C.S.

SCIENTIFIC
(Guano)
(Reports)

No. 843/21

MIN/GUA/1#7

1921

Govt. Geologist

SUBJECT.

1921

2nd September

Previous Paper.

Dr. H. A. Baker,

Report on the Penguin Guano deposits of Kidney Island, East Falkland.

'21/32.

MINUTES.

Minute from Govt. Geologist, 31st September, 1921
Encl....(1)

H.E. the Governor

Submitted
W. Thompson
a.c.s 2/9/21

To go on by Next Mail: when are fresh ones?
When asked 2 copies of report for H.C.
Sept Reports.
2 Sept 1921

C/C
H.C.
3/9/21

H.C.S.

There is altogether correspondence with Sgs regarding market value of constituents of manures it should be attached to other papers. C.S. 649/21.

Can if C.S. 649/21 cannot be found the papers should be accumulated with copies of telegrams sent & received.

2. Report should be sent in duplicate.
H.C.
7 Sept 1921

Subsequent Paper.

W.E.
C/C
W.E.

Dr Baker should see despatch
[initials]
9 Sept 1921

Hon. Col. Sec. Seen accordingly.
H. A. Baker
10 Sept. 1921.

S of S. Despatch No 13 of 2nd February 1922 ——— Encl (3)
S of S. Despatch No 16 of 16th February 1922 ——— Encl (4)
S of S Despatch No 21 of 28th February 1922 ——— Encl (5)

Y. E. Submitted
[signature] 10/4/22

~~H.C.S.~~
~~Enclosures to (3) should be published in Gazette~~
~~[initials]~~
~~10 April 1922~~

H.C.S.
The two reports from Imperial Institute
(a) Guano (marked A) 16 January
(b) Sand (marked B) 16 January
should be published in gazette.

2. It seems unnecessary to publish Mr. Rebeltons long report on Guano but any person who is interested in the subject may see it.
[initials]
10 April 1922

Draft. Notice. app.
[signature] 19/4

C.S.O. No. 843/21

Inside Minute Paper.

Sheet No. 1

Government Notice of 15.4.22 Encl. (6).

7. Letter to Captain O.W. Roberts of 5.11.36.

(8) Letter from Manager, H.C. 5/1/37

111

C.S. 8431

FALKLAND ISLANDS.

C.S. No.....

MINUTE PAPER.

Departmental Number. XV. 3.

From Government Geologist.

Date 2/9/1921.

To Ag. Hon. Col. Sec.

SUBJECT.

Submits three copies of report on the Penguin Guano Deposits of Kidney Island, East Falkland.

Reference Numbers.

Sir,

I have the honour to submit herewith, three typewritten copies of my report on the Penguin Guano Deposits of Kidney Island, East Falkland.

I have etc.,

Herbert A. Baker.

Government Geologist.

(2)

C.S. 843/21

FALKLAND ISLANDS.

No. 78.

GOVERNMENT HOUSE,

STANLEY,

7th September, 1921.

Sir,

In duplicate.

With reference to Viscount Milner's despatch, No. 134 of the 13th of November, 1920, I have the honour to transmit a report by Dr. H. A. Baker, D. Sc., F. G. S., F. R. G. S., on the Penguin Guano Deposits on Kidney Island, East Falkland.

2. It will be observed from the concluding part of Dr. Baker's report that, on the occasion of his visit to Kidney Island, he was unable to land on Cochon Island where guano deposits are stated to exist. If a favourable opportunity occurs arrangements will be made later for samples being obtained from this island.

3. It is possible that there are deposits of guano on other small islands, and in the course of his geological survey Dr. Baker will collect information as to the existence of such deposits but there may be difficulty in landing on the islands. Dr Baker has been informed that, pending examination of the samples which have been sent to England, his geological work should not

THE RIGHT HONOURABLE

W. L. S. CHURCHILL, M.P.,

SECRETARY OF STATE FOR THE COLONIES.

be/

be delayed if there are practical difficulties in visiting the islands where guano deposits are reported to exist.

I have the honour to be,

Sir,

Your most obedient,

humble servant,

J. Middleton.

REPORT ON THE PENGUIN GUANO DEPOSITS OF KIDNEY ISLAND, EAST FALKLAND.

BY

HERBERT A. BAKER, D.Sc., M.Sc., D.I.C., F.G.S., F.R.G.S.

GOVERNMENT GEOLOGIST.

Port Stanley,

Falkland Islands,

31 Aug. 1921.

REPORT ON THE PENGUIN GUANO DEPOSITS OF KIDNEY ISLAND, EAST FALKLAND.

Sir,

I have the honour to submit herewith a report on the deposits of Penguin Guano at Kidney Island, East Falkland. This report embodies the observations I have been able to make as the result of two visits to the Island, the first being a day's excursion on July 19, 1921 for the purpose of making a preliminary survey, and the second a stay at the island from August 15 to 18 1921 inclusive, in order to carry out a more detailed examination of the deposits.

In the Falkland Islands the guano deposits which may possibly be of consequence commercially are those occurring at the rookeries of the "rock-hopper" penguin" (Catarrhactes chrysocome or Eudyptes nigrivestris, Gould). These birds congregate at th their rookeries in very large numbers and although they become pelagic during the winter months, generally return year after year to the same spots. In the case of the "gentoo" penguin (Pygoscelis papua, Forster) the rookeries usually contain fewer inhabitants and the birds are somewhat more liable to desert one spot for another.

