

Abdominal cavity was black, the viscera had almost disappeared from decay, one long silvery lobe only being recognizable, probably the air-bladder. Vent situated immediately in advance of anal fin.

In form this specimen corresponded almost exactly with figure at p. 136, vol. iii., *Trans. N.Z. Inst.*, which is an excellent drawing of the species. According to the *Catalogue of New Zealand Fishes*, the upokororo had not been found in the sea, but only in the rivers and lakes of both islands. Mr. Rutland's account however (vol. x., *Trans. N.Z. Inst.*) is, I think, conclusive circumstantially that during a portion of the year it is resident in salt water, as it is never seen in the Maitai and other neighbouring rivers of Nelson excepting during autumn and winter when spawning or getting into spawning quarters, but disappears entirely for the rest of the year. Recently, on 29th September, Mr. A. K. Smith informed me of a fish he had been keeping for me which was taken in the sea at Otago Heads off the North Spit but which I did not get—evidently a grayling. He described it as found by him among some mullet to which it had a general likeness, but on closer inspection he found the first dorsal fin was softer and had more rays than the mullets, while the second dorsal had no rays. The head was small and salmon-like, pectoral fin-origin lower than in mullet, body rounder, silvery and spotless. I have found Mr. Smith very correct and reliable in his observations on fish, so that I believe in this case also he is not mistaken, although it is not impossible that the fish may have been a spotless trout or young salmon-trout.

*References.*—*Cat. N.Z. Fishes*, 1872, p. 123; *Trans. N.Z. Inst.*, vol. iii. p. 136, and vol. x., p. 250. Specimens are in Otago Museum.

*NOTE.*—The order of classification I have followed is that of Dr. Günther in his "Study of Fishes," 1880, as regards families.

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ART. XVII.—*Notes on Moa Remains in the Mackenzie Country and other Localities.* By FREDERICK CHAPMAN.

[Read before the Otago Institute, 10th June, 1884.]

I PROPOSE in this paper to give the result of some unconnected observations made during the past summer upon the remains of moas which I found in widely separate localities. There may be nothing very interesting in these observations, but I think it may be of some use to record facts gathered in this way, as they all serve in some slight degree at least to add to the accumulated fund of information on the subject. The subject is one of interest, and when it comes to be dealt with as a whole by some competent

writer at a future date he will certainly have no cause to complain that the literature relating to it in this country is too copious. If upon this and kindred matters, and notably upon such subjects as the history, traditions and customs of the Maori race, colonists with good opportunities would record all the facts they observe upon their travels while these facts are fresh, much valuable matter now daily growing scarce would be preserved. It has occurred to me that it is worth-while to jot down in this way observed facts relating to our gigantic extinct birds, especially in connection with their relation to the inhabitants of these islands, as the opportunities of observing these facts occur only now and then when a piece of ground is newly disturbed, and the observations lose their value if deferred until other elements come in.

What is known as the Mackenzie Country, though somewhat undefined as to limits, is now comprised in a new county called Mackenzie County, lately cut off the large original County of Geraldine. It consists of the Mackenzie Plains and a large amount of mountain country besides extensive downs. These plains and downs occupy a central position, stretching from the Waitaki up towards the three alpine lakes, Ohau, Pukaki, and Tekapo. The climate is cold in winter and very warm and dry in summer. The whole region is, like the central districts of the South Island generally, devoid of trees, but the mountains show signs of extensive areas of thick high scrub which has been burnt off.

When on a visit there during the past summer I was told that on a sandy flat on the banks of the Waitaki remains of moa skeletons were to be found. I accordingly visited the flat, which I found to be about ten or twelve miles down the Waitaki Gorge, starting from Mr. Sutton's Black Forest Station. I was accompanied by my brother, Mr. E. A. Chapman, of Grampians Station, and Mr. Murdoch, Mr. Sutton's manager. The ride down the bank of the river is rather rough, but the rocky scenery is very fine. A slight bridle-track among the boulders leads along the narrow margin between the steep crumbling ranges and the Waitaki, which is here a fine stream tinged with the dull colour of the glacial water. Where it is concentrated in the narrowest part of the gorge the river runs with great rapidity, and for many miles it forms an impassable barrier between Otago and Canterbury. A long way above the gorge it is fordable in winter, when the severe alpine frosts have reduced the water supply. There are no feeders for many miles, until the point is reached, where, on the Otago side, the Ahuriri pours in a considerable quantity of clear water.

