Rept. Bk. No. 59/126
G.S. No. 3022
D.M. 2070/63

DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGI CAL RECONNAISSANCE

OF THE

SIR JOSEPH BANKS GROUP OF ISLANDS.

by

L. G. Nixon
Senior Geologist

DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL RECONNAISSANCE OF THE SIR JOSEPH BANKS GROUP OF ISLANDS

by

L. G. Nixon
Senior Geologist

CONTENTS

Plan No.	Title	Scale
L64-204	Islands of the Sir Joseph Banks Group General Geological Map.	1250 ft. to 1 inch
S-3960	Sir Joseph Banks Group of Islands Diagrammatic Composite cross Section through Younger Sediments.	
64-1027	Density Diagrams of Structural Features Sir Joseph Banks Group of Islands. Spencer Gulf.	
S3970	Sir Joseph Banks Group of Islands, Sand Sieve Analysis.	

Rept. Bk. No. 59/126
G.S. No. 3022
D.M. 2070/63

20th November, 1964.

Rept.Bk.No. 59/126
G.S.No. 3022
D.M. 2070/63

DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL RECONNAISSANCE OF THE SIR JOSEPH BANKS ISLANDS SPENCER GULF, SOUTH AUSTRALIA

ABSTRACT

The Sir Joseph Banks Group of islands lies 30 miles east of Port Lincoln in Spencer Gulf. The oldest rocks exposed constitute a gneissic complex intruded by younger microgranites, amphibolites, pegmatites and quartz veins. Unconformably overlying the gneissic complex is a series of younger sediments of Cainozoic age.

Molybdenite and scheelite occur on the southern coast of Spilsby Island. A continuous chip sample taken from the mineralised zone revealed anomalous values for molybdenite. The highest value averaged over 100 feet was 300 parts per million. The molybdenite is not of economic grade but the presence of scheelite warrants further investigation. A recommendation is therefore made for the islands to be examined using ultra-violet lamps.

No deposits of economic significance were found during the reconnaissance.

INTRODUCTION

The islands of the Sir Joseph Banks group lie between latitudes 34°27'S and 34°42'S and between longitudes 136°10'E and 136°25'E, approximately 30 miles east of Port Lincoln, on Spencer Gulf. There are about 20 islands and reefs extending for a length of 14 miles from north to south over a width of 11 miles from east to west within an area of approximately 154 square miles. The land area of all the islands combined is just over 4½ square miles, the largest island in the group is Spilsby which is just over 1000 acres, the smallest island is English which is about 7 acres.

The average annual rainfall is between 15 and 19 inches and most of this falls between April and October.

The only inhabitant of the group is Mr. P. Jacobs who grazes sheep on Spilsby Island. None of the other islands was being used for agricultural purposes at the time of the reconnaissance.

The islands were discovered in 1802 by Matthew Flinders during a survey of the southern coast of Australia in

the sloop "Investigator" of 344 tons. He named them after the President of the Royal Society "to whose exertion and favour the voyage was so indebted". He also named various islands after Lincolnshire villages near one of which Sir Joseph Banks lived in Reevesby Abbey.

Howchin visited Reevesby Island in 1907 but did not study the geology or make any report.

In 1909 H. Jones, an Inspector of Mines, visited Marum Island and reported on the phosphate deposit there. At that time the island was the property of the Spencers Gulf Fertilizer Company.

Members of the McCoy Society spent approximately 2 months on the islands in 1936, investigating the geology, botany and zoology of the group, their main efforts being confined to Reevesby.

Langton Island was visited by the State Mining Engineer in 1942, following the discovery of wolfram on the island by Mr. E. Follett of Pt. Lincoln. In the same year E.P. Utting of B.H.P. inspected the wolfram deposit also, and reported that molybdenite was rumoured to occur on Spilsby Island.

In August 1963, approximately 40 members of Scotch College Expeditions Club, led by the Headmaster Mr. Fisher assisted by the Housemaster, Mr. Stevenson, explored and mapped portion of Spilsby Island. In the course of a traverse along the south-eastern coast, some club members discovered molybdenite in granodiorite blocks just above sea level. Following this find, the Department of Mines chartered the Fisheries Research Vessel "Investigator" and made a brief inspection and appraisal of the molybdenite deposit and a rapid reconnaissance of all the larger islands in the group between 19th - 24th November, 1963. Altogether sixteen islands were examined in this period. The objectives of this investigation were to assess the economic potential of the molybdenite deposit at the southern end of Spilsby Island and to search for extension to the deposit, to explore for other mineral deposits which may be of economic

importance, and to map the general geological features of the group of islands.

The Department of Mines field party comprised three geologists and one technical assistant operating from the "Investigator". For fieldwork the party was split into two groups; where the islands were relatively small and close together each party examined an entire island; where the islands were relatively large i.e. Spilsby and Reevesby, both parties landed at the same point and traversed along the coastal strip in opposite directions arranging for a pick up at some pre-arranged spot. Landings were made from motorpowered dinghies.

The best available air photographs of the area at the time were on a scale of just under one inch to 1 mile. No effective mapping could be done on these photographs which were used only for locality identification. Tape and compass traverses were carried out from the positions identified on the air photo. These spots were later transferred to photographs enlarged 4 times: the appended map was compiled from the enlargements.

Appendix I is included for use with the sample locality plan. The first column lists the islands, the second column shows the sample locality numbers which are plotted on the sample locality plan appended to this report (plan no. L64-204), the third column lists the field numbers for samples from the locality. The remaining columns give the laboratory numbers assigned to the sample and indicate the types of investigations carried out.

The writer was assisted in the field by Messrs. K.R. Warne, S. Robson, Geologists, and J. Johnson, Technical Assistant. Dr. N. Ludbrook (Senior Palaeontologist) examined the clay, soil and kunkar samples for fossils. J. Firman offered helpful suggestions in connection with the origins and ages of the clay and kunkar horizons.

The ready co-operation of the Director and members of the Department of Fisheries and Game is acknowledged. Special

thanks are due to the Master and crew of the "Investigator" who gave us cheerful co-operation and willing help whenever it was required.

REFERENCES

Dewhurst, I., 1938. Reports of the expedition of the McCoy Society for field investigations and research. Proc. Roy. Soc. Vic. Vol. 50, No. 2. Vol. 51, No. 1.

Jack, R.L., 1914. The Geology of the County of Jervois and of portions of the Counties of Buxton and York, with Special Reference to Underground Water Supplies. Geol. Surv. Bul. No. 3.

Jack, R.L., 1919. The Phosphate Deposits of South Australia. Bul. 7, 43-44.

Johns, R.K., 1961. Geology and Mineral Resources of Southern Eyre Peninsula. Geol. Survey S.Aust. Bull. 37.

Tilley, C.E., 1921. The granite-gneisses of southern Eyre Peninsula (South Australia) and their associated amphibolites. Quart. Jour. Geol. Soc. Lond.

Woolnough, W.G., 1927. Presidential Address. Journ. Roy. Soc. N.S.W. 61, 1-53.

Wopfner, H., 1964. Tertiary duricrust profile on Upper Proterozoic sediments, Granite Downs area. Quart. geol. Notes Geol. Surv. S.Aust. No. 11.

PHYSIOGRAPHY

All the islands are relatively low, none of them reaching 200 ft. in height above sea level. The larger islands have gently undulating topography, the smaller ones are either relatively flat or gently domed. There are no creeks and no natural accumulations of fresh surface water. Dams have been constructed on Spilsby, which provide water for stock for a limited period. A bore near the house on Spilsby provides fresh water for household purposes and two wells on Reevesby are reported to yield a supply of brackish water.

Rock is well exposed along the coasts between high and low water marks, but outcrops are generally poor inland where the rock is obscured by kunkar, or brown sandy soil. The outline of the coast is controlled by such geological features as the nature of the rock, the depth and degree of weathering, the direction of joints and foliation planes.

Where granite is kaolinised the coast is irregular and usually cut back to form small bays. The exposed rock is rugged and reef like and under cutting is common. (See photos 1 and 2 Appendix II). It is noticeable that in these areas there is frequently a fairly thick development of green and red mottled clays capped by kunkar, and low cliffs may be formed (see photo No. 3 appendix II). Amphibolites in granites and gneisses are more easily eroded than the enclosing rock and tend to form channels; aplites on the other hand resist erosion and usually form low ridges.

Well developed beaches and sand dunes tend to occur together and are better developed towards the northwestern sides of the Islands, this feature is well illustrated at Spilsby. Their location might be related to the prevailing wind and current directions. Some of the dunes reach heights estimated at 20 feet. At the present time they are fixed by sea grasses and low shrubs, but there is movement along their extremities.

Mesambryanthemum flourishes in the more open parts of most of the islands together with grasses.

REGIONAL GEOLOGY

The rocks on the islands belong to two ages, each with distinctive rock assemblages. The older rocks include gneisses, granites, microgranites, amphibolites, quartz veins and lenses, equated with the Flinders Group (Johns 1961). The absolute age or ages of these rocks is unknown; field relationships indicate a complex history which would require much detailed mapping to decipher.

Notable features are the absence of amphibolites on

Spilsby, Duffield and Boucaut islands and their abundance on Reevesby and the surrounding islands, also the relative abundance of quartz veins and lenses at the southern end of Spilsby.