In the vicinity of Port Stanley there are at present eight penguin rookeries, four of which are inhabited by the rock-hopper. The rock-hopper rookeries occur at (1). Kidney Island (2). Cochon Island (3). On the southern shore of Berkeley Sound, about two miles west of Cochon Island. This is usually called the Mount Low rookery.

The Honourable

The Acting Colonial Secretary.

(4). On the northern shore of Berkeley Sound, westward of Eagle Point. This, the largest example, usually known as the Eagle Hill rookery, extends for a considerable distance along the shore westward of Eagle Point, but the birds occur in scattered groups.

Except for a very narrow and rocky coastal fringe, Kidney Island is entirely overgrown with dense tussac grass, which reaches a height of from six to eight feet and sometimes more. The island is a rendezvous for large numbers of sea-lions. The grass grows so densely that it is frequently necessary to force a passage between the clumps. Should the guano deposits of the island prove commercially profitable the presence of this grass will be a hindrance. On the north-west side of the island, however, there occurs an open space of about four-fifths of an acre in extent, around a small inlet (see map). This site has served for many years as the rookery of the rock-hopper penguins, although I am informed that latterly the birds have shown a tendency to migrate eastward along the northern shore of the island, and that in the breeding season greater numbers are now to be seen on the north-eastern portion of the island than on the old site. There were no penguins on the island when I visited it, all the birds being away in the open sea, but they will return in October.

It is very apparent that Kidney Island does not offer a good site for the preservation of guano deposits. The island owes its existence to an upfold, along an east and west axis, of the Upper Devono-Carboniferous quartzite. Along the northern shore of the island the quartzite rock emerges sharply from the sea at an angle which is never less than 30 degrees and is frequently much more. The tilt of the strata then abruptly decreases to about 12 degrees, and this dip appears to be maintained inland towards the centre of the island. On the south-

ern side of the island the quartzite can be seen dipping sharply southward into the sea again.The open space which has served for many years as the rookery-site is situated on the more flattened portion of the rock-fold,where the dip of the strata is about 12 degrees to the north (seaward) The ground-surface on the site possesses a steeper seaward slope than that of the underlying quartzite.It drops 36 feet in 150 feet,which is about equivalent to an average slope of 14 degrees.The quartzite rock below is of a particularly impervious character.Water has great difficulty in getting through it.I have often noticed,when riding in the "camp", that the areas occupied by the outcrop of this quartzite are always very wet and boggy.

The rookery-site is a particularly exposed spot,as I realised fully during the bitterly inclement weather I experienced when engaged in surveying it.The exposed situation,seaward slope both the land-surface and the underlying geological formation,and the impermeable character of the latter,are circumstances which combine to bring about the rapid deterioration of the guano deposit occurring here.In fact,the process of deterioration can be seen in operation before one's eyes.In a score of places a dark-brown,strong-smelling liquid can be seen oozing out of the guano deposit and trickling away over the rocks into the sea.

My first visit to Kidney Island followed a very wet period, and I found the rookery-site a quagmire.The surface quaked beneath my feet and frequently gave way,causing me to sink to the knee.In the tussac to the eastward (where latterly the birds have congregated in preference to remaining on the old site) matters were worse.I sank to,and below,the knee at every step, hemmed in by clumps of tussac grass rising high above my head and completely obscuring my view,and enveloped in a powerful stench of sulphuretted hydrogen.

As the result of this preliminary visit I was impressed by three points:- (1).The very high water-content of the materi (2).The likelihood of deterioration of the material by drainage.(3).The practical difficulties in the way of sampling the material according to the instructions furnished by the Home Government Chemist.

With regard to consideration (3).,the Home Government Chemis suggested the use of a boring-tool for the purpose of obtaining cores,from which representative samples of the material, from known depths,could be selected.Apart from the expense involved and the very real difficulty which I should experie in securing the necessary labour to carry out boring operations on Kidney Island,it was quite clear that it would be impossible to use a boring-tool on such a quagmire.

I decided,therefore,that when I revisited the island later, to make a more detailed examination and take samples,I would have recourse to simple digging-operations alone.

My second visit was made in severe weather.I engaged a small sailing-cutter for the purpose which was anchored in a bay at the western end of the island and served as a house-boat during my stay.When Dr.Newton visited Kidney Island he went in a cutter with the same skipper,so that the latter was able to point out to me the exact places from which Dr. Newton took his samples of the guano.I believe that all Dr. Newton's samples came from the surface, or just below the surface,of the deposit,and that after his examination of them,he had 20 tons (400 bags) of the material brought in to Port Stanley.

On revisiting the site I found the sloping surface frozen hard,and very slippery.It was necessary to exercise considerable caution to avoid sliding down the slope over the rocks into the sea.There was,however,the advantage that the surface bore one's weight,so that I was able to get about on it and construct a contoured map of it,by means of plane-table, sighting-level and measuring-tape.

