DEPARTMENT OF MINES
SOUTH AUSTRALIA

R/B 63/12

REPORT ON GUANO DEPOSITS
SOUTHERN EYRE PENINSULA

by

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PLANS

Plan No.	Title	Scale
66-540	Guano deposits, Southern Eyre Peninsula	1 inch = 4 miles.
	With enlargements of islands (scales, various)	

Rept. Bk. No. 63/12
G.S. No. 3494
D.M. 782/65

20th July, 1966.

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ABSTRACT

Avian guano has been recovered from a number of islands off the coast of Southern Eyre Peninsula. Sampling of remnants of the deposits on several islands of the Sir Joseph Banks Group in Spencer Gulf and of the Brothers in Coffin Bay revealed that no useful reserves of mineable material remain.

INTRODUCTION

Guano, which occurs on a number of islands off the coast of Southern Eyre Peninsula, was recovered for almost two decades at the turn of this century and was applied directly to the soil as an agricultural fertilizer. Available records relating to occurrence and production are very scanty. In South Australia guano is not defined as a mineral; it is under the control of the Department of Lands which leases Crown lands and issues licences for "obtaining and removing therefrom guano or other manure." In practice this has applied principally to avian guano of insular occurrence.

The list of localities that have produced guano and their relative importance is incomplete but licences have at some time been issued over the following islands (Jack, 1919, pp. 23-24) off the West Coast (Goat, Evans, Thomson, Eyre, St. Francis Group, Franklin, Olive, Flinders, Waldegrave, Venus Bay), Coffins Bay (Rocky, The Brothers, Greenly, Hummocks, Curta rocks, Laguanea), Spencer Gulf (Williams, Smith, Hopkins, Lewis, Grindal, Taylor, Bickers, Kangaroo reef, Dessmington reef, Dangerous reef, Louth, Rabbit and of the Sir Joseph Banks Group (including Reevesby,

Wincoby, Marum, Partney, Lusby, Kirkby, Dalby, Blyth, Hareby, Boucaut, Milne, Duffield, English, Sibsey and Rokeby), Wardang, Neptune, Gambier, Wedge, Ward rock, Althorpes), off Kangaroo Island (in Pelican Lagoon, Busby, Beatrice, Casuarina) and off the South East coast (Bowden Rock and Godfrey's Island).

The principal merchant who recovered, shipped and traded in guano appears to have been A.W. Sandford & Co. of Adelaide. The original source of supply was Pelican Lagoon, Kangaroo Island; as these deposits were exhausted attention was given to the islands of Venus Bay, afterwards to the Waldegrave Islands, near Elliston, and later from the islands of the Sir Joseph Banks Group. Working of these deposits ceased prior to World War I when over a period of about 20 years the quantity sold amounted to 15,000 to 20,000 tons. The product is reported to have contained 12 to 20% P_2O_5 with selected materials, higher; "the ammonia contained in same was from 1% to 3%."

During the period 21st-25th March, 1966, the writer was accompanied by N.N. Hiern, M.G. Mason and P.J. Russ in the launch "Aberdeen" on an inspection of the guano deposits on the islands of the Sir Joseph Banks Group, while T.M. Steel visited the Brothers in Coffin Bay. This report summarises the results of these investigations.

GEOLOGICAL SETTING

Southern Eyre Peninsula is underlain by Archaean meta-sediments including a diversity of gneissose, schistose and granitoid rocks, migmatites, quartzites, dolomites, amphibolites and iron formations (Johns, 1961). Pleistocene calcareous aeolianites and their derivatives blanket large areas of the basement adjacent to the southern and western coasts. There are numerous islands which are generally low and rounded, having

elevations similar to that of the adjacent mainland coasts.

The various islands and reefs off the eastern coast are composed essentially of Flinders Group granitoid gneisses of variable composition and texture; the islands of the Sir Joseph Banks Group have been reported on recently in some detail by Nixon (1964) and Blissett and Warne (1965). The crystalline rocks of the basement outcrop in coastal platforms and occasionally at higher levels, being mantled by Quaternary calcareous aeolianite, clays, kunkar and sandy soils. Kunkar formation is probably of late Pleistocene age derived by consolidated and reaggregation of calcium carbonate of calcareous sands (aeolianite) in situ and, in part, of loessial material in soil.