The rock assemblages do not contain minerals diagnostic of a particular metamorphic facies. In the petrological report appended (see appendix III) it is suggested that the rocks belong to the amphibolite or granulite facies.

It is notable that the only granodiorite from Dalby (J.J. Dalby 2) and the granodiorite from Spilsby are both distinctly richer in sulphide minerals than other rock types and that these rock types have not been recorded from Eyre Peninsula.

Pinkish grey gneisses with interlayered amphibolites are intruded by basic dykes and later by granites, microgranites, pegmatites and quartz veins. Frequently younger intrusives cross-cut and offset older amphibolites and microgranites. The pegmatites have a preferred orientation along an east-west direction whereas the obvious amphibolite dykes tend to be oriented in a north-northwesterly direction.

Small crenulations and minor folds have preferred orientations plunging flatly towards the north east and south west. The accompanying contour diagram, (fig. 3) is constructed from approximately twenty-two fold plunge directions. This number is not sufficient to be a reliable guide, but they give an indication of the probable orientation of a major fold pattern.

Approximately one hundred and forty joint directions have been recorded, the majority of these are steep, the dips ranging from 60° to vertical. The dominant system is orientated along a bearing of N58°E with steep dips either towards the north-west or south-east as shown on the accompanying contour diagram. (fig. 2).

Unconformably overlying the kaolinised granites and gneisses is a sequence of relatively young sediments of Cenozoic age commencing with silcrete usually grading up to a ferruginous zone which is overlain in turn by a sequence of mottled red and

green clays (See photos No. 3 and 4 Appendix II). Kunkar usually caps the red and green mottled clay. The contact between the kunkar and clay, where seen, is undulating. Overlying the kunkar is a pale brown to greyish brown sandy and slightly calcareous loam which forms a relatively thin but extensive soil cover over the island and supports most of the vegetation. In places, the migrating extremities of the white dunes cover this soil. Coxiella limestone underlies the dunes on Reevesby Island. Fig. 1 outlines the main relationships of the various rock types.

Silcrete occurs at the base of the younger sediments. It immediately overlies kaolinised granite and granite gneiss which it strongly resembles. The rock types are difficult to distinguish in the field although in some places the granite can be recognised by the faint outlines of the kaolinised feldspar crystals. Contact between the rock types is very irregular. (See photo No. 5 appendix II).

Silcrete outcrop is usually very jagged and reef like; usually it is an off-white to greyish white colour, with a fine clayey matrix, containing clear quartz crystals. In hand specimen it has a definite terrazzo appearance. The total thickness of this unit is unknown, but where found on the east coast of Spilsby it may be up to seven feet thick.

Although the writer only noted its occurrence at one place on Spilsby Island, petrological reports reveal that it also occurs at Roxby and probably elsewhere. For petrological descriptions see appended petrological reports P555/63, L.N. Spilsby I. T.S. 13293 and P562/63. L.N. Roxby 2. T.S. 13299. The petrologist's remarks regarding specimen P.555/63. L.N. Spilsby I. T.S. 13293 which bears a marked resemblance to silcretes previously described from Oodnadatta and Warramboo, is noteworthy because of the possible time significance and its use as a morpho-stratigraphic unit, (Wopfner 1964).

The locations for these samples are marked on the accompanying Map No. L64-204. Refer to Appendix I for sample

locality number.

The contact between the silcrete and overlying clays, which usually occurs in a ferruginous zone, is approximately 8 feet above the granite at Spilsby. The clays which are up to 16' thick are a mottled red and grey-green colour with polyhedral cracks, slightly sandy and unfossiliferous. The dominant clay mineral is illite with sub dominant kaolin; the sand grains, which are angular to sub rounded consist of 80-85% quartz, 15-20% feldspar and 1-5% opaques. In samples from the pallid zone, kaolin tends to be the dominant clay mineral. Details of the petrological work on these samples are contained in Appendix III attached to this report. Near the top of the clay zone at least one narrow lime rich layer about 2 inches thick occurs and frequently there is a second located about 2 feet beneath the bottom of the kunkar.

The contact between the clay and the overlying kunkar is undulating and well defined. In general the kunkar shows the same profile on all the islands although it may vary in thickness from 6 ft. to 10 ft. The lower one third is usually a relatively soft pinkish white nodular kunkar overlain by another one third of hard pinkish white nodular kunkar topped with a hard layered kunkar band. On Partney Island dark grey limestone nodules occur in the kunkar. A sample submitted for petrological examination (see petrological report P530/63. L.N. Partney I. T.S. 13135) revealed abundant microfossils. These were identified by Dr. Ludbrook as foraminifera of the family Miliolidae and echinoderm spines. Unfortunately the fossils were not diagnostic of any particular age and are therefore of limited value. Usually the kunkar lies directly on gneiss; Photo No. 10 in places it is depressed below sea level.

Overlying the kunkar is a narrow layer of red brown clay followed by a pale brown to greyish brown loam composed of quartz, feldspar, opaque minerals, fish bones and both marine and freshwater shells of Recent age. The grains are mostly subrounded, quartz forms about 85 percent of the sand fraction,

feldspar 14 per cent and opaques 1 per cent. The sieve analyses show average grain size to be much smaller than the dune sand being mostly in the silt range and the sorting is poorer; a cumulative curve of the sieve analysis of this material is plotted and appended. On Roxby Island at least 7 feet of loam overlies the kunkar but it is very variable in thickness and is non existent on parts of some islands.

White weathered coxiella limestone outcrops near the beach a short distance to the north of the hut on Reevesby, the rock is composed almost entirely of this small gastropod. These fossils are of no diagnostic value since they were capable of living in saline, brackish or fresh water and have a range extending over the Tertiary and Recent. Their presence probably indicates the existence of a salt lake or marginal swamp.

White sand dunes found on the north-western coast of Spilsby, around Blyth and in several areas on Reevesby, are the youngest sediments on the islands, and overlap every other type of deposit.

Beach sand samples were taken from Roxby, Hareby, Partney and Reevesby islands, and submitted for spectrographic analysis, sieve analysis and petrological examination. Sieve analysis showed the sand to be well sorted with concentrations of the heavy minerals in the + 300 + 200 + 150 mesh fractions. Cumulative curves of the sieve analysis are shown in fig. 9 appended. Petrological examination of these samples revealed that quartz comprises between 61 and 87 percent of the sand, feldspar 7-18 percent, opaque minerals 5-14 percent, a noteworthy feature being the presence of a pyrope-rich garnet. in the sand The more common pink garnet, though common on the mainland was not found in rock samples from the islands.

No economically significant mineral deposit was found on any of the islands although ore minerals have been identified from the following:-

(i) Spilsby island. On the southern and southeastern coastal strip, molybdenite and scheelite are widespread in

granite, and in microgranites and quartz veins. In addition ilmenite, cassiterite, chalcopyrite, covellite, chalcocite, galena, pyrite and marcasite have been identified in samples of granodiorite.

(ii) Langton Island (also known as Milne Island). 411 lbs. of wolfram was obtained between 1942 and 1944.

(iii) Dalby Island. Chalcopyrite, sphalerite and marcasite in a granodioritic rock.

(iv) Hareby Island. Wolfram, tungstite, scheelite and lead in quartz lenses.

(v) Reevesby. Chalcopyrite is found at the southern end of the island in amphibolite.

The phosphate deposit in Marum Island was not examined. Jones who visited it in June 1909 reported that both guano and rock phosphate were being exploited from the southeastern end. The guano is of recent age; the rock phosphate is thought to be formed by the replacement of the carbonic acid by phosphoric acid derived from guano and acting upon calcium carbonate in the underlying kunkar.

Production of phosphate is estimated at 80 tons of guano containing 30% tricalcic phosphate.

At least six relative changes in sea level during the Cenozoic can be inferred either from existing physiographic features or from geological data. For the purposes of this report these changes are referred to as transgressions and regressions. There is a possibility that the kunkar was warped after its formation but no evidence to support this idea was found.

The oldest level is thought to be early Tertiary and below the present base of the silcrete which is just below present sea level. It is suggested that there was a regression at the time and a period of erosion and deep weathering prevailed. With transgression, remnants of relatively deeper pockets of weathering were scoured out. Later these pockets were filled with kaolin and quartz derived from the adjacent kaolinised granite. After partial infilling of the weathered pockets,

silicification of the kaolin was effected.

Probably there was a time break and a climatic change which produced the laterite overlying the silcrete and granite. No evidence of infilling during the period of lateritisation was found.

After the formation of laterite a more pluvial period may have prevailed during which time clays and sand were washed into hollows covering the silcrete.

A transgression at about this time partly covered the silcrete. Evidence of this transgression can be seen on Spilsby and Duffield Islands where the remnants of wave cut platforms were found (See photo [redacted]11 Appendix II).

A later regression followed during which kunkar developed over the prevailing surface. On Spilsby island this surface slopes towards the northwest. Again the sea transgressed and covered the kunkar on the northern coast of Spilsby and on the north-western corner of Partney Island. The kunkar is now below present day sea level.