I sampled the material on this site at three places A,B,C, lying in a straight line down the slope.The sampling-sites are shown on the contoured map appended.From each place two sets of samples at known depths were taken.The Director of t the Imperial Institute having requested samples of about 14 lbs. weight,these have been procured and are being forwarded to him.The Home Government Chemist requested 10 oz. samples and has very thoughtfully forwarded me a supply of suitable bottles in carton-lined metal cases.These bottles are provided with metal screw-caps and cork pads.The water-content of the material is an important consideration and every precaution has been taken to prevent gain or loss of moistur during transit by the samples now being forwarded.The smaller samples were bottled,labelled,and closed down on the spot and with regard to the larger ones,the cans containing them were soldered down immediately they were taken aboard the cutter i.e. within an hour of the collection of the samples. On revisiting the site of the digging operations on the following morning,it was found that the three holes were partly filled with a dark-brown liquid which had percolated into them by drainage through the deposit.The liquid was frozen hard on top but the ice was removed and samples of the strong smelling solution were taken from sampling-site B.These liquid samples are also being forwarded for analysis.They indicate the extent of the deterioration which the deposit is undergoing at present,since this liquid,in oozing through the material,eventually finds its way into the sea.

The area of this rookery-site,as determined from the map by means of the Amsler planimeter,is about .81 acre.The thickness of guano upon it varies from an unknown maximum on the more elevated,inland border,down to nothing,or a feather-edge,along the line of the sharp turn-over of the rocks.At C, the lowest sampling-site,and that nearest to the edge of the deposit,about 1½ feet of coffee-coloured guano was seen lying upon strongly impregnated sand.At B,the central sampling-

site,about the same thickness of the guano was seen resting upon 2-3 feet of darker peaty material (obviously tussac-bog) with sand below,the whole being strongly impregnated.At A,the highest site,nearly 5 feet of coffee-coloured guano was proved,incorporated with peaty material,but sand was not touched.

In order to form some idea of the quantity of guano on this site it is necessary to adopt an average figure for the thickness of the deposit.Probably two feet is a conservative estimate.Adopting this figure,and taking the weight of the material at 50 lbs. per bushel (good guano should weigh about 40- 50 lbs. per bushel) the yield from this site comes out at rather more than 1200 tons.

The quartzite rock,where it emerged from beneath the guano deposit,appeared to be quite unaffected by the superincumbent material.There was no trace whatever of anything in the nature of rock-phosphate.

Leaving the rookery-site I made a general inspection of the island.The guano deposits appear to occur on all the seaward slopes,and to spread up into the dense tussac growth towards the crest of the island.In all probability much of the material is tussac-peat strongly impregnated by the excreta of penguins and sea-lions,but even if so,it may still have a commercial value as a manure.

Certainly well over a foot of what appears to be pure guano extends all along the northern seaward slope of the island. I took samples of this at a site marked D on the map,where the tussac was growing a little less densely,although it may be that at this spot there has been some incorporation with peaty material.

I further sampled the deposit at a site marked E on the map, on the slope facing south-west towards the small bay in which our cutter was anchored.

In order to form some idea of the quantity of guano on Kidney Island,it is first necessary to know the area of the island.

The largest available outline of the island appears to be that on Plan No. 1774 of Stanley Harbour. I enlarged this outline by redrawing it on a scale three times as large, thereby producing a map on the scale of 340 yards to the inch. I found, however, that the map so obtained needed considerable modification when compared with the actual coastline of the island. I have drawn in the shape of the island, as it appeared to me from observations on the spot, although the outline I give is to be regarded as only approximate.

Applying the Amsler planimeter to this outline, the area of the island comes out at 137 acres.

In my opinion it is safe to say that at least one-third of the island (i.e. 45 acres) is covered with guano, or at any rate, tussac-peat so strongly impregnated by guano as possibl to be commercially valuable as manure. If we put the average thickness of the manurial substance at 2 feet, this should be a conservative estimate. From these figures I calculate that this island might safely be expected to yield some 68,000 tons of manure. Two points, however, should be borne in mind. Owing to the very high water-content of the material there would be a very considerable decrease in weight on drying. Further, since so much of the guano occurs in the tussac-covered area, the securing of the former would probably mean the destruction of the latter - an undesirable contingency, since Kidney Island affords the chief source of supply of tussac-grass to Port Stanley - this grass being very valuable feed for cattle and horses. It would be possible, however, to secure a good quantity of guano without seriously interfering with the tussac.

It is conceivable, however, that the liquid which percolates through the guano has a high manurial value and might prove commercially profitable. Large quantities of this liquid could readily be obtained by the simple expedient of digging suitably placed trenches or soakage-pits, or by the installation of a wind-operated pump, such as is now commonly used

in the Falklands for obtaining water. Or, should it be desirable to produce, for commercial purposes, a solid manure, such a material could be obtained by soaking finely comminuted peat with the liquid. As is well known, peat-dust is a powerful absorbent and deodoriser.

I append to this report explanatory photographs, maps and a section.

I gather, from a perusal of the Bulletins of the Imperial Institute, that the commercial value of a guano is based on the current market values, per unit per cent, of the constituents nitrogen, phosphoric acid, and potash. Analyses of the Kidney Island guano are already available (Bull. Imp. Inst. Vol. xii, No. 2, April - June 1914, p. 209) and if I knew the present market prices of the three constituents alluded to, I could form some idea as to the likelihood of the working of Kidney Island guano proving a profitable venture.

It would certainly be necessary to subject the material to some sort of drying process before shipment. Rough experiments carried out by myself show that at present the guano contains over 50% by weight of water. It should be possible, however, to dry the material in the same way as peat is dried in the Falkland Islands. It could be placed in sheds with open-work sides, and spread out on tiers of floors. In spite of the frequency of rain, good drying winds are not uncommon in the Falklands. I have been informed that on a good drying day, blankets washed in the morning are dry by midday.