Terns, gulls and petrels (Mother Carey chickens) are the principal sea birds that frequent these islands; Green parrots and Cape Barren geese are less common. Penguins inhabit most islands, while seals were observed on English and Milne Island. The only inhabited bird rookery is on Winceby Island, where at the time of the visit cormorants (shags) were nesting.

The islands carry a sparse vegetation of grasses and low shrubs, including box thorns on several of those visited. There is no surface drainage.

GUANO DEPOSITS

Bickers Islets

These two islands are situated about five miles easterly from Port Lincoln and lie at a distance of about ¼ mile apart between Boston Island and Surfleet Point. The northern island (Mawson Island) is about 500 yards long and up to 300 yards wide and rises to about 50 feet above sea level, the southern one is slightly smaller. Granitic gneisses are exposed round the periphery of the islands while irregular outcrops and scattered granitic boulders protrude through the kunkar which marks the consolidated surface of a thin veneer of aeolianite at higher level

The sandy soil is thin and ranges up to little more than 12 inches in thickness and supports a fair amount and variety of herbage over both islands.

Guano workings are restricted to a small area along the western side of the northern island.

In 1909 Jones (1919) reported that the workings of the Spencer Gulf Fertilizer Company consisted of "two wide open cuts 98ft. apart. In each of these a wide deposit of phosphate rock is exposed. In No. 1 cutting, which is 25ft. wide, and has been carried in on the deposit for a distance of 36ft., the deposit is soft and decomposed, with large boulders of granite distributed through it." The deposit here ranged from only a few inches to 10ft. in thickness.

"In No. 2 cutting, which is 96ft. east of No. 1, the rock phosphate is from 50ft. to 60ft. wide, and from 1ft. to 2ft. thick, thinning out to a few inches on each side. About 20ft. from the face a shaft has been sunk to a depth of 16ft. The rock phosphate passed through in the shaft was much thicker than it is in the cutting."

Production to the end of June 1909 from these workings, totalled 260 tons while a further 60 tons were recovered in the following year. Mineral Claims were last held by F.W. Montague in 1925.

It is apparent that the guano deposit marks the site of a former bird rookery and that the excreta accumulated in a limited area on a granitic pavement. The material marketed appears to have been scraped directly from this surface and from between loose boulders. The shallow openings represent the mined-out open crevices and joints and fractures in granite; these were formerly filled with guano which would have been washed by rainwaters into crevices and fractures in the bedrock (see plates 1, 2 and 3). The deposits accumulated near the contact between granite and the superficial limestone cover so

that fragments of limestone and granite were incorporated into the guano.

Analyses of samples taken by Jones are tables below:-

Sample	N	P_2O_5(%)
Each side No. 1 cutting, limestone and rock phosphate	-	8.0
West " " " " " "	-	16.2
" " " " " "	-	29.4
East " " " " " "	-	11.0
guano, 6 inches thick	0.4	22.2
" " " "	0.7	12.3
from all over face, including limestone	-	9.8
from shaft, 8ft. deep, guano	0.5	16.1
top of shaft, sand and guano	0.5	7.4
north of workings, sand and guano	0.5	4.3
phosphate rock, present workings	-	21.9
" " " "	-	21.1
capping	-	3.7
east end of island, sand and guano	0.7	1.2

During the course of the present survey samples were taken with results as follow:-

Sample	P_2O_5(%)
D1 main workings, hard band 9 inches thick	17.2
D2 " " soft off-white chalky kunker in crevice	0.4
D3 " " soft, red-brown mottled phosphate	24.6
D4 channel sample, 24 inch thick phosphate rock, limestone	4.2
D5 off-white kunker, near surface above D3	0.1
D6 Hard brown guano, east of main pit.	19.0
D7 Kunker, 20 yards north of main pit.	0.7

There is no record of phosphate production on Bickers South Island; samples of surface exposures of limestone (1.9% P_2O_5) and of limestone and guano (5.3% P_2O_5) were recorded by Jones (1919).