Some distance below this point we came upon the flat we were in search of. It is of considerable area, perhaps fifty acres, and is merely composed of fine light material deposited there by the river. This fine soil is grassed

over, with the exception of a few acres, which are in a shifting state. Before reaching the main mass, we came upon a few moa bones of large size lying in the neighbourhood of some old Maori ovens. When we came upon the ground disturbed by the wind we soon found a number of distinct groups of gizzard stones. It was impossible to mistake them. In several cases they lay with a few fragments of the heavier bones. In all cases they were in distinct groups; even where they had become scattered each group only covered a few square yards of ground, and in that space lay thickly strewn. Between the groups scarcely any were seen. In several instances they lay in close masses. Mr. Murdoch showed me one piece of ground which had recently become covered with blown sand, where he had not long before seen several groups lying in close clusters, such as I shall describe hereafter.

The peculiar feature of the stones was that they were almost all opaque white quartz pebbles. The few in the three sets I now exhibit from this spot which are not white quartz have white veins in them. In one place I found a small group of small pebbles of different colour, more like the few brown water-worn pebbles which may be picked up hereabouts. These lay with a set of bones much smaller than the very large bones I found with most of the clusters of pebbles.

I did not gather these brown pebbles, as I thought it uncertain whether they were gizzard stones or not, though it is possible that the species to which the smaller bones belonged was not so careful in selecting white stones. A glance at the pebbles lying about in the surrounding country showed that the quartz-pebbles were not collected here. In only one instance did I find the moa bones burnt, and this may have been accidental. Mr. Murdoch and I collected three sets of pebbles, and these I can safely pronounce complete, or nearly so. It is beyond question, too, that each set belongs to a distinct bird. No. 1 weighs 3 lbs. 9 ozs.; No. 2 weighs 4 lbs.; while No. 3 weighs no less than 5 lbs. 7 ozs. This giant set contains individual stones weighing over 2 ozs.; indeed, I have picked out 8 stones weighing almost exactly 1 lb.

Moa bones do not seem to be very plentiful in the Mackenzie Country, and when found seem to be old and in bad preservation. I should say from such observations as I made, that the moa had become scarce or extinct on these plains while it still flourished in many other places I have examined. The bones at this place were very friable, and generally broke when picked up. I searched in vain for foot-prints in places where the sand was blown away, though I was tempted to search by finding foot-prints of a horse standing above the general level of the surface, the weight of the animal having packed the fine binding soil and thus increased its

stability in comparison with that beside the foot-prints, leaving the surrounding soil to blow away more readily. The next occasion upon which I noticed moa remains was in a bank of *débris* thrown up on the side of an old Maori chert quarry, at Gray's Hills Station, to which I propose to refer in another paper. In this bank several well-preserved fragments of bone were found so broken and so situated as to leave no doubt that they had been left there by Maoris working at the quarry. The specimen which I exhibit is manifestly broken by human agency. It may have formed part of the handle of an instrument for getting out the chert, or for splintering it when gotten ; but there is nothing in its appearance to support this.