Many (in fact, most) of the deposits of penguin guano in the Falkland Islands occur on outlying islets, and in view of the lack of means of communication, together with the great frequency of very bad weather-conditions at sea, I see little or no hope of finding opportunity to visit the sites. I can only say that I will utilise any such opportunities as may occur in the course of my geological work.

On the completion of my survey of the Kidney Island deposits

I proceeded to the smaller Cochon Island, about 1½ miles to the N.W. of Kidney Island, with the object of examining the guano deposits there. Unfortunately there was a heavy swell, and although I was rowed round a great part of the island in a small flat-bottomed scow, it was quite impossible to effect a landing. I append photographs to show the precipitous character of the 70 foot cliffs of this island. Many of the outlying haunts of the penguins are in similar places. The guano deposits of Cochon Island have never been surveyed. Although Dr. Newton succeeded in effecting a landing on this island for a few minutes on one occasion, he did not see the deposits, and the material which purported to have come from there was brought into Port Stanley subsequently by a cutter.

In my survey of the guano deposits of Kidney Island I was hampered by adverse weather-conditions. The Government picket-boat was sent out to bring me back into Port Stanley, but did not come into touch with me, being unable to round William Point. I returned in the cutter, and we succeeded in making Stanley only after many hours of beating about.

On my second excursion to Kidney Island I was accompanied by, and had the advantage of the enthusiastic co-operation of, Mr. A. G. Bennett, Customs Officer.

I have the honour to be

Sir,

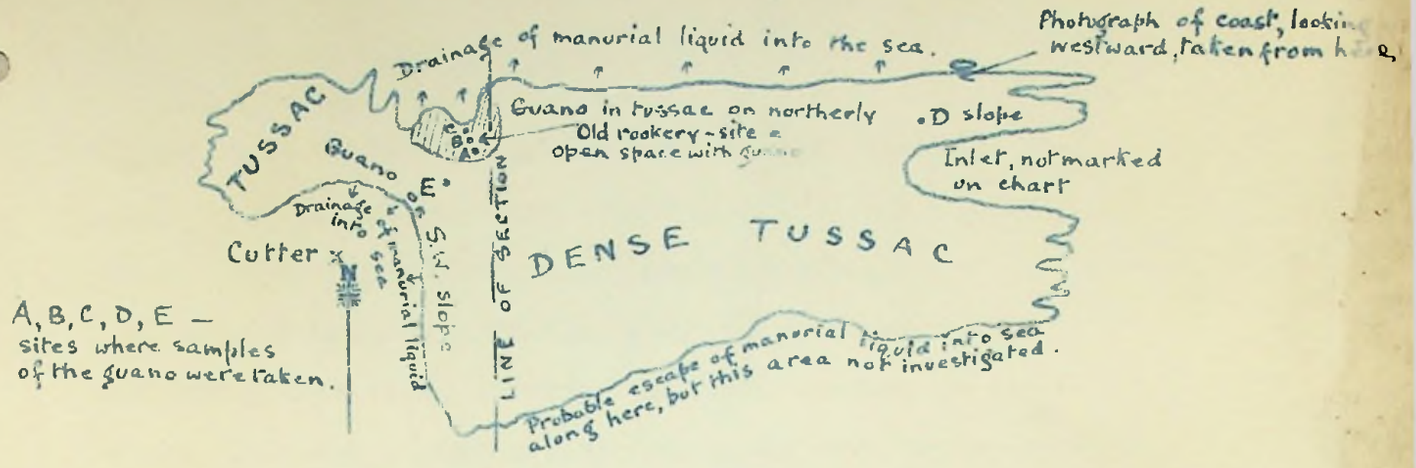
Your obedient servant

Herbert A. Baker.