Seven samples of kunkar and aeolianite taken during the present survey from widely separated localities contained the following:

BS1	1.5%	P_2O_5
BS2	0.8	"
BS3	0.5	"
BS4	1.4	"
BS5	1.0	"
BS6	0.3	"
BS7	0.2	"

The Brothers

William Morgan was granted a licence in about 1900 to recover phosphate from the Brothers (formerly known as the "guano islands") which are situated in Coffin Bay, one mile west from the southwestern extremity of Horse Peninsula. There are two islands, the larger and most westerly being 7 chains long, 4 chains wide and rising 40 feet above sea level and the smaller easterly one being 2 chains long, 1 chain wide, and rising about 15 feet above sea level.

The workings on the western end of the larger island were inspected in 1902 by George, who reported the occurrence of a small deposit of fossil-bones and bone breccia in an eroded cave. "Although somewhat fragmentary, the fossil bones are in a good state of preservation ..... consolidated by calcareous matter into breccia, while the limestone rock in the immediate vicinity ..... is more or less phosphatic. On the north side of the island..... several small crevices in the limestone rock

..... are partly filled with rock phosphate.

"A considerable quantity of guano mixed with sand, broken up sea shells, and a little vegetable matter has been removed from the larger island for use as manure, and in collecting this the holes and cavities in the limestone rock have been followed down and this material obtained to a depth of 6ft. or 7ft. Bone breccia has been met with at a depth of 10ft."

"Samples of bone breccia from W. end of the island gave 25.1% and 27.1% P_2O_5; samples of rock phosphate from N. side of the island gave 25.7% and 31.4% P_2O_5; samples of the limestone rock gave 1.0% and 2.0% P_2O_5."

On 28th March, 1966, geologist T.H. Steel inspected these deposits and reported that there is little soil present, the islands being composed of aeolianite throughout. Solution cavities ranging from six inches to almost 3ft. in diameter are ubiquitous and into these have been washed guano soil and sea shells a sample of which contained 16.5% P_2O_5.

Rock from the eroded cave has been almost entirely removed; a sample of the fossil bone breccia (6 inches thick on the old cave floor) contained 1.7% P_2O_5. A sample of adjacent limestone contained 0.4% P_2O_5.

No phosphate rock capable of exploitation remains.

Sibsey Island

Sibsey Island in the Sir Joseph Banks Group, rises almost 100ft., from deep water and is 1,000 yards in length and varies from 200 yds. to 550 yds. in width. Gneissic granite outcrops over much of the island; there is very little kunkar and it is practically devoid of soil. The guano appears to have been 12 inches to 24 inches in thickness and to have incorporated limestone and granite fragments.

Guano which accumulated on the northern slopes of the

island over an area 250 yards x 100 yards was worked prior to World War I by A.W. Sandford and Co. Ltd; relics of their operations remain. It is apparent that only small reserves of phosphatic material remain. A number of samples were taken from and adjacent to the abandoned workings and submitted for partial analyses; the results are tabled below:-

Sample No.	Remarks	P_2O_5 (%)
S.1	Mottled white-brown phosphate (6 inches thick)	17.0
S.2	Soft white chalky phosphatic limestone (18 inches thick); overlies sheet kunkar	3.4
S.3	Soil and guano (12 inches); overlies sheet kunkar	22.1
S.4	Phosphatic sheet kunkar from floor of pit	9.0
S.5	" " " " " " "	4.5
S.6	" " " " " " "	15.6
S.7	" " " " " " "	3.6
S.8	Soil with guano (6 inches).	22.0
S.9	Phosphatic kunkar (6 inches) from below S.8	14.8
S.10	Soft phosphatic limestone, below S.9	3.6
S.11	Guano on dump.	19.8
S.12	" " "	16.3
S.13	Soil and excreta from bird burrow	14.8
S.14	Soil and guano from northern slope of island	5.7

The nearby English Island, seven acres in area and rising about 40ft. above sea level, is devoid of soil and vegetation. It is inhabited by sea birds, especially shags, and their white excreta covers most of the outcropping granitic rocks.

