', dogs', and human bones promiscuously intermingled" ("On the Fossil Remains of Birds collected in various parts of New Zealand by Mr. Walter Mantell," by G. A. Mantell, F.R.S., in Quart. Journ. Geol. Soc. vol. iv. 1848, p. 234).

gone the action of fire. Dr. G. A. Mantell also tells us that Mr. Taylor had met with similar hillocks in the valley of Whaingaihu. These observations are not isolated. In the northern part of the North Island, at the Pataua river, near Wangarei, Mr. Thorne discovered, side by side with remains of ancient Maori-ovens, a mixture of shells, ashes, pieces of charcoal, and bones of seals, fishes, men, and Moas, which had evidently served as a repast for the natives*. Mr. Roberts has also found some human bones mixed with those of the Moa and with charcoal, side by side with stones formerly employed in cooking them†. Lastly, Mr. Robson has made analogous observations in the neighbourhood of Cape Campbell‡. Thus, contrary to Dr. Haast's assertions, the Moa-hunters *were* anthropophagi.

VII.

I have just examined Dr. Haast's principal propositions, those which most directly touch the special question which is the subject of this study. They are not much in accordance, as will be seen, with precise facts upon which doubt can hardly be thrown. This is the case also with what he advances with regard to the absence of local traditions relating to the Moas§. As long ago as 1848 Dr. Mantell announced to the Geological Society of London that his son had found near Wellington the very distinct recollection of these birds, larger than a man, which were formerly very abundant in the country, and that some of the oldest Maoris even asserted that they had seen some of them||. Later on, in 1870, Sir George Grey, in reply to a first memoir by Dr. Haast, wrote a letter to the Zoological Society of London, in which he affirmed that twenty-five years before (*i. e.* in 1845), the natives always talked to him of the Moas as having been well known to their ancestors. He added, that the Maori poems contain numerous allusions to these birds¶. In 1875 Mr. Hamilton published a conversation which he had held with an old native, who said that he had seen the last of the

* "Notes on the Discovery of Moa and Moa-hunters' Remains at Pataua River, near Wangarei," by G. Thorne ('Transactions' &c. vol. viii. p. 85, pl. iii.)

† "Notes on some Ancient Aboriginal Caches near Wanganui," by H. C. Field ('Transactions' &c. vol. ix. p. 220).

‡ "Further Notes on Moa-remains," by C. H. Robson ('Transactions,' vol. ix. p. 279).

§ Second proposition.

|| *Loc. cit.* p. 26.

¶ "Letters of Sir George Grey," cited by Dr. Haast, in his Address, p. 100.

Moas, and who described it so as to impress vividly his English interlocutor*. Among other things this Maori described the curvature of the neck with an exactitude of which a well-informed European might judge, but the elements of which could only be furnished to a savage by the observation of the living animal. I could multiply these testimonies, but I shall confine myself to borrowing some details upon this subject given to Mr. Travers by Mr. White in the letters which I have already cited†. Even then it could be seen, and it will be still more visible here, that far from being vague and obscure, the traditions in question are remarkably precise.

"The Maoris," writes Mr. White, "were afraid of it [the Moa], as a kick from the foot of one would break the bones of the most powerful brave‡; hence the people made strong spears of 'Maire' or Manuka wood 6 or 8 feet long, and the sharp end of which was cut so that it might break and leave 6 or 8 inches of the spear in the bird§. With these the men would hide behind the scrub on the side of the track, and when the birds were escaping from the fear of the noise of those who had driven them from the lakes, those spears were thrown at them, thus sticking in the bird; the scrub on the sides of the track would catch the spears and break the jagged end off, leaving it in the bird. As it had to pass many men the broken spear-points thus put into the bird caused it to yield in power when it had gained the open fern-country, where it was attacked in its feeble condition by the most daring of the tribe."

The Moas when killed were cut up with a particular variety of obsidian named *Tuhua Waiapu*||. The Maoris brought with them a block of this stone and detached from it flakes, which only served a single time, were not employed in cutting any other flesh, and were abandoned on the spot.

* "Notes on the Maori Traditions of the Moa," by J. W. Hamilton ('Transactions' &c. vol. vii. p. 121).

† 'Transactions' &c. vol. viii. p. 79.

‡ Mr. Travers adds, in a note, that a hill situated on the eastern coast bears the name of a chief who, having pressed too closely upon a wounded Moa, received a kick which broke his thigh and made him roll to the bottom of the hill. We see how all these popular reminiscences agree.