D. Sc., M. Sc., D. I. C., F. G. S., F. R. G. S.

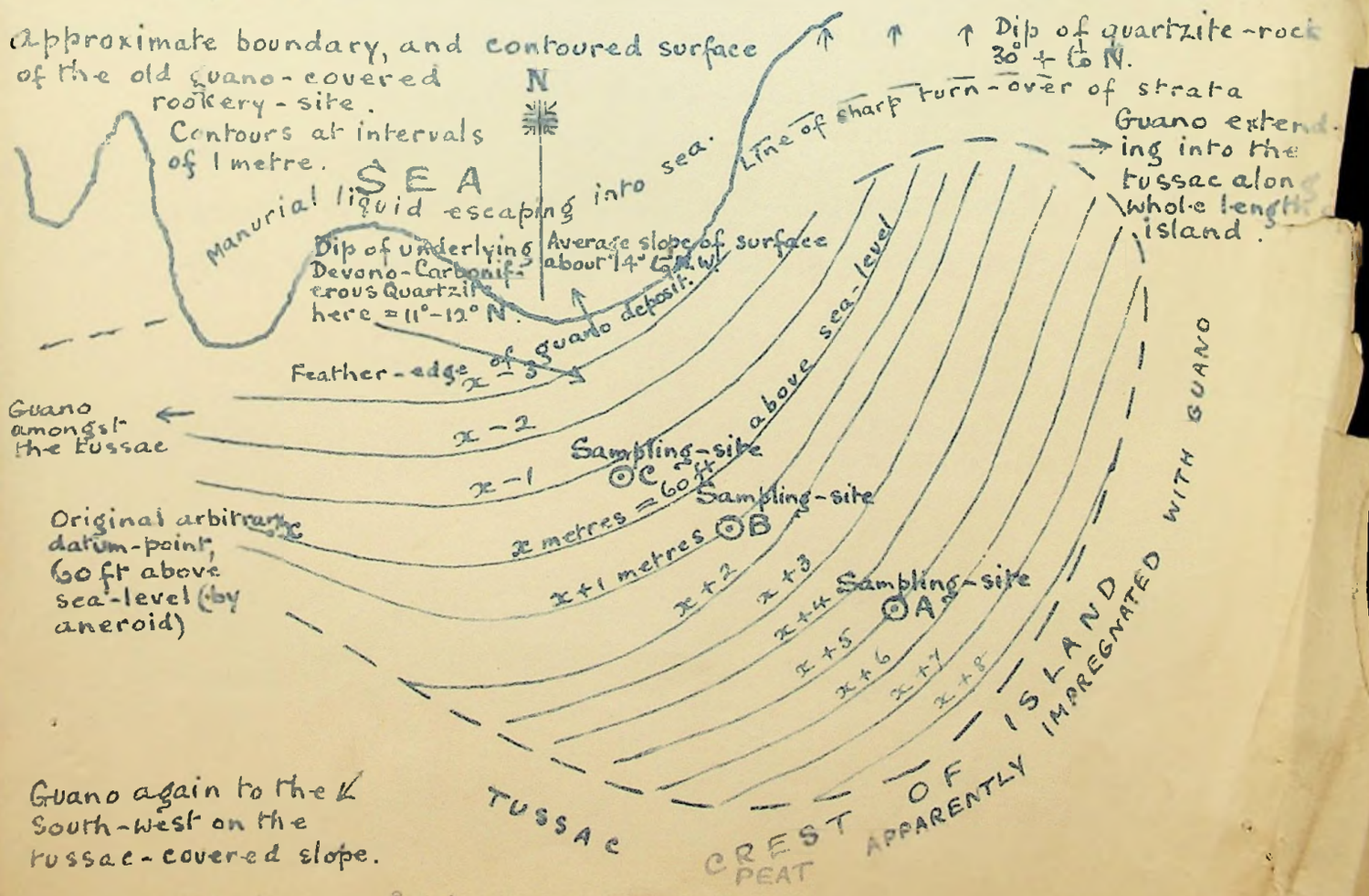
Government Geologist.

KIDNEY ISLAND, E. FALKLAND.



Scale. 1 inch = 340 yards
approximate area of island = 137 acres.

Section across Kidney Island along the line shown on map above.
Vertical scale 3 times the horizontal scale. Showing anticlinal folding of the Upper Devono-Carboniferous quartzite.



Guano again to the S.W. on the tussac-covered slope.

Scale. 1 inch = 50 feet.
Approximate area of site = $\frac{4}{5}$ acre.

H.A. BAKER, D.Sc., F.L.S., F.R.G.S.

Explanation of Photographs.

(1). Kidney Island. N.W.side. Looking S.E. towards the guano-covered rookery-site. Showing anticlinal folding of the Upper Devono-Carboniferous quartzite.

(2). Kidney Island. N.W.side. Looking W. Mount Low in the distance. Showing covering of tussac-grass, and the abrupt decrease in the dip of the Upper Devono-Carboniferous quartzite. The rookery-site is immediately behind, and to the left (south) of the camera.

(3). Kidney Island. N.E.side. View looking W., towards N.W. extremity of island, from spot marked on map. Showing how, with the exception of one projecting spur, the coastline lies to the left (south) of the line of vision. The chart shows this coastline transgressing the line of vision northwards from this point.

(4). Kidney Island. Sea-lions in tussac. Showing general character of the tussac-covered portions of the island.

(5). Cochon Island. Snapshot of portion of the island, taken from scow during the attempt to land. Showing general character of the 70 foot cliffs.

(6). Cochon Island. Snapshot of another view of portion of the island, taken from scow during the attempt to land.

(3)

Reference to previous correspondence
Governor's Despatch No. 78
of 7th September, 1921

FALKLAND ISLANDS

No. 13.

Downing Street,
2nd February, 1922

Sir,

I have the honour to transmit to you the papers noted below on the subject of the examination of samples of Penguin Guano and Sand from the Falkland Islands.

I have the honour to be,
Sir,
Your obedient humble servant,
WINSTON CHURCHILL

The Officer Administering
the Government of
the Falkland Islands

Date	Description.
1921	
29th December	Report by Mr. R. Robertson
1922	
16th January	" " Imperial Institute
16th "	" " " " on sand

DUPLICATE

COPY.

C.A.C.46-55/21-22

Government Laboratory,
Clement's Inn Passage,
Strand, London. W.C.
29th December, 1921.

Report on the examination of ten samples of penguin guano from Falkland Islands, received at this Laboratory on 16th November, 1921.

The samples were enclosed in screwecapped bottles, bearing labels stating that the samples had been taken at Kidney Island, East Falkland by Dr. H.A. Baker, Government Geologist. The labels bore the following distinguishing details:-

Lab.No.	Description.	Sampling Site.	Depth.
46	Penguin Guano.	A.	1st. foot.
47	do.	A.	3rd. foot.
48	do.	A.	4-5 feet down
49	do.	B.	1st foot.
50	Liquid which percolates through and escapes to the sea.	B.	2-3 feet down.
51	Penguin guano	B.	3 ft.
52	do.	B.	5 ft. chiefly sand impregnated with guano.
53	do.	C.	1st foot.
54	do.	D.	do.
55	do.	E.	1-2 feet.