Milne Island

On the easternmost tip of Milne Island a sand spit which extends for almost 100 yards from the main island mass is covered in part by relatively fresh guano admixed with sand and plant fibre. A sample taken by Nixon (1964) contained 10.3% P_2O_5 0.2% Al_2O_3 and 0.5% Fe_2O_3.

Two samples of the guano and one of kunkar which caps the island proper were recently taken; on analysis these showed the following:-

Sample M.1	0 - 6 inches, guano and sand	9.1% P_2O_5
" M.2	6 -18 inches, guano, sand; plant fibre.	3.3 " "
" M.3	Kunkar (separated by red-brown mottled clays from granitic basement.)	0.2 " "

Marum Island

Marum Island is almost 500 yards long and up to 300 yards in width; it is flat topped and rises little more than 20ft. above sea level. Granite gneisses comprise a continuous bedrock apron about the margin of the island, and this is capped by limestone which includes relatively soft to strongly consolidated calcareous sands (1 to 3 feet in thickness) at the base, passing up into harder nodular kunkar (1 to 5 feet) which gives way to hard sheet kunkar (3 to 6 feet in thickness). Separating the crystalline basement rocks from the limestones, discontinuous sandy clay lenses are occasionally present while rounded granite cobbles are common at this level.

On the tableland above the kunkar there is a thin development of sandy soil (6 inches to 18 inches) which supports "pig face and occasional shrubs; the soil is riddled with bird burrows.

Records disclose that the Penguin Guano Co. Ltd. were given the sole rights for guano production in 1898 on Marum and a number of other islands nearby. The lease was cancelled in 1903 and one half the licence fee refunded because there proved to be no guano commercially available from Partney, Lusby, Kirkby, Dalby and Hareby Islands.

When inspected by Jones in 1909, the principal workings of The Spencer's Gulf Fertilizer Company were situated on the southeastern end of Marum Island and consisted of "long trenches 5ft. wide and from 1ft. to 3ft. deep. There are a great number of

these trenches north and south, with others intersecting them east and west, embracing an area operated on of about 5 chains long by 2½ chains wide. Eighty tons of guano, which contained 13.8% P_2O_5, have been marketed from these workings, and ..... 35 tons of the same percentage material ..... ready to send away, and, ... a considerable amount of the crude material, which was taken out of the trenches, stacked on the surface and which should, when screened, and the dirt taken out of it, yield a fair quantity of marketable guano. In the eastern part of the workings a stratum of rock phosphate is exposed for a length of 40ft., varying in thickness from 1ft. to 3ft., and thinning out to nothing on both sides." Recorded production totalled 150 tons in 1909 and 60 tons in 1910.

Jones estimated that reserves of 7,000 tons might be available "if the whole deposit on the island proves of marketable value." He noted that mining operations had disclosed two caves "both of which were full of sand and guano, consequently their extent could not be determined. At the north-east end of the island there is a large cave fully 100ft. long by 40ft. wide and from 3ft. to 4ft. high, which appears to contain a fair quantity of guano". Samples taken at this time from the workings and elsewhere gave the following results:-

Remarks	N(%)	P_2O_5 (%)
Rock phosphate, 3ft. thick	-	16.1
Limestone capping, 2ft. thick	-	1.6
Limestone and rock phosphate	-	13.6
Guano, 1-2ft. thick	0.2	13.0
Guano and sand, 1ft. thick	0.8	7.8
Guano, south-east end, 1ft. thick	0.7	21.4
Guano, centre of workings, 1ft.6ins. thick	0.4	11.0
Guano, centre of workings, 1ft. thick	0.6	15.4
Guano, north-west end, 1ft. thick	0.8	13.2
Guano, east cave in workings	0.4	12.1
Guano, south cave in workings	1.3	12.2
Limestone capping, 5 chs. north-west of workings	-	0.6
Guano and sand, 15 chs. north-west of main surface workings, 1ft. thick	0.3	2.9
Guano and sand from large cave north-west of island	0.6	7.5

The present survey revealed that further mining took place from caves round the periphery of the island, below the layered and nodular kunkar, following the visit of Jones and before 1918 when the leases were cancelled. There is an almost continuous series of caves about the island, some with connections to the surface by way of shafts and/or sinkholes. The caves are seldom more than 3 ft. in height and extend under the low cliffs for up to 40 ft.; the floors of these comprise pavements of granitic gneiss (plate 5). Pillars of rock were occasionally left to support the roof while elsewhere some timber was used.