Early in March, 1884, I accompanied my brother and several others on an excursion to Mount Cook. Our first halting place was Lake Tekapo, one of the reservoirs of the Waitaki, a beautiful alpine lake about 2,800 feet above the sea on the upper edge of the Mackenzie Plain. As the lake is approached from Burke's Pass a large uninviting patch of sandy country may be noticed surrounding the woolshed of Mr. Cowan's station. A hundred acres or so of country here have a very unpleasing appearance. Something has set the sand moving in a south-easterly direction and nothing can stop it. A large part of the ground has been stripped of the loose friable soil down to a hard bed, which dries and crumbles in the sun and is set moving by the wind. The sand thus set free has then covered another large part of this sandy country, half choking the tussocks in some places and killing them out in others. Upon the hard bare part I observed what must be a rare sight. Here and there lay scattered the last remains of giant moas. I am unable to say to what species they belonged as the bones are generally too brittle to bring away, but all or nearly all appeared to be of one species. I found no less than nine specimens, not lying close together but quite isolated. In most cases the *femur* and the *tibia* of each leg remained apparently lying in the exact position in which they had fallen when the bird fell to pieces. In one or two cases I found fragments of smaller bones. In some cases even these very heavy bones had nearly disappeared. Here, as elsewhere, I noticed that the *femur* was about the last bone to disappear. In nearly every case the cluster of gizzard stones lay with the group of bones. So striking and obvious was the fact that here the remains of these great birds lay where they had died, that when I stood upon a slight eminence I could at one time see three or four of these white groups of bones at once, perfectly isolated, with no loose bones on the intermediate ground. The last I found was in a paddock which had once been enclosed in a gorse hedge. In this unused enclosure lay a few well-preserved fragments. I did not gather any gizzard stones here, as I had no means of carrying them, and on my return no opportunity offered. The remains had

probably been but little noticed before, as they were quite undisturbed. The gizzard stones here were not so pure white as those down the Waitaki. In some cases the bird had contented itself with a collection of hard dark stones, among which lay here and there a white one. I suppose the pure white stones are scarce here, while down the Waitaki the birds lived nearer to Otago where quartz is more plentiful. This seems to indicate that their habits confined them to a comparatively small area, and perhaps that they were able in some way to cross the Waitaki. I saw nothing to lead me to think that the birds had been slaughtered. In one case the bones were broken, but as they were not burned, and lay *in situ*, I concluded that they had been fractured by accident. I found one *umu* or oven on the ground. I can only express a hope that these remains may be left undisturbed until some competent person has thoroughly examined the locality, making something more than a mere cursory survey of it.

On the journey to Mount Cook, up the western bank of the Tasman, we halted for a day or two, close to Mr. Darke's out-station. Here I ascended a mountain in the Moorhouse Range, locally called Mount Peak. It rises immediately behind the hut, and terminates in a peak nearly free of snow. I make its summit about 8,400 feet above the sea, but I am not certain of this, owing to an accident which affected my aneroid. At various heights, from 1,500 up to I think nearly 5,000 feet above the sea, I found pure white quartz pebbles. They were never isolated; generally three or four lay together. In one place I found nearly 30 in a patch. Mr. F. F. C. Huddleston, one of our party, found a similar patch. Some of these groups were far above the level where water-worn stones of this character might be found. The material was local, as at all levels I occasionally found angular fragments from the fine quartz veins which occur in the strata here. I have no doubt that these small patches of pebbles were from the *excreta* of the moa, as they were always well worn and smaller than the largest stones of the collections. Mr. Huddleston confirmed this view, having found similar pebbles in similar places in Otago.

I now take the opportunity of exhibiting three magnificent sets of gizzard stones sent me from Lake Manapouri by Mr. Mitchell, manager of Manapouri Station. I give his own account of them: "Each lot is complete, as I gathered them very carefully. With one lot I got one or two small pieces of bone which I send also. In the case of the two large lots one or two stones were scattered while all the rest were as if in a pocket a few inches below the surface and may belong to a young bird, but I fancy it is from a smaller species."

No. 4 is a small set containing 210 small stones, weighing in all only 8 ozs. No. 5 contains 389 stones and weighs 4 lbs. 7 ozs. No. 6 contains 342 stones and weighs 4 lbs. 10 ozs. It will be observed that they are

nearly all pure white and make a very beautiful collection. It is possible that No. 4 may have lost some stones. Mr. Huddleston, who lived for many years at the head of Lake Wanaka, informs me that he often found them in pockets just as Mr. Mitchell describes them. A crunching noise told when the plough had passed through a pocket. A gentleman who occupies a large agricultural farm in Southland where moa bones in all stages of preservation are extremely plentiful, says that in his district white quartz is scarce and he finds complete sets of dark stones.