§ The Maoris, like all the Polynesians, were unacquainted with or disdained the use of the bow.

|| Mr. White tells us that the Maoris distinguished three kinds of obsidians, characterized by their colour. That which was used for cutting up the flesh of the Moa was of a light colour; another, of a green colour, *Tuhua panetua*, was used by the natives to wound themselves in their funeral ceremonies. When the deceased was a chief or a child, and when human flesh was to be cut up, they employed the third kind, *Tuhua kahurangi*, the colour of which is red.

Before proceeding to the chase when Moas were to be attacked, the Maoris pronounced one of those *incantations* or prayers which with them preceded all actions of more or less importance. Mr. White was unable to remember the terms exactly, but he gives the sense of one of them, and tells us that the mists of the hills* where the chase was to take place are supplicated so to act that the fat of the birds may flow like the drops of dew which fall from the leaves of the trees at the dawn of a summer-day; and the god of silence is prayed to keep the Moas free from apprehension and fright.

The last Moa-hunt of which the memory is preserved, according to Mr. White, took place in the North Island, in the neighbourhood of Whakatane, in the Bay of Plenty. The feathers of the birds killed there were, until recently, in the hands of a chief named Appanui†.

Several material facts testify to the truth of the details given by Mr. White. Thus all the memoirs relating to excavations executed near the ancient *Moa-ovens* mention flakes of obsidian which had evidently served to cut the flesh of those birds; and all of them remark upon the great number and the close resemblance of these primitive knives. Mr. Thorne has, moreover, found one of those blocks which the Maoris carried with them as a matter of precaution, and recognized, by the quantity of fragments, the point where the temporary manufactory of these instruments was established‡. At an elevation of 4000 feet, on a mountain-plateau near Jackson Bay, Dr. Hector has discovered numerous tracks cutting in all directions through a dense thicket. These tracks

* It is evident that the *Spirits of the mists* are here referred to. Contrary to assertions which have been too often repeated, the Maoris had a very complicated mythology and a very numerous Olympus, although, perhaps, not so well hierarchized as that of the Tahitians (see Mœrenhout, 'Voyage aux îles du grand Océan'). Of this, the publications of the New-Zealand *sacants* are bringing fresh proofs every day. Among others, the natives believed in a kind of *goblins*, gnomes, or sylphs, whom they represented as innumerable, and to whom they attributed the great part of their good or ill fortune. It was therefore necessary on every occasion to render them favourable. Hence arose that multitude of prayers or invocations which are constantly spoken of in the Maori traditions. Upon all these questions the following works may be consulted with advantage:—Grey, 'Polynesian Mythology'; J. F. Wahlers, "Mythology and Traditions of the Maoris" ('Transactions' &c. vol. viii. p. 108); Colenso, "Historical Incidents and Traditions of the Olden Times, now for the first time faithfully translated from old Maori Writings and Recitals" (*ibid.* vol. xiii. p. 38, and vol. xiv. p. 3); Colenso, "Contributions toward better knowledge of the Maori Race" (*ibid.* p. 33); Taylor, "*Te ika a Maoui*, or New Zealand and its Inhabitants."

† Mr. White adds the name of another known individual, and enters into details which it is unnecessary to reproduce here.

‡ *Loc. cit.* p. 86.

were not the work of man; they are well beaten and about 16 inches wide. They are so many runs such as wild animals make, and, being in New Zealand, they are necessarily the work of birds. From the height of the thicket they could only have been made by animals much larger than the kiwis (*Apteryx*), which alone traversed them at the time of Dr. Hector's visit, the imported mammals not having as yet penetrated so far*. Do not these tracks answer perfectly to the idea that one is led to form of those in which the Moa-hunters lay in ambush? and their state of preservation would seem to attest that they cannot have been abandoned for centuries.

VIII.

But the most decisive proof of the recent disappearance of the Moas is furnished by the repeated discoveries of bones to which the soft parts, the muscles and integuments, still adhere. At least three† well-attested examples are known. The colonial museum possesses a portion of a neck, the origin of which I have not found mentioned anywhere‡. In 1871 Mr. Low announced to Dr. Hector that he had just sent to him a piece of Moa's flesh bearing down and many quills of feathers§. Nearly at the same time Dr. Thomson obtained from a gold-pro prospector, who had discovered them in a cave and under an accumulation of mica-schist, the bones of a Moa to which ligaments, muscles, and some fragments of skin still adhered. The portion of neck above mentioned formed part of this find, and was sent to Dr. Hector, who carefully figured and described it||.

In these various specimens the soft tissues appear to have undergone no alteration; they are only much dried. The flesh is not at all fossilized and its fibres can easily be de-

* "On recent Moa-remains in New Zealand," by J. Hector ('Transactions' &c. vol. iv. p. 119). Dr. Hector's visit to the mountains in question took place in 1863.