It would appear that guano and sand was washed from a former bird rookery, established perhaps at the southeastern end of the island, into sink holes and cavities which had been developed in the underlying calcareous materials immediately over granites. It is likely that many caves are related to present day sea erosion, sculptured by wave action on the peripheral granite platform, having no bearing on the accumulation of phosphate. Almost all would be influenced by

storm waves so that openings resulting from phosphate mining operations with remnants of guano scoured out have only an occasional pillar or roof prop to distinguish them.

The area outlined by the old workings (plate 4) appears to mark the limits of the surface deposits though undisclosed accumulations in cavities may remain.

Samples cut from a section exposed in the surface workings at the southeastern end of the island (locality M1) were submitted for analysis - the results follow:

Sample No.	Depth	Remarks	P_2O_5(%)
M1	surface - 3 ins.	Dark brown soil, sand and guano	9.5
	3 ins. -15 ins.	phosphatic sand	7.5
	15 ins. -31 ins.	soft earthy guano with plant fibres	14.5
	31 ins. -48 ins.	mottled white-brown guano	11.6
	48 ins. -49 ins.	hard massive sheet kunkar	0.4

The incidence of hard kunkar at locality M2 and at other sites foiled an attempt to sample the Quaternary section on the tableland (plate 6). Other samples were taken of the limestone from the cliffs and the caves at the margins of the island - details are as below:

Sample No.		Remarks	P_2O_5(%)
M2	surface - 1 ft.	brown sandy soil	0.8
	1 ft.- 2 ft.	nodular kunkar	0.3
	2 ft.- 2 ft.6ins.	massive kunkar	0.5
M3	surface - 15 ins.	kunkar	1.0
	15 ins.-30 ins.	"	0.1
M4	surface - 36 ins.	"	0.3
	36 ins.-42 ins.	"	0.2
	42 ins.-52 ins.	"	0.2
M5	surface - 30 ins.	"	1.4
	30 ins.-40 ins.	"	0.4
M6	surface - 24 ins.	"	0.2
	24 ins.-42 ins.	"	0.1
M7	5 ft. - 6 ft.	Kunkar in cave, overlying granite.	0.1
M8	surface - 2 ft.	Kunkar in cave workings overlying granite.	0.4
	2 ft. - 4 ft.		0.3

Sample No.	Remarks	P_2O_5(%)
M9	5 ft. -6ft.6ins. nodular kunkar in cave (under hard massive layer) and overlying granite.	0.1
M10	2 ft. guano in cavern workings, floor of granite; cave roof comprises 8 ft. of cemented nodular kunkar.	9.3
M11	Chalky kunkar, overlying granite; wall of cavity overlain by 8 ft. kunkar; 2ft.-3ft. guano mined out.	0.2
M12	3 ft. nodular kunkar under 4 ft. massive kunkar; guano exhausted from cave workings	0.1
M13	1 ft. Nodular kunkar	0.2
M14	2 ft. chalky limestone overlying granite	0.1
M15	surface - 6 inches kunkar	0.2
	6 ins. - 36 ins. sandy limestone	0.1
	36 ins. - 72 ins. " "	0.1
	72 ins. - 78 ins. " "	0.1
	78 ins. -108 ins. chalky "	0.1

Winceby Island

Winceby Island, the northernmost of the Sir Joseph Banks Group, is approximately 1 mile in length, 400 yards in width and rises to about 50 ft. above the sea; a lighthouse is located at the summit. The island supports the only inhabited bird rookery in the Group and at the time of the inspection shags were nesting (plates 7 and 8) - numerous gulls also frequent the island. Nests with eggs and young were closely grouped on the ground and in low shrubs on the northeastern end of the island where foul smelling excreta containing about 14% P_2O_5 is accumulating on the ground and is coated over granite outcrops to seaward.