There may have been other levels which have not been included in the sequence because of lack of data. Among these are (i) The level at which the coxiella limestone is found on Reevesby Island about 5 ft. or 6 ft. above present sea level. (ii) The level from which the black limestone nodule containing milliods and echinoderm spines was obtained which is now 10 ft. above sea level.

The structural features mapped were gneissosity, layering, feldspar orientation, microgranite, pegmatite and amphibolite dykes, joints, mylonite zones, the plunges of tabular feldspar crystals, amphibolite xenoliths and fold axes. Some of these structures have been plotted on Lambert equal area nets (Schmidt nets) and presented as density diagrams. (See figs. 2 to 7).

The most obvious feature both on the ground and on the air photos is the well developed joint system. Most of the joints dip steeply between 60° and 90° and strike either E.N.E.,

or W.N.W. Some are flatly dipping, but their numbers are few and they do not show up in the density diagram (fig. 2).

The poles of 147 microgranite dykes and pegmatites have been contoured. (See fig. 3). Their distribution is similar to the poles of the joints although the areas of greatest density do not coincide. It is probable that jointing has had some control on the emplacement of the acid intrusives.

Amphibolites occur as bands and dykes. The distribution of their poles is similar (fig. 4) to those of the joints and microgranite dykes. The density grouping however is W.N.W. and E.S.E. near the primitive circle. These groupings differ from both the joint and microgranite dyke directions.

One hundred and thirty one poles of foliation planes have been contoured in fig. 6. These show density groupings near the primitive circle in the northwestern and southeastern quadrants and across the centre of the diagram trending from southwest to northeast.

Layering in the granite is readily recognised because of differential weathering (See photo No. 7 appendix II). The density diagram fig. 7 indicates two main directions. Groupings near the primitive circle are located in the northwest and southeast quadrants and dip steeply, the other groupings tend to form a girdle trending from southwest to northeast through the centre of the diagram. The general location and trend of the contours in fig. 7 is similar to those of fig. 6.

All the folds recorded are located on islands to the north of Spilsby. Altogether twenty two readings were made of the pitch of the fold axes. These have been contoured (see fig. 5). The number of readings plotted is insufficient to give a reliable guide to structural trends but they may indicate what the trends might be. The density pattern shows a tendency for the main pitch directions to be towards the N.E. and S.W.

LOCAL GEOLOGY

Name - Spilsby Island

Area

1030 acres (approximately). The largest island within the group.

Land Title

Perpetual lease No. 15027 exclusive of 150 link coast reserve held by Percy L. Jacobs and Sydney M. McFarlane of Pt. Lincoln. Reserved from the operations of the Mining Act, gazetted 12.12.63.

Location

Approximately 30 miles east-northeast of Port Lincoln, one of the southernmost islands in the group.

Result of Investigation

The molybdenite mineralisation is confined to the southern portion of the island. It is found disseminated in granodiorite and granite; aggregated along the margins of "aplites" and in quartz scheelite lenses and veins within the granite and pink-red "aplite" rock. Three chip samples taken over 100 ft. intervals across the most highly mineralised portions of the granite gave the following results:-

Sample			Spectrographic analysis
From		To	Molybdenite
0	-	100'	300 ppm
100	-	200'	70 ppm
200	-	300'	30 ppm

These values are too low to be exploitable, however the identification of scheelite associated with the molybdenite warrants further mapping using ultra violet lamps.

Topography

The coastal features are controlled by geological features as discussed in the general geology section

Topography (contd.)

earlier in this report. At Spilsby the land tends to shelve flatly up from the sea where the rock is massive granite or sandy beach. On the eastern and north-eastern coasts small cliffs have developed where the granite has been kaolinised and there is a relatively thick development of clay. Fresh granite also rises steeply from the sea in this area.

The surface of the island itself is gently undulating rising to a height of 165' in the central northeast portion.

There are no creeks on the island and no natural accumulations of surface water.

Geology

The rocks of the island fall into three main groups

(i) Unconsolidated silty loam, dune sand and beach sand.

(ii) Consolidated Cenozoic sediments including kunkar, clay and silcrete.

(iii) Pre-Cambrian gneissic granite complex including pegmatites, microgranites, quartz veins and lenses, and amphibolites.

Grey and pink gneissic granite with large aligned tabular crystals of orthoclase is common. Other feldspars include microcline and sericitised plagioclase; quartz is the other main constituent of the rock, biotite is rare. The orthoclase crystals may be up to 3 cms. long and frequently show plunge directions. Photograph below No. 6 (appendix II) shows feldspar crystals in a grey granite gneiss.

Along the northern coast of the island the gneisses show layering with coarse grained grey granite gneiss and a finer grained lighter granite gneiss variety dipping flatly towards the southeast, the coarser grained variety tends to weather more quickly, and differential erosion reveals these layers quite clearly (See photo No. 7, Appendix II). A massive aplite dyke several hundreds of feet long cuts across the grey granite gneiss north-east

Geology (contd.)

of layered gneissic granite, the discordant relationship of the microgranite and gneiss is shown in the photograph No. 8 appendix II showing the microgranite cutting across the gneissosity of the coarser grained granite gneiss. The gneissosity here strikes 124°(M). Note that the joint system developed in the aplite does not extend into the coarse grained granite gneiss.

On the southeastern coastal fringe, pink and grey gneissic granite appear to be layered, but this feature is not so clear as at the northern end of the island. Pink granite is recorded as grading up to grey granite and dipping flatly southeastwards into the sea. Both feldspar crystals and schlieren are parallel and strike along 320°(M). Intruding the granite gneiss is a variety of pegmatites, microgranites and quartz veins and lenses. At least three ages of intrusion can be deduced from the field relationships of the pegmatites, this does not imply any important time break between these events. Most pegmatites appear to be of a composite variety in this area, being finer grained and frequently a grey colour in the centre and coarse grained and often pink along the margins.

Scheelite and molybdenite appear to be associated and confined to the southern end of the island. The molybdenite occurs in granodiorite, in pale grey stressed granitic gneiss (which is frequently a reddish colour near the mineralised zone) as regular aggregations of crystals along the edges of pegmatites, in microgranite dykes and in quartz lenses and veins. Other sulphides visible in the hand specimen are pyrite and ? chalcopyrite. A thin section cut from mineralised granodiorite revealed scheelite scattered through the rock as rounded aggregates, a minor amount of cassiterite is associated with it, pyrite with molybdenite are the dominant opaques, minor chalco-

Geology (contd.)

pyrite is associated with covellite which forms a replacement rim around the chalcopyrite and also appears to have replaced pyrite. Some chalcocite is associated with the covellite and is thought to be altering from it. Marcasite has formed from some of the pyrite and is intimately associated with it. Galena is rare and also associated with the pyrite. The metallogenetic sequence appears to be molybdenite followed by pyrite and later by chalcopyrite.

Purple fluorite was also found in the vicinity of the molybdenite mineralisation in grey granitic rocks as irregular patches sometimes found in association with rare copper sulphide mineralisation.

A traverse made parallel to the coast in the southern portion of the island gave disappointing results for all the elements requested for analysis. Only chromium, molybdenum and lead gave anomalous values. Of these chromium is suspect because of possible contamination from the crushers. Neither of the other elements were sufficient to warrant further investigation by themselves. It is interesting to note that although the scheelite appears to be associated with molybdenite in the field, there is no significant concentration of this element in the area sampled and the metal is in concentrations too low to be detected by the spectrograph.

Evidence for a number of recent changes in sea level relative to the island mass, is to be found along the coast line in the northern part of the island, where several levels prior to the existing one can be inferred based on the following factors:

(i) The kunkar dipping beneath the sea off the north western part of the island.

(ii) The stranded shore line exposed at various points above sea level on the eastern, western, and northern coasts of the island.

(iii) The surface on which the silcrete was deposited now below sea level.

(iv) The present sea level.

It is possible that there has been some warping in recent times but further work, including levelling, would be necessary to establish this.

No faulting was found in the younger sediments but minor faults occur on the southern tip of the island where they dislocate pegmatite veins.

It is noted that silcrete is always found overlying kaolinised granite and overlain by red and green mottled clays. It is suggested that these were pockets of deep weathering in early Tertiary or pre-Tertiary times which were later eroded out and filled first with kaolin and quartz from the surrounding weathered granite and later by transported clays.

Investigated by

L.G. Nixon, K.R. Warne, S. Robson, J. Johnson.

Date

19th and 20th November, 1963.

Name - Boucaut Island and Seal Rock

Area

40 acres approximately.

Land Title

Unallotted. Reserved from the operations of the Mining Act gazetted 12.12.1963.

Location

Approximately $\frac{3}{4}$ mile to the east of Spilsby.

Result of Investigation

No significant mineralisation was found on the island. No traverse was made over Seal Rock.

Topography

A relatively low lying fairly flat island rising to a height of about 20 feet above sea level. Where the granite is weathered it forms low cliffs on the northwestern coast.

Geology

Kunkar and a thin layer of loam cover most of the island, there is no development of clay. Kunkar rests directly on granite along the northwestern coastal strip, layered gneissic granite dipping 65° to the SW is the main rock type. Where the granite is lateritised and kaolinised it forms low rounded cliffs; cross cutting fairly coarse granitic dykes intrude the granite gneiss, which shows evidence of folding and shearing with myloniisation. The layering of fine grained pink microgranite and coarser grained granite with large pink feldspars persists across to the western coastal strip. Granite gneiss is intruded by narrow pink microgranite veins.