With the exception of No. 50 which was a dark coloured liquid, the samples consisted of dark brown material resembling wet peat. They did not possess a strong smell of the kind which is associated with ordinary samples of guano.

The results of the analysis of the samples are as follows:-

Lab.No.	Water.	Total Nitrogen.	Phosphates as $Ca_3P_2O_8$	Potash as K_2O	Organic matter	Total Ash	Sand.	
								per
46.	76.56	0.90.	0.18.	0.24.	21.68.	1.77.	0.75	cent.
47	78.16	0.95	0.21	0.27	19.64	2.20	0.69	"
48	77.96	0.81	0.09	0.31	19.96	2.09	0.37	"
49	60.46	0.44	0.09	0.22	11.85	27.68	26.48	"
50	99.43	0.04	0.10	0.04	0.37	0.20	nil.	"
51	39.99	0.30	0.05	0.41	8.71	54.28	53.59	"
52	23.01	0.10	0.28	0.01	1.44	75.56	75,29	"
53	79.82	0.60	3.89	0.20	12.00	8.18	2.97	"
54	76.50	1.08	0.36	0.32	20.86	2.65	1.37	"
55	87.94	0.35	0.14	0.09	11.27	0.78	0.15	"

The total nitrogen includes organic nitrogen, ammoniacal nitrogen and nitric nitrogen.

The organic matter present in the samples consists of grass fibres mixed with indefinite material.

For purposes of comparison the following table shows the composition of the water-free samples.

Lab.No.	Water %	Total Nitrogen %	Phosphates ($Ca_3P_2O_8$) %	Potash (K_2O) %	Organic matter %	Total Ash %	sand %	Nitrogen lost on air-drying %
46	-	3.85	0.76	1.04.	92.47	7.53.	3.22	0.34
47	-	4.29	0.96	1.23	89.90	10.10	3.15	0.29
48	-	3.69	0.40	1.38	90.53	9.47	1.68	0.05
49	-	1.10	0.23	0.85	30.03	69.97	66.99	0.02
50	-	7.00	17.50	7.00	64.90	35.10	-	?
51	-	0.49	0.09	0.68	9.52	90.48	89.32	-
52	-	0.13	0.36	0.01	1.87	98.13	97.78	-
53	-	2.89	19.29	1.01	59.47	40.53	14.76	0.10
54	-	4.50	1.53	1.35	88.75	11.25	5.85	0.03
55	-	2.87	1.18	0.75	93.51	6.49	1.23	-

The determination of the water and of the total nitrogen was made upon the material as received. After the quantities were taken for these determinations, the remainder of the sample was air-dried to a moisture content of about 10 per cent. In this operation there was a slight loss of nitrogen which is shown in the last column of the table. On account of the small amount of solid matter in No. 50, the loss of nitrogen in this sample on drying could not be determined.

The

The composition of the liquid (sample No.50) which Dr. Baker describes as percolating through the guano and escaping into the sea, is of considerable importance. It shows that it contains the manurial ingredients which are being washed out of the deposits. The extent to which this exhaustion process has proceeded is shown by the very low amounts of nitrogen, phosphates and potash which are present in all the samples, excepting No. 53 in which there still remains an appreciable quantity of phosphates. This is also borne out by comparing the figures with those of guano from drier climates Peruvian Guanos, for example contain from 8 to 14 per cent. of nitrogen, 26 to 39 per cent. of phosphates and 2.7 to 3.7 per cent of potash calculated on the water free material, while their original moisture content is from 15 to 26%.

With regard to the value of the samples for manurial purposes, it may be pointed out that -

(1) The three samples from site A - Nos. 46, 47 and 48 are of similar character although taken at different depths indicating that there has been no deposit of so recent a date in the upper layers that it has not had an extraction approximately equal to that of the lower layers. The material from site A may therefor be considered as the same throughout. It is not of high value for manurial purposes. In its wet condition is it slightly superior in nitrogen, but markedly inferior in potash and phosphates to average farmyard manure. In the dry state it consists mainly of organic matter, with 3 to 4 per cent of nitrogen, and about 2 per cent of potash and phosphates.

It

It resembles peat in its high proportion of organic matter and could be used for fuel if partially dried. It would obviously be impracticable to export it in its natural condition for manurial purposes, while its value, even after drying to about 10 per cent of moisture, on the basis of the nitrogen, phosphates and potash, would be less than £3 per ton.

(2) The three deposit samples from site B - Nos. 49,51 and 52 are taken from different depths, like those from site A, but they are of different character from the site A samples. The site B samples consist largely of sand, and the upper layers contain higher proportions of manurial ingredients and organic matter than the lower layers. Thus the nitrogen in the sample taken at depth of one foot is 1.10, and the organic matter 30.0 per cent. (on the dry), while at a depth of 3 feet the corresponding figures are 0.49 and 9.5 respectively and at a depth of 5 feet, 0.13 and 1.87 per cent.

The dry material from the lower portions of site B does not contain any greater proportions of nitrogen phosphates and potash than are found in light sandy soil. It may therefore be said to have no fertilising value, and while the upper portions are somewhat richer in nitrogen and organic matter, it would not be practicable to work the material on site B for any purpose, except possibly the top layer as an inferior fuel if it were dried.

(3) The material from site C is richer in phosphates than any of the other deposits, although the amounts of nitrogen and potash are not substantially different. It would therefore be rather better than the material from site A so far as phosphate is concerned, but too

poor

poor to transport in its natural condition. Even dried to about 10 per cent of moisture its value would be less than £5 per ton, a value which would probably be too low for its commercial exploitation as a guano, especially if artificial heat were needed for drying. Since it contains 60 per cent of organic matter, it might be practicable to burn it by means of its own combustible matter, whereby a phosphatic ash containing about 50 per cent of phosphates and 2 per cent of potash would be obtained.