Granite which is exposed round the periphery is overlain by kunkar while brown sandy loam forms a thin but extensive cover over most of the island. A disused shag rookery covering an area 250 yds. x 50 yds. on the north-eastern end of the island carries a luxuriant growth of "ice plant"; the deposit is up to 2 ft. in thickness. A sample of this material contained 11.5% P_2O_5,

0.6% N while a sample of soil 12 inches thick taken from near the centre of the island contained 4.0% P_2O_5, 0.5% N.

Shallow cave workings in kunkar were sampled near the southeastern margin of Winceby Island (localities W1, W2 and W3) and each showed a P_2O_5 content of 0.1%.

CONCLUSIONS

Guano deposits which were exploited some 50 years ago on several islands off the southern coast of Eyre Peninsula produced small tonnages of low grade fertilizer. No useful reserves remain.

They appear to mark the former nesting sites of colonies of sea-birds and only one island is now inhabited by shags; the excreta of other birds which nest in burrows and on the ground make smaller contributions.

Accumulations of guano on Sibsey Island were restricted to an area near the northern end of the Island where there was some replacement of the kunkar by phosphate. Elsewhere the substitution of PO_4''' for CO_3'' was not effected.

On Harum, Winceby and the Brothers islands the generally small deposits were preserved in sinkholes in Pleistocene limestones while at Dickers Islet they accumulated in crevices in the underlying granite.

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20/7/66

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ISLAND 16346

Plate 1. Abandoned guano workings, Bickers Islet (north). Guano was scraped from surface (foreground) and recovered from crevices in granitic basement (quarry).

ISLAND 16347

Plate 2. Remnants of guano separate granite boulders, Bickers Islet northern workings (see plate 3). Granite in background veneered by aeolianite.

ISLAND 16348

Plate 3. Remnants of guano occupying crevices between granite boulders. Layer, 9 inches thick, beyond hammer contains 17.2% P_2O_5 while lighter coloured material with limestone (24 inches thick) at lower right contains 4.2% P_2O_5.

ISLAND 16349

Plate 4. Old surface workings, Marum Island. Kunkar is exposed in floor of pits. Partney and Reevesby Islands in background.

ISLAND 16350

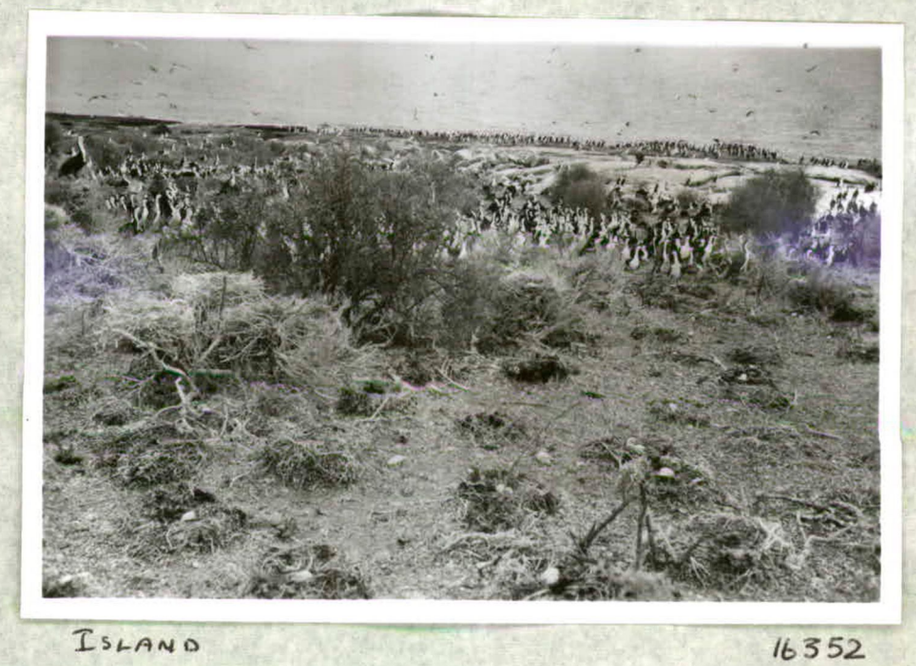
Plate 5. Cave workings, western side of Marum Island. Up to 3 ft. of guano (9.5% P_2O_5) has been mined from cave infilling which extends back to 40 feet under kunkar shelf. Granite pavement in foreground.