Investigated by

L.G. Nixon, K. Warne, S. Robson, J. Johnson.

Date

20.11.1963.

Name - Stickney Island and Linklater Point

Area

150 acres approximately.

Land Title

Held under miscellaneous lease No. 12612 by Doris E. Hammat of Port Lincoln. Reserved from the operation of The Mining Act. Gazetted 12.12.1963.

Location

Approximately 3.5 miles W.S.W of Spilsby Island.

Result of Investigation

No mineral deposit was seen anywhere on the island and no anomalous metal values were revealed by spectrographic analysis of selected samples.

Topography

A rocky coastline with a small sheltered bay and beach on the northern coast and a small beach along the south-eastern edge near Linklater Point. Estimated height betweer 40 - 80 feet above sea level. There is no surface water, neither are there any wells, stock or inhabitants. Along most of the coast granite rises steeply up from the sea except along the eastern coast and in bays at the northern and southern ends of the island.

Geology

There is no development of silcrete or clay on the island and kunkar rests directly on granitic gneiss. The soil cover is comparatively thin and granite is exposed inland in some places. Layered grey granite gneiss with oriented feldspars and pink granite gneiss similar to the rocks found on Spilsby are common. In addition amphibolite pods are found along the western coast of the island. The layering in the granite has an average strike of 310° dipping at about 60° N-E. On the air photograph, the

Geology (contd.)

Island shows a noticeable difference in outline between the western and eastern halves, these are assigned to geological features such as jointing and lineation. It is possible that a N-S oriented fault strikes across the centre of the island.

Two specimens of granite from the northern part of the island (the probable fault zone) show microbrecciation in thin section. (See petrological report P 539/63. LN. Stickney I. T.S. 13240 and P 542/63. S.R. Stickney 4: T.S. 13243).

An interesting feature of one sample is that the orientation of the feldspars bears no relation to the gneissosity (See petrological report JJ. Stickney 4. T.S. 13242).

Field relationships of the granites on the western side show repeated intrusions by younger granitic material. Augen gneiss appears to be the oldest rock on the island; this is intruded by younger grey and pink granites which are intruded by microgranite dykes and narrow medium grained grey granite dykes.

Investigated by

L. Nixon, K. Warne, S. Robson, J. Johnson.

Date

24.11.1963.

Name - English Island

Area

7 acres approximately.

Land Title

Unallotted. Reserved from the provisions of the Mining Act gazetted 12.12.1963.

Location

About ½ mile to the east of Sibsey Island.

Result of Investigation

Predominantly a grey massive gneissic granite.

Topography

Low rounded island, rising to about 10 feet above sea level. The island is the resting place for a great number of sea birds especially cormorants, their excreta has covered most of the outcropping rock with white guano. Virtually devoid of vegetation.

Geology

Massive jointed grey gneissic granite.

Investigated by

No landing was made on this island; observations were made from the boat only.

Date

24.11.1963.

Name - Blyth Island

Area 12 acres

Land Title

Unallotted. Reserved from the operation of the Mining Act gazetted 12.12.1963.

Location

Approximately 1½ miles S-S-E of Reevesby Island.

Result of Investigation

No significant mineralisation was found on the island.

Topography

An island of low sand dunes and white sandy beaches. Its highest point would probably not exceed 20 feet.

Geology

Only one small outcrop of a pink coarse to medium grained jointed granite was found overlain by recent sand dunes.

Investigated by

S. Robson and J. Johnson.

Date

21.11.1963.

Name - Sibsey Island

Area

Approximately 74 acres.

Land Title

Unallotted. Reserved from the provisions of the Mining Act, gazetted 12.12.1963.

Location

Approximately 8 miles W.N.W. of Spilsby.

Result of Investigation

No significant mineralisation was located on the island.

Topography

Generally the island rises steeply from the sea forming a broad rounded outcrop. It is unlike any of the other larger islands in the group, being practically devoid of soil and having very little kunkar. Jointing appears to have influenced the coastal topography.

Geology

The main rock type exposed on the island is a coarse grained pink augen biotite granite gneiss containing xenoliths of amphibolite and intruded by amphibolite and pegmatites. The pegmatites are of two types and are thought to be of two ages. The older is very coarse grained, is sometimes folded, has irregular contact with the enclosing rock and is confined to the coarse grained pink augen gneiss. The other type intrudes all other older rock types, has definite, sharp straight contact with the enclosing rock and is not as coarse grained as the "older" variety.

In the field, pink-grey augen biotite gneiss is found as xenoliths in fine to medium grained microgranite which intrudes grey augen granite, coarse grained pegmatites and coarse grained gneiss. Amphibolites are

Geology (contd.)

intruded by coarse grained pegmatites and microgranites. The coarse grained pegmatites intrude grey and pink microgranites and are in turn intruded by later pale pink coloured microgranites.

Investigated by

L.G. Nixon, K. Warne.

Date

24.11.1963.

Name - Kirkby Island

Area

68 acres approximately.

Land Title

Miscellaneous lease No. 12988 held by Doris E. Hammat of Port Lincoln. Reserved from the provisions of the Mining Act gazetted 12.12.1963.

Location

Approximately 3 miles W.S.W. of Reevesby Island.

Result of Investigation

No significant mineral deposit was found during the investigation.

Topography

Granite is exposed along the entire coastline. There are no beaches on the island which rises fairly steeply from the sea to form a broad dome shaped profile rising to a height of about 50 feet above sea-level. Unlike on Sibsey, joints do not appear to be so strongly developed nor do they seem to have influenced coastal topography.

Geology

The dominant rock type on the island is a massive medium to coarse grained grey-to pink gneissic granite. The pink colour of the granite is due to the pink feldspar content. Older gneisses are intruded by composite dykes of pink fine grained microgranite bordered by fairly coarse grained pegmatitic rock, and also by gneiss with tabular feldspar crystals.

There appears to have been at least two and possibly three ages of intrusions, the first is thought to be basic, in which rocks now mapped as amphibolites intruded the gneisses, these show discordant relationships to the gneissic folds but never intrude any of the younger acid

Geology (contd.)

intrusives. The acid intrusives appear to be divisible into two groups, those which are discordant to the gneissic features but are folded and those which intersect and displace them but are not folded.

Kunkar occurs directly on the granite, there is a lack of kaolinisation of the granites, and no other younger sediments apart from a thin soil cover occur on the island.

Investigated by

L. Nixon, K. Warne, S. Robson, J. Johnson.

Date

23.11.1963.

Name - Lusby Island

Area

36 acres approximately.

Land Title

Miscellaneous lease No. 12988, held by Doris E. Hammat, of Port Lincoln. Reserves from the provisions of the Mining Act gazetted 12.12.1963.

Location

Approximately ½ mile west of southern Reevesby Island.

Result of Investigation

No economically significant mineral deposit was found during the investigation.

Topography

Relatively flat low lying island; maximum height is estimated to be about thirty feet above sea level. An old sand dune now fixed and probably covered by loam forms a low rise in the centre of the island as inferred from examination of the air photographs. Granite is exposed along most of the coast line except on part of the northern coast where a small beach and sand bar have developed. Sand dunes here are about 10 feet high.

Geology

Pink gneissic granite is the main rock type outcropping along the coastal belt. In the northern and northwestern part of the island the granite gneiss contains pods of amphibolite and aplite and is intruded by aplite dykes. Kaolinised and lateritised granites are common and usually underlie red brown and green mottled clays; the profile being similar to those described from Spilsby. It is suspected that silcrete also occurs in this area. The south eastern portion of the island is composed of mainly unweathered pink gneissic granite with amphibolite layers and pods, and intruded by basic dykes and aplites. There are no kaolinised zones recorded from this area and kunkar

Geology (contd.)

rests directly on granite gneiss.

Investigated by

S. Robson and J. Johnson.

Date

23.11.1963.

Name - Partney Island

Area

103 acres approximately.

Land Title

Miscellaneous lease held by Doris E. Hammat. Reserved from the provisions of the Mining Act gazetted 12.12.1963.

Location

Approximately ¾ mile west of Second Rocks, Reevesby Island.

Result of Investigation

No mineral deposit of economic significance was found.

Topography

A roughly star shaped island rising gently to a height estimated to be between 50 and 80 ft. above sea level. Only one small beach and a spit of sand and gravel was found, located on the north-eastern corner of the island. Granite or granite boulders and kunkar or collapsed kunkar blocks occur around the remainder of the island.

Geology

Kunkar is well developed and appears to cover the entire island. On both the northeastern corner and on the westernmost point of the west coast the kunkar persists beneath sea level. It is estimated to be over 10 feet thick in these areas. Specimens of kunkar on the northeastern corner containing black limestone nodules were submitted for petrological examination. These were reported as being fossiliferous. The Senior Palaeontologist identified milioloids and echinoderm spines in the thin section, indicating a shallow water marine environment. Because the fossils were sectioned, no proper examination of them could be made, and no age could be assigned to the rock, since the range of these fossils is from Tertiary to Recent. The black colour in the nodule was described as being carbonaceous and sandy.