(4) The samples from sites D and E - Nos.54 and 55, do not differ substantially from those from site A; and the remarks made in connection with the deposits from site A apply to these samples. It is of interest to note that, comparing the samples from sites A, D and E, the wettest sample, No. 55 contains the lowest proportions of nitrogen, and potash, and the driest sample sample No. 54 the highest proportions of these substances. The results are probably related to the wetness and drainage of the sites.

Some analyses of samples of guano from the Falkland Islands in 1913 were published in the Bulletin of the Imperial Institute Vol.12, pp 208-210. Among them are two samples from Kidney Island with the following figures:-

Sample	Water	Total Nitrogen	Phosphates $Ca_3P_2O_8$	Potash K_2O	Organic matter	Ash
4	63.69	1.23	3.39	0.21	21.73	14.58
5	80.07	1.02	5.80	0.20	12.13	7. 80
Calculated on the water free samples, the results becom						
4	-	3.39	9.34	0.58	59.90	40.20
5	-	5.12	29.10	1.00	60.86	39.14

It

It will be seen that one of these No.5, contains 29.1 per cent of phosphates compared with 19.3 in No.53 of Dr. Baker's samples, and the other one No. 4 is richer in phosphates than most of the samples now examined. With the exception of the amount of phosphates there is close similarity between the Imperial Institute samples and that taken by Dr. Baker from site C.

When the question of the examination of the Falkland Islands Deposits was brought before this Department in October 1920, the Board of Agriculture and Fisheries submitted some papers in which proposals for drying the guano on the spot were made by Dr. Birmingham Newton. It was not clear to us how he obtained the figures for "Air-dried Guano" and "Guano-Ash" which were submitted, but if the Colonial Office has the papers we should be prepared to examine the figures in the light afforded by the analysis of these samples. Dr. Newton, it may be said, considered that the samples examined at the Imperial Institute had been taken below the "storm line", but gave no explanation of what was meant by this designation.

(SGD.) R. ROBERTSON.

29.12.21.

A

COPY

181/22.

IMPERIAL INSTITUTE.

of the

UNITED KINGDOM, THE COLONIES AND INDIA.

REPORT ON

GUANO FROM THE FALKLAND ISLANDS.

The guano from Kidney Island which is the subject of this report was forwarded by the Government Geologist, and was received at the Imperial Institute in November, 1921.

Description.

The samples were labelled as follows:-

No. 1. "From sampling site A, 3-4 ft. down in the deposit". Weight 14 lbs.

No.2. "From sampling site B, 2-3 ft. down in the deposit". Weight 23 lbs.

No.3. "From sampling site C, 1st foot down in the deposit". Weight 22 lbs.

No. 4. "From sampling site D, 1st foot down in the deposit". Weight 16 lbs.

No. 5. "From sampling site E, 1-3 ft. down in the depsoit". Weight 34 lbs.

These five products all consisted of dark brown guano in a very moist condition.

No. 6. "Liquid percolating through deposit at sampling site B, 2-3 ft. down". Weight 14 lbs.

This was a brown aqueous liquid.

Results of Examination.

The five guanos were examined with the following results:-

(Table)

	No.1.	No.2.	No.3.	No.4.	No. 5.
	per cent	per cent	percent	per cent	per cent
Moisture on drying at 105°C	78.25	49.38	80.09	77.87	56.66
Additional loss on ignition	19.56	7.25	16.16	20.43	41.64
Ash	2.19	43.37	3.75	1.70	1.70.

Chemical analyses of the materials gave the following results, which are expressed in each case on the guano as received.

		No.1.	No.2.	No.3.	No. 4.	No. 5.
		per cent	per cent	per cent	per cent	per cent
Lime	CaO	0.52	0.25	1.21	0.25	0.13
Magnesia	MgO	0.16	0.13	0.55	0.13	0.11
Phosphoric acid consisting of:-	P_2O_5	0.16	0.09	1.74	0.18	0.09
Portion soluble in 2 per cent citric acid solution ϕ		0.16	0.07	1.60	0.18	0.071
Portion insoluble in 2 per cent citric acid solution		nil	0.02	0.02	nil	0.019
Nitrogen consisting of:-	N	0.808	0.488	0.62	1.03	0.434
Portion present in organic form		0.696	0.429	0.51	0.82	0.428
Portion present as ammonium salts		0.104	0.055	0.04	0.19	nil
Portion present as nitrates		0.008	0.004	0.07	0.02	0.006
ϕ Including phosphoric acid (P_2O_5) soluble in water		0.09	0.02	0.92	0.17	0.064

The liquid (No.6) from sampling site B was found to consist of water containing 0.66 per cent of total solids which consisted largely of soluble phosphates

Remarks.