ISLAND 15021

Plate 6. Drilling operations using "Whacker" hammer, Marum Island. Old surface workings in background near the cliff edge.

ISLAND 16351

Plate 7.

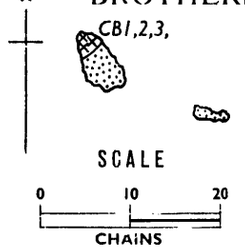


ISLAND 16352

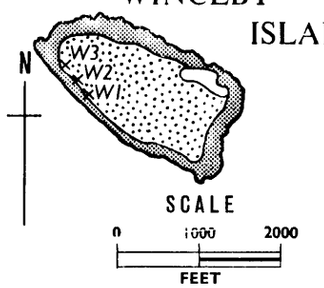
Plate 8

Plates 7 and 8. Shag rookery, northeastern end of Winceby Island; granite pavement margins shore in background.

THE BROTHERS



WINCEBY ISLAND



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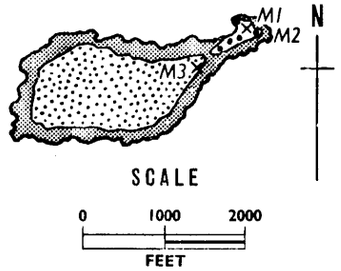


LEGEND (INSETS)