Geology (contd.)

Red and green mottled clays showing polyhedral fractures with sheen on the fracture surfaces are up to 16 feet thick near the northeastern coast. These are thought to be transported clays composed mainly of illite. Of the sand fraction quartz forms 80%, feldspar 18% and opaque minerals 1%. Sample LN-Partney-4 submitted for palaeontological examination was unfossiliferous. For sample locality refer to Appendix 1 and plan No. L64-204 appended.

A sample of sand from the northeastern coast, Sample LN-Partney-2 submitted for petrological examination, spectrographic analysis, sieve analysis. The sand is composed mainly of subangular quartz 61%, feldspar 18%, shell fragments 19% and opaques 2.6%, some grains are subrounded and have a low sphericity. Magnetite, ilmenite and goethite constitute the opaques. A cumulative curve for the sieve analysis has been constructed as shown in appendix I. This material is poorly sorted as shown on the graph and quite different from the sand samples taken from Reevesby.

It is possible that silcrete occurs on this island although it was not recognised in the course of the survey.

A variety of granite gneisses, microgranites, pegmatites and amphibolites are exposed around the coastal belt. On the eastern coast, south of the clay occurrences, massive pink-grey augen granite gneiss is interlayered with medium to coarse grained grey granite gneiss and discontinuous bands of black amphibolite; occasional coarse grained pink and white pegmatites and fine grained pink aplites intrude the gneiss transgressing the gneissosity. The grey augen granite gneiss is found to be contorted in places and intruded by younger aplites not affected by folding.

Investigated by

L.G. Nixon and K.R. Warne.

Date

23.11.1964.

Name - Duffield Island

Area

19 acres.

Land Title

Unallotted. Reserved from the operation of the Mining Act gazetted 12.12.1963.

Location

About ½ mile to the west of Spilsby Island.

Result of Investigation

No significant mineral deposit was found on the island.

Topography

A flat low lying island rising to an estimated maximum twenty five feet above sea level. A relatively small sandy beach occurs on the eastern end of the island. Sand extends inland a few tens of feet and is covered with low shrubs and mesembryanthemum. Remnants of a stranded beach were seen along the southern coast line.

Geology

Kunkar caps the granite gneiss and associated rocks, and covers most of the island. Only around portions of coastal strip up to 100 feet wide is the gneissic complex exposed. The main rock types along the southern and south-western coasts are a coarse grained grey gneissic granite, a coarse grained grey and pink gneissic granite intruded by narrow quartz veins and microgranite dykes. On the southern coast a 3 inch wide aplite vein has been folded into a small drag fold pitching flatly towards the south. Generally the microgranites are parallel to the jointing. Micro-brecciation was reported from a sample of porphyritic granite on the north coast. Rock types along the northern coast show banding of light aplitic and darker grey layers in a relatively coarser grained grey gneissic granite. Kaolinisation of the granite and lateritisation of the kaolin were noted from the northern coast. A stranded

Geology (contd.)

beach remnant was found beneath about 10 ft. of kunkar on the southern coast of the island. Although the rocks here were thought to be kaolinised granite at the time of investigation it is probable that they may in fact be silcrete similar to the rock on Spilsby.

Investigated by

L.G. Nixon, K. Warne, S. Robson, J. Johnson.

Date

20.11.1963.

Name - Roxby Island

Area

203 acres approximately.

Land Title

Miscellaneous lease No. 11429 held by Doris E. Hammat of Pt. Lincoln. Reserved from the operation of the Mining Act gazetted 12.12.1963.

Location

Approximately 4 miles north of Spilsby Island.

Result of Investigation

No economically significant mineral deposit was found on the island.

Topography

Where the granite has been kaolinised and there is a relatively thick clay and kunkar sequence, low cliffs have been formed along the coast; these areas are mainly in the north western third of the island and in the south eastern corner. From the coast the ground slopes gently upwards, inland, towards a low round ridge thought to be an old sand dune running across the length of the island in an E-W direction. Vegetation consists mainly of shrubs, grasses and mesembryanthemum creepers. In areas where kaolinised granite and suspected silcrete occur the outcropping rock is jagged and usually very rough; where fresh granite outcrops the coast is smoother.

Geology

A small beach of white sand occurs in the north western corner of the island. Eastwards from the beach along the northern coastline for about two thirds of its length, kaolinised granite and suspected silcrete outcrop, occasionally a fresh kernel of massive coarse grained pink granite may be exposed near sea level.

Along the northeastern, eastern and southeastern coast the main rock type is a massive pink coarse grained

Geology (contd.)

granite, showing feldspar orientation in places. It is usually overlain by weathered white kaolinitic granite. A noteworthy feature is the absence of any recorded basic rock from the Island, (in this respect it resembles Spilsby island). Microgranites and fine to medium grained greyish white granite dykes intrude the coarser grained pink granite.

Weathered granite overlain by suspected silcrete, red clays and kunkar, extends from the northeastern corner for about 250 feet, southwards along the western coast. The development of silcrete, clays and kunkar is similar to that described from Spilsby and other islands in the group. Fresh pinkish grey coarse grained granite outcrops to the south of the weathered granite and continues along the western, southwestern and the rest of the southern coasts. One or two small pockets of weathered granite with clay kunkar and possibly silcrete have been recorded on the southern coast and outlined on the map appended.

Investigated by

L.G. Nixon, K. Warne, S. Robson, J. Johnson.

Date

20.11.1963.

Name - Marum Island

Area

24 acres approximately.

Land Title

Miscellaneous lease No. 12988 held by D.E. Hammat of Pt. Lincoln. Reserved from the provisions of the Mining Act gazetted 12.12.1963.

Location

Approximately 1½ miles W.S.W. of North West Point, Reevesby Island.

Result of Investigation

No significant mineral deposit was found during the investigation. Phosphate rock and guano have been mined by "The Spencers Gulf Fertilizer Company," but no evidence of their operations now remains.

Topography

Relatively flat, approximately 500 yards long by 300 yards wide and rising to a height of 30 feet above sea level.

Geology

The older rocks exposed along the coast include augen gneiss, and foliated sheared gneiss. Folds in the foliated gneiss plunge towards 290°. A grey granite apparently intrudes augen gneiss at the southeastern end of the island; further north along the north eastern coast a coarse grained norite dyke intrudes the gneiss; amphibolite pods are common, and on the southern coast, banding of amphibolite is associated with minor folds in the gneiss. Weathering along foliation planes on the western coast line has produced a small bay. The pegmatites are noted as being orientated E-W, these are intruded and offset by microgranite dykes.

Kunkar immediately overlies the granite; there is no

Geology (contd.)

development of red clays beneath the kunkar on the island. Guano and phosphate are reported to have been mined here early in this century. The phosphate rock is thought to be the result of replacement of calcium in the kunkar by phosphorous from the guano taken into solution as ammonium phosphate.

Investigated by

S. Robson, J. Johnson.

Date

23.11.1964.

Name - Winceby Island

Area

70 acres approximately.

Land Title

Miscellaneous lease No. 12988 held by Doris E. Hammat of Port Lincoln. Reserved from the operation of the Mining Act gazetted 12.12.1963.

Location

About $\frac{3}{4}$ mile north off North West Point, Reevesby Island. This is the northernmost island of the group and the only island with a lighthouse.

Result of Investigation

No economically significant mineral deposit was found on the island.

Topography

This island rises to a height of approximately 50 feet along a gentle slope. There are no outstanding topographical features, and there is a complete absence of beaches. Along the north coast small inlets have been formed along joints and where differential weathering has removed basic rock intrusives from the surrounding granite.

Geology

The main rock type is a medium to coarse grained pink to grey gneissic granite with oriented feldspars, and interlayered amphibolites intruded by later amphibolites, microgranites and pegmatites. In some areas along the western, southern and eastern coasts the gneisses, pegmatites and amphibolites are folded and plunge westerly at varying angles between 20° and 40°.

Relatively younger microgranite intrusives which have not been folded intrude amphibolites and are intruded by relatively coarse grained pink pegmatites.

Generally the intrusive amphibolites tend to parallel one another and strike towards the southeast along a

Geology (contd.)

bearing of 135° dipping about 60° to the S.W. The pegmatites tend to be oriented along an E.W. bearing.

A relatively thin kunkar crust overlies the granite and this is overlain by a greyish sandy to silty loam.

Guano forms a thin coating over the gneissic granite on the north eastern tip of the island and obscures the nature of the underlying rock.

Investigated by

L.G. Nixon, K.R. Warne, S. Robson, J. Johnson.

Date

22.11.1963.

Name - Dalby Island

Area 14 acres.

Land Title

Miscellaneous lease No. 12988, held by Doris E. Hammat of Port Lincoln. Reserved from the operations of the Mining Act gazetted 12.12.1963.

Location

About 2 miles southwest of Reevesby Island.

Result of Investigation

No economically significant mineral deposits were found but spectrographic analysis revealed anomalous values for copper, zinc and iron on the southwestern corner of the island.

Topography

A low flat island shaped roughly like a hemisphere estimated to rise between 25 and 30 feet above sea level. On the northwestern coast low dunes back a small beach; around the remainder of the island granite gneiss extends from beneath the sea to the kunkar layer varying from 50 ft. to 100 ft. inland and sometimes forming low rounded cliffs.