† [The York specimen of *Dinornis robustus* makes a fourth (see note, p. 132), here again passed over in silence, although parts of the skin of the feet were actually figured by Sir Richard Owen in the sixth volume of the 'Transactions of the Zoological Society,' the remains of feathers were described and figured by myself in the 'Proceedings' of the same Society for 1865, and a translation of the Abstract of the latter paper appeared in the 'Annales des Sciences Naturelles.'—Tr.]

‡ Haast, third paper, *loc. cit.* p. 102.

§ Note added to Dr. Hector's memoir, p. 114.

|| "On recent Moa-remains in New Zealand" ('Transactions' &c. vol. iv. p. 111, pl. v.).

tached*. Mr. Millen Coughtrey, to whom the objects collected by Dr. Thomson were sent, anatomized the neck, and was able to recognize the different muscles; on the right femur he found the fibres and the tendons of nine muscles; the other bones only presented traces of tendons †.

In reply to the objections to his theory which spring from the preceding facts, Dr. Haast asserts that the bones of the neck, described by Dr. Hector, are in a state of semi-fossilization, like that presented by most Moa-bones; and he explains the persistence of the muscles and integuments by their accidental position in a layer of dry sand ‡. But can we imagine how the bones could be fossilized while the flesh remained intact? Moreover, on the first point, the learned geologist is formally contradicted by Dr. Hector, who represents these same bones of the neck as being in a perfect state of preservation, and not at all fossilized §. Mr. Low makes the same assertion with respect to the specimens in his possession. How can we doubt the correctness of these statements in presence of the fact that the muscles adhering to these bones could be dissected?

Dr. Haast, indeed, replies to observations of this kind, that in Europe bones dating from the Quaternary epoch have sometimes shown a remarkable degree of preservation. He cites particularly the facts ascertained by MM. de Ferry and Arcelin, at the Clos-du-Charnier, where the bones and antlers of the reindeer had retained the greater part of their gelatine||; but he forgets that none of these bones ever exhibited the least trace of muscles or tendons. At Solutré, as wherever fossil bones have been collected, the soft parts have totally disappeared.

It is precisely the preservation of these soft parts that gives to the remains of Moas studied by Dr. Hector their great historical significance. Moreover, it is evident that there must have been some exceptionally favourable circumstances to account for a portion of the muscular and cutaneous tissues having escaped destruction, while the greater part of them disap-

* Low, *loc. cit.*

† "Notes on the Anatomy of the Moa-remains found at Earnscleugh Cave," by Millen Coughtrey ('Transactions' &c. vol. vii. p. 141). To judge from the details given by Dr. Thomson, all the material in the way of muscles and skin contained in this cave was not collected (see Dr. Hector's memoir, *loc. cit.* p. 112).

‡ Additional notes, p. 93; Third paper, p. 102.

§ "Without being in the least degree mineralized" (*loc. cit.* p. 114).

|| "L'âge du Renne en Mâconnais" (International Congress of Pre-historic Archaeology, 1868), quoted by Dr. Haast, in 'Geology of Canterbury and Westland,' p. 442.

peared. But it seems to me impossible to imagine a set of conditions, naturally produced, capable of preserving these tissues for centuries under the circumstances which its insular position imposes upon New Zealand*.

Thus every thing concurs to make us regard the final extinction of the Moas as having taken place at no very distant period. There is nothing opposed to our accepting as true the statements collected by Sir George Grey and by MM. Mantell, White, and Hamilton. On the contrary, if we suppose that some of these great Brevipennes were still living about a century ago, we can explain without difficulty several perfectly well-ascertained facts which are incompatible with Dr. Haast's theory, such as the existence of tracks still easily recognizable, the preservation of fragments of flesh and skin, &c. Now it is towards this date that the information collected by Mr. Hamilton carries us back. Haumatangi, the old Maori of whom he speaks, was one of the oldest of his compatriots in 1844. He said that he saw Cook†. We know that that illustrious mariner re-discovered New Zealand, which had been almost forgotten since Tasman's time, on October 6, 1769. Haumatangi was therefore more than seventy-five when he was interrogated by Mr. Hamilton, and not seventy only, as the author is made to say by some printer's error. If we suppose that he was about twelve years old when he observed the large bird which he remembered so well, New Zealand would have still had living Moas about 1770 or 1780.