QUATERNARY

Guano, admixed with sand etc. _____

Sandy soil on kunkar _____

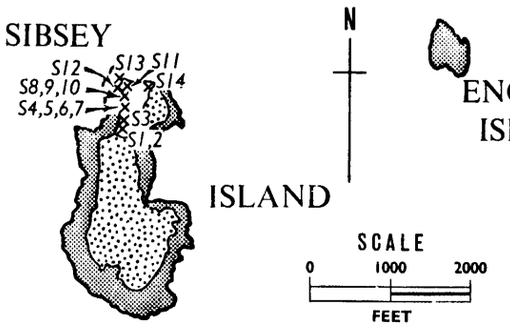
Sand, gravel _____

OLDER PRECAMBRIAN

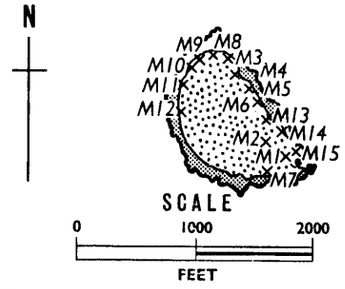
Granite Gneiss etc. _____

Sample localities _____ ×M15

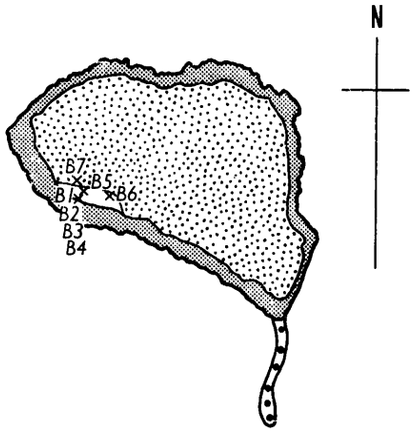
SIBSEY ISLAND

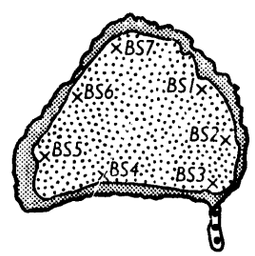


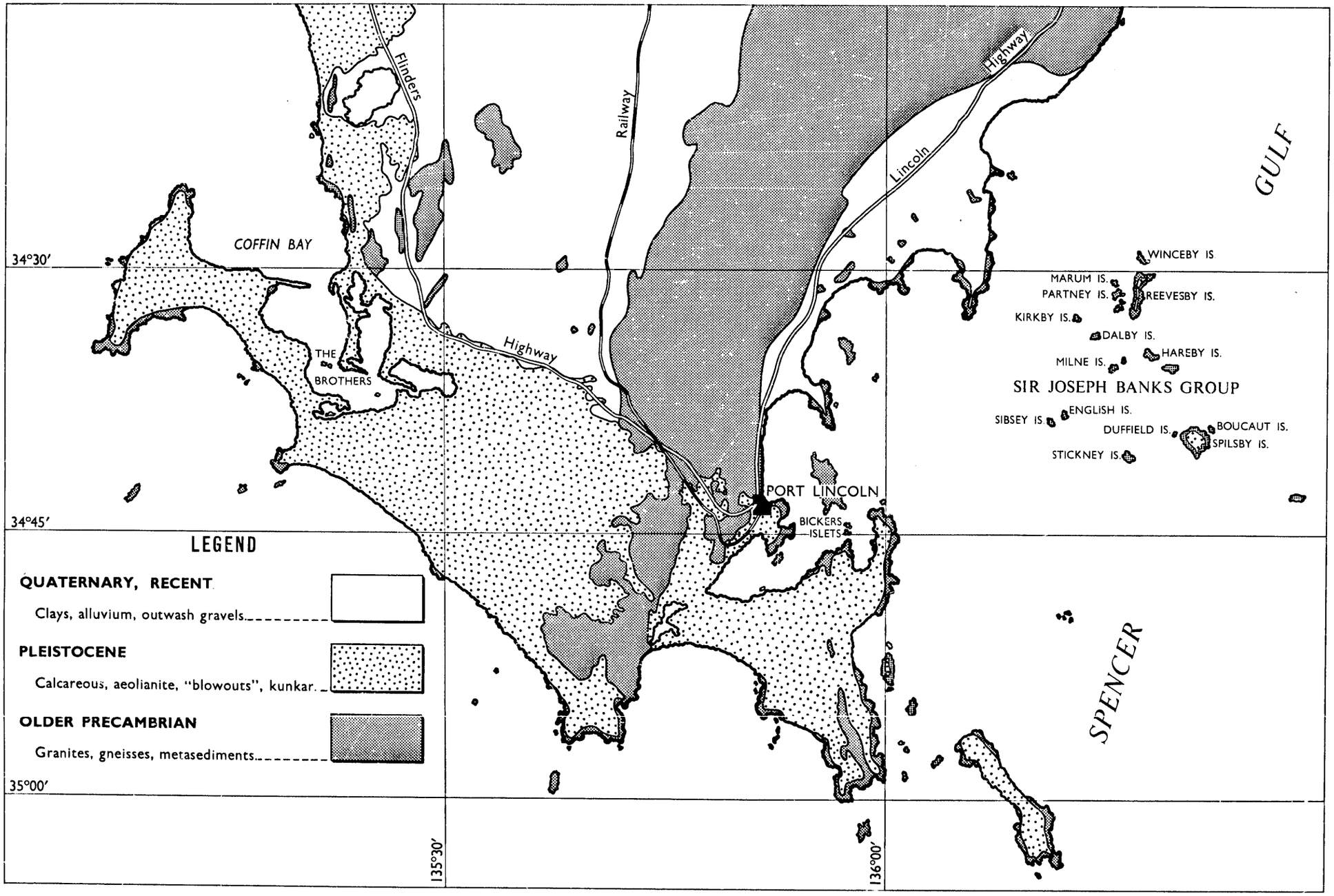
MARUM ISLAND



BICKERS ISLETS







LEGEND

QUATERNARY, RECENT

Clays, alluvium, outwash gravels _____

PLEISTOCENE

Calcareous, aeolianite, "blowouts", kunkar. _____

OLDER PRECAMBRIAN

Granites, gneisses, metasediments _____

SCALE

MILES 5 0 5 10 15 20 25 MILES

66-540

R. K. Johns Supervising Geologist

S.A. Dept. of Mines

SCALE IN MILES 5 0 5 10 15 20

SCALE IN KILOMETRES 10 0 10 20 30

20