Geology

The oldest rock types exposed are pinkish grey coarse grained granite gneisses, granodiorite, amphibolite, microgranite and pegmatites. The whole of the southern coastline has extensive amphibolite intrusives, coarse grained pegmatites and granodiorite almost to the exclusion of the granitic gneiss. In the northeastern part of the island amphibolite dykes are less common and the main rock type is a pinkish grey gneissic granite. On the northwestern coast low sand dunes of recent age obscure most of the older rocks which are mainly granite gneiss. Southwestwards from the sand dunes only small pods of

Geology (contd.)

amphibolite are found in the gneiss.

Investigated by

S. Robson and J. Johnson.

Date

23.11.1963.

Name - Milne Island

Area

65 acres approximately.

Land Title

Miscellaneous lease No. 12612 held by Doris E. Hammat of Pt. Lincoln. Reserved from the operation of the Mining Act gazetted 12.12.1963.

Location

Approximately $2\frac{3}{4}$ miles S.S.E. of Reevesby Island.

Result of Investigation

No economically significant mineral deposits were found on the island during the survey. Along the northern coast Wolfram has been won from weathered granite. Recorded production is as follows

Year	Mineral	Amount	Value
1942	Wolfram	31 lbs.	£6
1943	"	300 lbs.	£10
1944	"	80 lbs.	£10

Topography

Milne Island, along with Hareby and Roxby Islands is oriented with its longest axis in a roughly east-west direction. On the eastern tip, sand and a relatively thick coating of guano, extends out from the main island mass for a couple of hundred feet eastwards; the fresh guano here has a noticeable odour. The island is relatively flat and would not be much more than 30 feet above sea level. Well formed cliffs of altered granite, clay and kunkar are developed along the north coast. Small bays have developed along weathered foliation planes.

Geology

The central portion of the north coast consists of weathered kaolinised coarse grained granite overlain by a relatively thick sequence of red brown and green mottled clays capped by kunkar. Wolfram won from the weathered granite in this area is reported to have occurred in narrow veinlets traversing granite in the zone between high and low tides. Granite crops out to the west of the weathered zone and kunkar rests directly on the granite. Farther west injection gneiss with a well defined foliation appears.

On the eastern and southeastern coast pink coarse grained granite is interlayered with pink microgranite dipping at 20°. Along the southern coast there is a noticeable absence of pegmatites and aplites.

Samples of rock taken from the southeastern coastal strip are described as granite gneiss with orthoclase and quartz as the dominant minerals and plagioclase forming a minor constituent with brown pleochroic mica, and with zircon as an accessory.

It is possible that silcrete occurs above the kaolinised granite on the northern coast of the island although no special note was made of this feature. The clay development is the same as on Spilsby and other islands in the group. The guano on the sand at the eastern end of the island is something which was not found on the other islands, although guano is found covering granite on English Island and on the northeastern corner of Winceby. Samples of guano and underlying sand submitted for analysis assayed up to 10.35% P_2O_5. (See chemical analysis appendix III).

Clay samples (P508/63: SR MILNE 2B, P509/63: SR MILNE 2C) from the northern coast show that kaolin is the dominant clay mineral with illite as accessory. In the sand fraction the grains, which are rounded or sub rounded,

Geology (contd.)

consist of quartz 33-65%, feldspar 14-33%, opaques 20-31%.

Investigated by

L.G. Nixon, K.R. Warne, S. Robson, J. Johnson.

Date

21.11.1963.

Name - Reevesby Island

Area

875 acres approximately.

Land Title

Miscellaneous lease No. 19332 held by Doris E. Hammat. Reserved from the operation of the Mining Act, gazetted 12.12.1963.

Location

About 17 miles north of Spilsby island.

Result of Investigation

No mineral deposit of economic significance was found on the island. Copper sulphide has been noted at two places near the southern tip of the island.

Topography

Reevesby is the second largest island in the group and easily the longest, extending for 3¼ miles in a N-S direction. It may be conveniently divided into three areas connected by two narrow beaches. The southern most "lobe" of the island rises to a height of approximately 90 feet above sea level, and is the highest part of the island, the central part which is mainly sandplain and fixed dunes rises to about 40 feet above sea level, this part of the island is connected by a narrow beach to the northern "lobe" which rises to about 50 feet above sea level. Two and possibly three salt pans occur, both to the north and south of the beach connecting the southern "lobe" to the central section of the island.

The southern lobe of the island has been fenced and partly cleared. It has been used for cropping and for grazing but at the time of the reconnaissance there was no evidence of agricultural or pastoral activity. The northern portion of the central part of the island has also been fenced and at one time cleared, but it is now overgrown with native vegetation. An old well is recorded

Topography (contd.)

in this portion of the island but it was not visited and its exact location is unknown. A second well is located near the house at the southern end of the island. Both are reported to be sunk in superficial deposits and yield supplies of brackish hard water.

Geology

Along the western coast of the southern lobe the older rocks exposed include fresh medium grained grey granite containing large xenoliths of black amphibolite and intrusions by pegmatites, aplites, and amphibolites. Near the southern tip of the island layered granite and gneiss and amphibolite veins strike along a bearing of 60° and dip flatly towards the northwest. Amphibolite pods in the granite carry chalcopyrite. Feldspars show definite orientation and schlieren textures are common in this area. Approaching the northern portion of the "lobe" from the south along both the eastern and western coastal strips the granite is weathered, kaolinised and lateritised in part. On the western coast it is overlain by very sandy red-brown and green mottled clays succeeded by silt and kunkar. A well developed soil profile overlies the kunkar here and includes clayey brown sand overlain by mottled brown sandy clay and lime followed by a hard coarse clayey sand, topped with a thin sandy loam.

To the north of the hut, white, partly exposed coxiella limestone was found, together with a number of bones. This rock is thought to be relatively young, possibly of Recent age. Its presence indicates the existence of a salt lake or marginal swamp.

Along the western coast from First Rocks to the southern part of Nicholas Bay the rocks are recorded as being predominantly fine to medium grained pink contorted granite gneiss, folds pitch W.N.W. between 10° and 20° Migmatitic granite is found in this area containing ingest-

Geology (contd.)

ed blocks of amphibolite. Pegmatites with magnetite intrude the gneisses. Microgranites with coarse grained pegmatitic margins, fine grained pink microgranites and amphibolites are common. At the southern end of Nicholas Bay the granite is crushed, and the gneiss is oriented along a strike of 50° dipping 85° S. On the opposite side of the island, the headland between McCoy Bay and Smokers Bay is composed of pink to grey gneissic granite which is folded with folds pitching 60° towards 265°. A crush zone bearing 070° dipping 75°N is located approximately 100 feet east of the folding. A large basic dyke estimated to be about 300' wide intrudes the gneisses in this area. Both margins of the intrusive are fine grained and are interpreted as being chilled. In the centre of the mass the crystals are relatively coarse.

The coast along Smokers Bay consists of white sand with no outcropping crystalline rock. To the south of the bay granites and gneisses are again exposed forming a headland that separates Smokers Bay from Haystack Bay. The gneisses here are contorted; with the minor folds pitching towards 250° between 5° and 20°. The gneisses are intruded by pegmatites which have also been folded, indicating at least 2 ages of folding. Younger microgranites which are not folded also intrude the gneisses. The gneissic granites alongthe coast, north of Holdfast Bay are layered but not contorted and there is a noticeable absence of amphibolites. The country between the eastern and western coast here may be described as sand plain, and there are no outcrops of crystalline rocks.

From Nicholas Bay almost to the north western tip of the island at North West Point the crystalline rocks are covered by sand or kunkar and are poorly exposed. Between North West Point and Moreton Bay the crystalline rocks include pink gneissic granite and coarser grained gneissic

Geology (contd.)

granite intruded by amphibolites, pegmatites and composite microgranite dykes with pegmatitic margins. Microgranite also occurs as pods in augen gneiss.

A narrow sandy beach separates Moreton Bay from McCoy Bay and connects the northern "lobe" to the rest of the island. The main rock type is a medium grained massive pink granite gneiss. Immediately north of Moreton Bay a strongly mylonitic zone approximately 30 ft. wide striking 105° dipping 85°S cuts across the granite gneiss, and farther to the north east massive pink-grey biotite granite gneiss transgresses biotite rich amphibolite gneiss. Most of the northern coast consists of medium grained massive gneissic granite intruded by coarse grained pegmatites, microgranites and amphibolites. The pegmatites have a tendency to be oriented along an easterly strike whereas the amphibolites tend to strike southeasterly.

Near the southeastern point of the northern lobe a mylonitic zone approximately 50 ft. wide striking 106° dipping 80°S has been mapped. It is believed to be the easterly extension of the zone mentioned in the previous paragraph. To the south of this mylonitic zone and along the northern part of McCoy Bay amphibolites are well developed.

Investigated by

L.G. Nixon, K.R. Warne, S. Robson, J. Johnson.

Date

22.11.1963.