* This is also the opinion of M. Alphonse Edwards, to whom the functions with which he is charged at the Museum, and his researches upon fossil birds, give a particular authority in the question now under consideration. The following is what he has been kind enough to write to me upon this subject:—"Dr. Haast ('Geology of the Provinces of Canterbury and Westland') refers, in support of his theory, to the discoveries made in Siberia of entire carcasses of mammoths whose death dates from Quaternary times. On this point I do not share in Dr. Haast's opinion; for if animals can be preserved indefinitely in the constantly frozen soil of Asia, this is not the case in New Zealand, where, throughout the historical period, the temperature has been very mild and the humidity considerable. These conditions must have facilitated the putrefaction of carcasses, whatever may have been the natural conditions of their entombment."

† Dr. Haast invokes, in favour of his views, the silence of Cook on the subject of the Moas; but it is evident that at that time they had nearly disappeared. Now as the coasts were everywhere populated, the last of these great birds could hardly have been found except in the interior, and it is quite simple that the great English mariner would receive no information about them. The same observation applies still more strongly to the travellers who came after Cook, and whose silence is also appealed to by Dr. Haast in support of his theory ('Geology of the Provinces of Canterbury and Westland,' chap. xvi.).

IX.

Hitherto, to my regret, I have had to oppose Dr. Haast. I am only the more pleased to bear testimony to the incontestable services which he has rendered to science in solving some of the most interesting questions which are raised by the history of the Moas. From his investigations, equally fertile and persevering, it appears that all the large and small Brevipennes which have inhabited and still inhabit New Zealand were contemporaneous. In exploring the alluvial deposits and the marshes of Glenmark, the learned geologist found, side by side, bones of *Apteryx* and remains of the largest and most curious species of Moas, just as with us the bones of the mammoth and rhinoceros are found mixed with those of the reindeer and the chamois*.

As with us also, the extinction of the lost species did not take place at the same time. If there are some which survived to the close of the eighteenth century, others perished at more or less remote periods. Further researches, hitherto too much neglected by the New-Zealand naturalists, will be necessary to determine the succession of these extinctions; and in order to solve the many questions raised by this problem, archæology and geology must come to each other's aid. Dr. Haast seems to me to be the only person who has already collected some data upon this subject, and for this we owe him our thanks †.

From the surveys published by the eminent geologist it appears that the bones of *Dinornis giganteus* have never been met with among the remains of feasts in the vicinity of the ancient ovens. The largest of birds would seem therefore to have ceased to exist before the arrival of man in New Zealand. Dr. Haast has only once found the remains of a *Dinornis robustus* among the refuse of a kitchen. This species, little inferior in size to the preceding, was probably near disappearance when the hunters killed one of its last representatives in Shag Valley. At Rakaia have been collected the remains of three specimens of *Palapteryx ingens*, the bones of which had been intentionally broken; but this bird has not been met with elsewhere. *Palapteryx crassus* has occurred very abundantly at Shag Valley and Rakaia. *Pala-*

* 'Geology, Glenmark,' chap. xvi. (D), p. 442. Dr. Haast estimates at over a thousand the number of Moas of which the remains have been obtained from this locality, from which the greater part of the specimens which have enriched the museums of the whole world have been derived.

† Address, p. 86; Third paper, p. 97; 'Researches in Sumner Moa-Cave,' p. 85; 'On a Moa-Encampment,' p. 99.

pteryx elephantopus has been met with in the same two localities, but in smaller quantity than the preceding.

We see that man has eaten some of the largest and most remarkable species of Moas. However, he seems to have soon exterminated them. None of those just mentioned has occurred at Point Cave. They are replaced there by the species of *Euryapteryx* and *Meionornis*, especially by *Meionornis didiformis*, which the natives, although sometimes killing it, seem to have disdained so long as they could hunt *Palapteryx* *.

I place here in the form of a table the results of the excavations made by Dr. Haast in some localities where man has eaten the Moas, adding the indications given by the author as to the greater or less abundance of the bones belonging to the different species :—

Genus DINORNIS.

D. robustus (Shag Valley, a few bones).

D. gracilis (Rakaia, dominant).

D. struthioides (Rakaia, dominant).

Genus PALAPTERYX.

P. ingens (Rakaia; three individuals).

P. crassus (Shag Valley, dominant; Rakaia, many).

P. elephantopus (Shag Valley, fewer; Rakaia, few).

Genus MEIONORNIS.

M. casuarinus (Shag Valley, very few; Rakaia, dominant; Point Cave, 15·05).

M. didiformis (Shag Valley, very few; Rakaia, many; Point Cave, 53·03).

Genus EURYAPTERYX.

E. rheides (Shag Valley, dominant; Point Cave, 49·01).

E. gravis (Shag Valley, fewer; Point Cave, 33·03).

Thus about two thirds of the species of Moas hitherto recognized have been met with in the remains of the feasts of the natives.