These guanos are very similar in composition to the two previous samples from Kidney Island which were dealt

dealt with in Imperial Institute report of the 10th March 1914. If the guanos were dried until only 20 per cent of moisture remained, they would contain the amounts of manurial constituents shown in the following table, to which corresponding figures for typical Peruvian guanos are added for purposes of comparison:-

	Phosphoric Acid P_2O_5	Nitrogen N.	Moisture
Falkland Islands.	Per cent	Per cent	Per cent
Present sample No. 1.	0.59	2.97	20
" " " 2.	0.14	1.09	20
" " " 3.	6.99	2.49	20
" " " 4.	0.65	3.73	20
" " " 5.	0.16	0.80	20
Peruvian guanos:-			
Labos de Afuera Is.	16.70	3.60	19.60
Guanape Is.	12.25	11.00	25.88
Ballestas Is.	12.23	12.50	14.87

From these figures it will be seen that the present samples from Kidney Island are very inferior to good Peruvian guanos in respect of the amounts of nitrogen and phosphoric acid which they contain. The water (sample No. 6) percolating through the guano deposit at site B was found to contain soluble phosphates and it seems likely that the inferior quality of the guano may be due to prolonged leaching by rain water.

The present materials, if shipped in the condition in which they were received at the Imperial Institute would in no case be worth as much as £1 per ton delivered in the United Kingdom. If however facilities could be arranged for drying the guano in the Falkland Islands it would be possible to prepare a partially dried material from guanos Nos. 1, 3, 4 and 5

which

which could be used as an organic filling material in the manufacture of compound manures, and would be of somewhat higher value. Guano No. 2 would not be suitable for use in this way as it contains little organic matter.

16th January 1922.

COPY.

No. 1/22.

B

I M P E R I A L I N S T I T U T E.

of the

UNITED KINGDOM, THE COLONIES AND INDIA.

Report on

SAND FROM THE FALKLAND ISLANDS.

The sand from Kidney Island which is the subject of this report was forwarded by the Government Geologist and was received at the Imperial Institute in November 1921.

Description.

The sample weighed 1lb. and consisted of rounded grains of quartz of uniform size, together with very small quantities of garnet, felspar and hornblende. Some of the quartz grains showed inclusions of rutile.

Results of Examination.

The sand was chemically examined with the following results:-

		Per cent.
Silica	SiO_2	97.43
Ferric oxide	Fe_2O_3	0.12
Alumina	Al_2O_3	1.08
Titanium dioxide	TiO_2	0.11
Lime	CaO	0.15
Magnesia	MgO	0.05
Potash	K2O	0.14
Soda	Na_2O	0.22
x Potassium chloride	KCl	0.017
x Sodium chloride	NaCl	0.08
Zirconia	ZrO_2	0.005
Loss on ignition		0.45

x Soluble in water

The

The sand was subjected to mechanical analysis and found to consist of the following portions:-

	Per cent.
Portion retained on a 30-mesh sieve[x]	0.02
" passing a 30-mesh sieve and retained on a 60-mesh sieve	13.68
" " " 60 " " " " " " 90 " "	85.36
" " " 90 " " " " " " 120 " "	0.90
" " " 120 " " "	0.04

[x] i.e. a sieve having 30 meshes to the linear inch.

Remarks.

This sand contains rather too much iron to be used for the manufacture of the best quality of glass. It could however be employed for the production of glassware of medium quality, for which purpose it would be quite satisfactory, in view of its general characters and the large proportion of grains of suitable size.

16th January, 1922.

Copy.

C.F.290/1921.

MINISTRY OF AGRICULTURE AND FISHERIES.

10, WHITEHALL PLACE,

LONDON, S.W.1.

24th February, 1922.

Guano deposits in the Falkland Islands.

Sir,

I am directed to refer to your letter of the 26th January, 1922, No. 2428/1922, and to ask you to be good enough to convey to Mr Secretary Churchill the Minister's thanks for forwarding a copy of Dr H.A. Baker's interesting report on the Penguin Guano deposits of Kidney Island. From a perusal of this report, and of the reports of the Government chemist and the Imperial Institute on the samples taken by Dr Baker, it does not appear that the exploitation of the guano from Kidney Island would be a sound commercial undertaking.

Dr Baker's report is returned herewith.

I am &c.,

(Signed) A.G.A. Dobson.

Assistant Secretary.

The Under Secretary of State,

Colonial Office,

S.W.1.

(6)

GOVERNMENT NOTICE.

No____

Colonial Secretary's Office,
Stanley, Falkland Islands.
15th April, 1922.

His Excellency the Governor directs the publication, for general information, of the appended Reports made by the Imperial Institute on the examination of samples of penguin guano and sand from Kidney Island, East Falkland.

By Command,
H. Honniker-Heaton,
Colonial Secretary.

M.P. 843/21.

(5)

843/21.

5th November, 36.

Sir,

With reference to our conversation regarding samples of sand forwarded to the United Kingdom for analysis, I am directed to forward to you for your information and return a copy of the Final Report on Geological Investigations in the Falkland Islands by H. A. Baker, D.Sc., D.I.C., F.G.S., F.R.C.S., Government Geologist (1920-1922) together with a copy of a Report by the Imperial Institute on a sample of sand received from the Falkland Islands.

I am,

Sir,

Your obedient servant,

Acting Colonial Secretary.

Captain D. W. Roberts,
STANLEY.

(8)

The Falkland Islands Company, Limited.

(INCORPORATED BY ROYAL CHARTER 1851.)

REGISTERED 1902.

AGENTS FOR LLOYDS.

TELEGRAMS "FLEETWING PORTSTANLEY" via RADIO.

Stanley.

5th January 19 37.

Sir,

With regard to your letter No. 843-21 of 5th November last I return herewith the reports enclosed therewith.

I am,

Sir,

Your obedient servant,

Manager.

The Honourable

The Colonial Secretary

Stanley.

LY/DM