CONCLUSIONS

Molybdenite is confined to the southern portion of Spilsby Island where it occurs in granodiorite, in pale grey stressed granite gneiss, as aggregations of crystals along the edges of pegmatites, microgranite dykes, quartz veins and quartz lenses.

The association of molybdenite with pegmatite and quartz lenses indicates that the mineralisation occurred during a late stage of igneous activity.

Scheelite is also confined to the southern end of Spilsby Island and has the same distribution as the molybdenite. In addition it is found on Hareby Island associated with Wolfram and tungstite.

Granodiorite rocks contain higher concentrations of copper, lead, zinc and iron than other rock types in the island group. It is noteworthy that no granodiorites have been recorded from Eyre Peninsula.

Continuous chip samples taken over a length of 300 ft. in the mineralised zone on the southeastern coast of Spilsby island showed anomalous values for molybdenum. The values are too low to be of economic significance. Best results over a 100 ft. section averaged 300 p.p.m. Mo.

The occurrence of scheelite with molybdenite on the southern end of Spilsby Island, and the association of wolfram, tungstite and scheelite on Hareby Island warrants further investigation.

It is recommended therefore that a field party of four examine all the islands of the group using ultra-violet lamps.

L. G. Nixon
Senior Geologist
METALLIC MINERALS SECTION

20/11/64

APPENDIX I

Island	Locality No. on Sample Locality Plan	Field No.	Assay No. (Spec.)	AssayNo. (Wet)	Assay No. (Sieving)	Pet.No.	Palaeo.
Spilsby	LN1	LN-Spilsby-1	A3367/63			P555/63	
	LN2	LN-Spilsby-2				P552/63	
	LN3	LN-Spilsby-3	A3368/63				
	JJ1	JJ-Spilsby-1	A3301/63			P490/63	
	JJ2	JJ-Spilsby-2	A3302/63			P491/63	
	JJ3	JJ-Spilsby-3	A3303/63			P492/63	
	SR7	SR-Spilsby-7	A3369/63			P557/63	
Duffield	JJ1	JJ-Duffield-1	A3338/63			P526/63	
	SR2	SR-Duffield-2				P527/63	
Boucaut	JJ1	JJ-Boucaut-1	A3342/63			P533/63	
	JJ2	JJ-Boucaut-2	A3343/63			P534/63	
Stickney	LN1	LN-Stickney-1	A3351/63			P539/63	
	JJ2	JJ-Stickney-2	A3352/63			P540/63	
	JJ4	JJ-Stickney-4	A3353/63			P541/63	
	SR4	SR-Stickney-4	A3354/64			P542/63	
Sibsey	LN1	LN-Sibsey-1	A3362/63			P550/63	
Milne	LN1	LN-Milne-1					
	LN2	LN-Milne-2		A1/64		P528/63	
	LN3	LN3	A3339/63	A2/64?		P529/63	
	SR2B	SR-Milne-2B	A3321/63			P508/63	
	SR2C	SR-Milne-2C	A3322/63			P509/63	
Roxby	LN1	LN-Roxby-1				P558/63	
	LN2	LN-Roxby-2	A3370/63			P559/63	
	LN3	LN-Roxby-3	A3371/63			P560/63	
	LN4	LN-Roxby-4	A3317/63	A3/64	A3314/63	P504/63	
	LN5	LN-Roxby-5	A3372/63			P561/63	
	LN6	LN-Roxby-6	A3318/63			P505/63	
	LN7	LN-Roxby-7	A3373/63			P562/63	
	LN8	LN-Roxby-8	A3374/63			P563/63	
Hareby	JJ1	JJ-Hareby-1	A3312/63		A3307/63	P497/63	
	JJ9	JJ-Hareby-9	A3364/63			P552/63	
	JJ9	JJ-Hareby-9A	A3365/63			P553/63	
	JJ9	JJ-Hareby-9B	A3366/63			P554/63	
	JJ11	JJ-Hareby-11	A3363/63			P551/63	
Blyth	JJ1	JJ-Blyth-1	A3337/63			P525/63	
Dalby	JJ1	JJ-Dalby-1	A3358/63			P546/63	
	JJ2	JJ-Dalby-2	A3359/63			P547/63	
	JJ2A	JJ-Dalby-2A	A3360/63			P548/63	
	JJ6	JJ-Dalby-6	A3361/63			P549/63	
Kirkby	JJ1	JJ-Kirkby-1	A3344/63			P535/63	
Lusby	JJ5	JJ-Lusby-5	A3355/63			P543/63	
	JJ5A	JJ-Lusby-5A	A3357/63			P545/63	
	SR5	SR-Lusby-5	A3356/63			P544/63	

APPENDIX I (contd.)

Island	Locality No. on Sample Locality Plan	Field No.	Assay No. (Spec.)	Assay No. (Wet)	Assay No. (Sieving)	Pet.No.	Palaec
Partney	LN1	LN-Partney-1				P530/63	Fossil-iferous
	LN2	LN-Partney-2	A3313/63		A3308/63	P498/63	
	LN3	LN-Partney-3	A3316/63			P503/63	
	LN4	LN-Partney-4	A3320/63			P507/63	F430/63
	LN5	LN-Partney-5	A3319/63			P506/63	
	LN6	LN-Partney-6				P536/63	
Marum	JJ1	JJ-Marum-1	A3340/63			P531/63	
	JJ2	JJ-Marum-2	A3341/63			P532/63	
Reevesby	LN1	LN-Reevesby-1				P511/63	
	LN2	LN-Reevesby-2	A3323/63			P512/63	
	LN3	LN-Reevesby-3	A3324/63			P514/63	
	LN3A	LN-Reevesby-3A	A3325/63			P513/63	
	LN4	LN-Reevesby-4	A3326/63			P515/63	
	LN5	LN-Reevesby-5				P516/63	
	LN6	LN-Reevesby-6	A3310/63		A3305/63	P495/63	
	LN7	LN-Reevesby-7	A3311/63		A3306/63	P496/63	
	LN8	LN-Reevesby-8	A3327/63			P517/63	
	JJ8	JJ-Reevesby-8	A3336/63			P524/63	
	JJ10	JJ-Reevesby-10	A3335/63			P523/63	
	JJ16	JJ-Reevesby-16	A3309/63		A3304/63	P494/63	
	SR16	SR-Reevesby-16	-	-	-	P522/63	F429/63
	JJ17	JJ-Reevesby-17					
	JJ17A	JJ-Reevesby-17A	A3331/63			P518/63	
	JJ17B	JJ-Reevesby-17B	A3332/63			P519/63	
	JJ17C	JJ-Reevesby-17C	A333/63			P520/63	
	JJ17D	JJ-Reevesby-17D	A3334/63			P521/63	
	SR5	SR-Reevesby-5	A3315/63			P502/63	
Winceby	LN1	LN-Winceby-1	A3350/63			P538/63.	

APPENDIX II

PHOTOGRAPHS

Photo No. 1. Reeflike kaolinised granite SPILSBY ISLAND

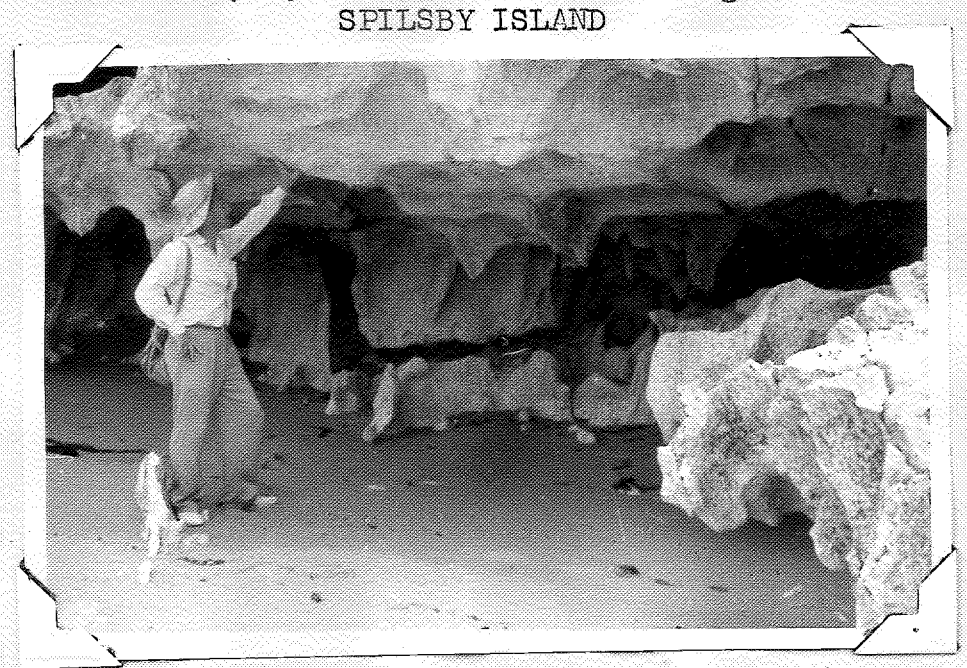


Photo No. 2. Kaolinised granite undercut by wave action. SPILSBY ISLAND.

Photo No. 3. Showing cliff development and profile of younger sediments overlying kaolinised granite N.E. coast SPILSBY ISLAND.