If the Maoris had hunted the Moas only by means of the processes described by Mr. White, it is very probable that Europeans would have been able to observe some species of

* Letter from Mr. W. H. G. Roberts ('Transactions' &c. vol. vii. p. 548).

these great Brevipennes for themselves. But besides these much more powerful means were employed against them. Nooses, in which they caught themselves, were placed in their runs*; immense battues, in which the whole population was associated, were organized; the birds were driven towards a lake, into which they threw themselves in despair, and where hunters in canoes killed them without difficulty†. Lastly, they went so far as to invest them with fire by burning vast tracts of forest, when they must have perished by hundreds, often without any profit to the incendiaries. In this way may be explained the fact noted by Mr. Taylor and various other reporters, who speak of whole fields covered with hillocks formed by the bones of Moas‡. It may be added that the Maoris were very fond of their eggs. Fragments of the shells of these have been found almost everywhere and sometimes in immense numbers.

Thus pursued to extremity and attacked even in their reproduction, the Moas evidently could not but disappear; but their extinction is certainly recent. In maintaining the opposite opinion and supposing that the total destruction of these large birds dates back to an epoch as ancient as our European neolithic times, Dr. Haast has deceived himself. He has been led astray by purely geological analogies, perhaps more apparent than real.

At any rate, we cannot establish any true assimilation between the zoological facts which have occurred in Europe and in New Zealand. The Quaternary fauna of New Zealand was entirely of local origin; it was otherwise here. The mammoth and the rhinoceros were immigrant animals, driven by the cold of the northern regions of Asia towards warmer countries§. The extinction of these species must have been hastened by the action of a medium quite different from that in which they had originated, and by the profound changes of climate which they had to support towards the close of the glacial epoch. Nothing of the kind took place in New Zealand. The Moas were there truly autochthonous; they never quitted their original centre of creation; in their conditions of existence they underwent only inconsiderable modifications, as, indeed, is very well shown by Dr. Haast himself||.

* Taylor, quoted by Travers ('Transactions' &c. vol. viii. p. 77).

† Roberts, *loc. cit.*

‡ Taylor, *loc. cit.*

§ Murchison, de Verneuil, Keyserling, and d'Archiac regard the mammoth and the tichorhine rhinoceros as having lived in Siberia during the Tertiary epoch. According to Lartet the reindeer was their companion.

|| Address, *loc. cit.*, and 'Geology,' *passim*.

The spontaneous extinction of these birds is therefore very difficult to understand. Nevertheless we must admit that natural causes were opposed to the indefinite duration of certain species. To judge from the known facts, it seems to be demonstrated that the largest species of *Dinornis* was no longer in existence when man reached these isolated lands in the midst of the ocean. The other species of the same genus and those of *Palapteryx* appear to have been very rare at this epoch, and not to have long survived the arrival of the hunters; they were consequently in process of natural decrease. On the contrary, the individuals of *Meionornis* and *Euryapteryx* seem to have been very numerous before the moment when the war of extermination, carried on with such improvidence, commenced*. In consequence of geographical conditions they could not emigrate like the reindeer, and their mode of life prevented them from seeking a retreat in the midst of the glaciers, as the chamois has done with us. They were consequently annihilated, but only in modern days, like the Dodo and those other birds of the Mascarene islands, of which M. Alphonse Edwards has recast or completed the history †.

XXII.—On two Species of Alveolites and one of Amplexopora from the Devonian Rocks of Northern Queensland. By ROBERT ETHERIDGE, Jun., and ARTHUR H. FOORD, F.G.S.

[Plate VI.]

Introduction.

THE interesting species described below form part of a collection of Corals lately received by one of us from Mr. R. L. Jack, F.R.G.S. &c., Government Geologist for North Queensland. The localities given on the instructions accompanying the specimens are Regan's, Philp's, and Benville's

* The following shows, according to Dr. Haast, in what proportion the various species of Moas are represented at Glenmark :—*Meionornis casuarinus* alone represents one fourth, and *M. didiformis* one fifth, of the total number of individuals discovered. Then come, in decreasing numbers :—*Palapteryx elephantopus*, *Euryapteryx gravis*, *Palapteryx crassus*, and *Euryapteryx rheides*; *Dinornis gracilis*, *struthioides*, *maximus*, and *robustus* occur in nearly equal numbers. *Dinornis ingens* is represented only by a few individuals.

† "Recherches sur la faune ornithologique éteinte des îles Mascareignes et de Madagascar," by Alphonse Milne-Edwards, 1866-79.