During the succeeding month, in the Easter holidays, I made an excursion with Professor Scott to the country beyond Riverton. Beautiful sandy beaches stretch for miles to the westward, broken here and there by rocky points. One of these, called Colac's Bay, is doubtless named after the old chief Korako, grandfather of Mr. H. K. Tairaroa, M.H.R., or else after a younger chief of the same name and family who died here eleven years ago. Beyond Colac's Bay is a fine beach on which is a prettily-situated *kaik* called Kawakaputaputa. This is nearly opposite Rarotoka (Rarotonga) or Centre Island. In a somewhat hurried search here we found the remains of four moa skeletons in fair preservation; at least, in each group lay a good many bones and fragments of bone, including toes, jaws, and tracheal rings. With one very large skeleton lay the white gizzard stones, rather widely scattered but quite distinguishable. Not far from this one too lay many fragments of eggshell, some quite fresh-looking and others old and worn. Two small skeletons lay twenty yards apart half-a-mile from the large ones. One of these was very interesting. The bird had died crouching, and the various bones lay almost as they had fallen, having been preserved in their positions by being covered with sand. The tracheal rings lay close together, and immediately under them were the contents of the gizzard. The stones were in a little conical heap unmixed with sand. The heap extended below the surface still unmixed with sand, but of course the mass could not be removed without also lifting some fine sand, which, however, was easily removed by washing through a sieve. They are pretty transparent flinty quartz stones, different from the white ones gathered elsewhere. This bird, evidently belonging to a small species, had no such liking for opaque white stones as the others, but had carefully selected transparent ones, which, when dry on the surface, look much darker than the others. It will be observed that these (No. 7) are all very small, and they are very numerous, the whole set weighing 1 lb. 4 ozs. The few dark opaque stones are probably intruders picked up with the sand lying about the mass. What I noticed here and in many other localities, including the sandy district near Otago Heads, satisfies me that a small moa was a regular denizen of the sea beaches, and that a large one, if not similarly disposed, often frequented

similar country. The small one must have been plentiful at one time upon narrow pieces of country which could not be reached or quitted without passing through miles of bush. The finding of these fine transparent pebbles from the gizzard of one of these small ones confirms this opinion, as I think these stones were local, the country behind the beach being either dense bush or swampy peat soil.

Earlier in the summer, namely, in 1888, I had occasion to go to Porirua on the west coast of Wellington. Near the western bank of the northern branch of this harbour, are situated several old sites of paha, famous in the old native wars, and in their early wars with the colonists. One of these was called Taupo, and not far from its site is the old stone stockade called Parramatta. The Manawatu railway crosses this harbour by a bridge, which was in course of construction when I visited the spot. I made a hasty search among the sandhills beyond the line of the bridge, a few hundred yards from the stone stockade, which is now a woolshed, and there found a piece of ground from which the sand, which must have been accumulating there for ages, had recently been blown away. Here, close to the large sandhill, upon which in 1847, a Maori was hanged by the sentence of a court-martial for rebellion, I found four beautifully-polished stone axes. Not far from these I found the neck of a moa, all the vertebrae of which lay in a string. A number of bones lay there, too, and upon them were plainly visible the marks of the stone implements which had been used to cut off the flesh. The bird had evidently been cooked and eaten, as burnt bones lay about. I saw numerous tracheal rings lying among the bones, and close by them some horny fragments like portions of the beak. I had very little time to examine these, and before I could gather them, a boat called for me, and I had to leave. Since then, a friend who lives in the neighbourhood has kindly gathered most of them for me. These bones were those of a very small bird when compared with the giant moas whose bones are so common in the interior of the South Island.

P.S.—Since the above was written, I have found what I take to be gizzard-stones on the high sand-crowned hills between Lyall Bay and the Wellington Heads.

I had originally fancied that gizzard-stones were worn somewhat flatter than water-worn stones, but abandoned this at the suggestion of a friendly critic. An examination of the beautiful set in the Colonial Museum at Wellington inclines me, however, to re-adopt this view.

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