Photo No. 4. Lateritic zone overlying silcrete and kaolinised granite.
SPILSBY ISLAND. N.E. COAST

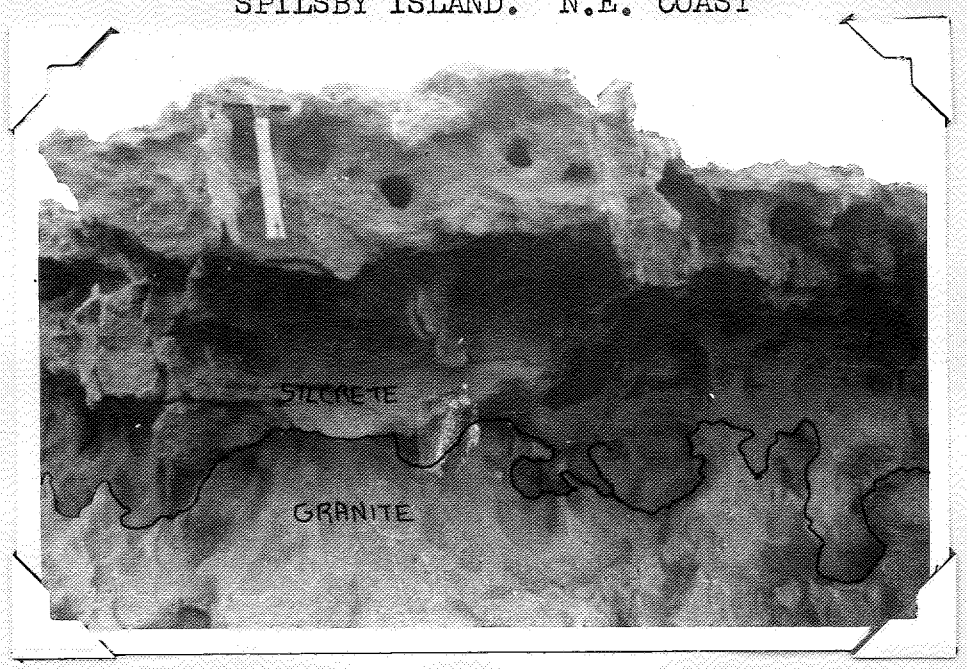


Photo No. 5. Showing irregular contact of silcrete and granite.
N.E. coast. SPILSBY ISLAND.

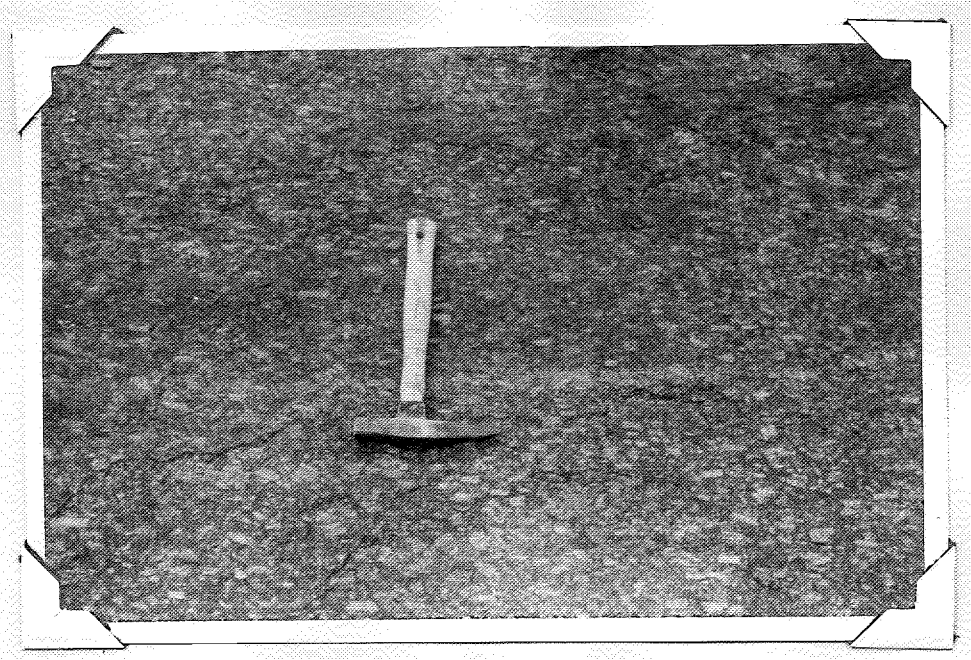


Photo No. 6. Oriented tabular crystals in grey gneissic granite. SPILSBY ISLAND.

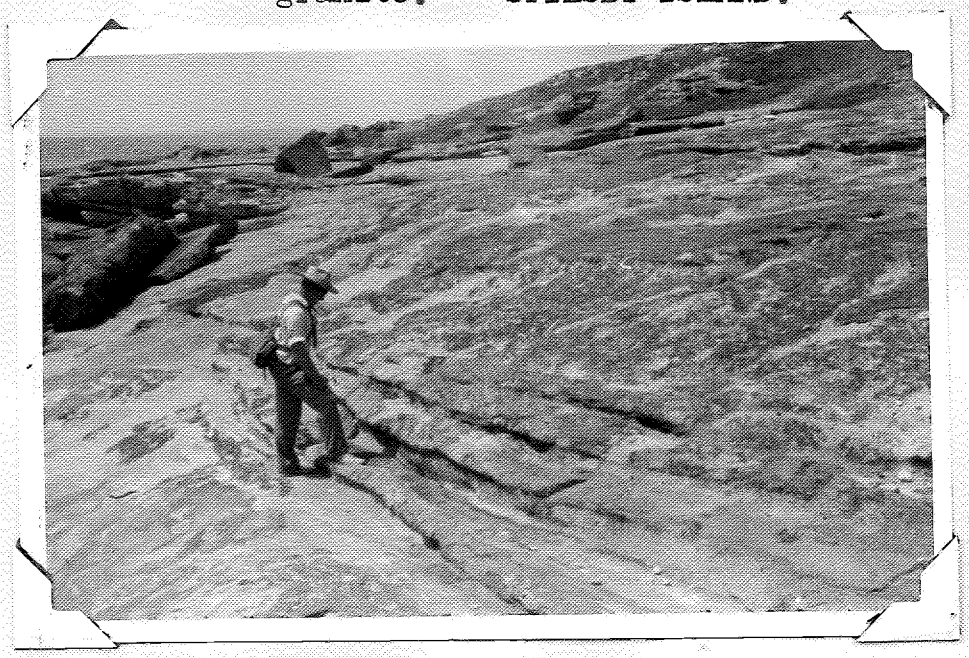


Photo No. 7. Layering in granite gneiss. N.W. coast. SPILSBY ISLAND. Differential weathering between fine and coarser grained layers.

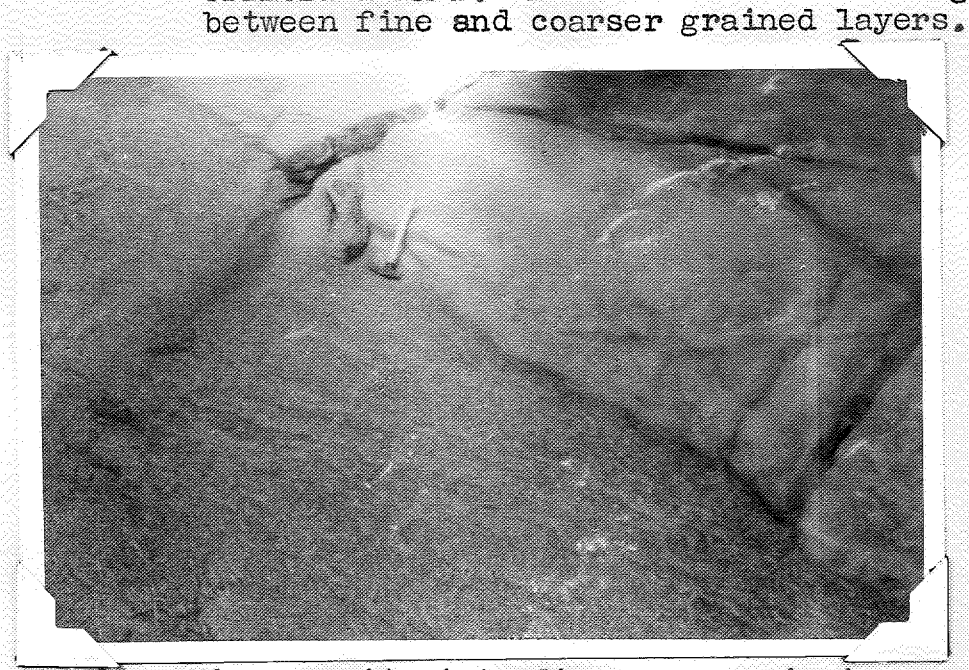


Photo No. 8. Microgranite intruding grey gneissic granite N. coast. SPILSBY ISLAND.

Photo No. 9. Flatlying microgranite on greyish pink granite. Note also the flatlying joints.

Photo No. 10. Kunkar overlying gneissic granite.

Photo No. 11. Wave Cut Platform in Silcrete-
Eastern Coast of Spilsby Island.

APPENDIX III

PETROLOGICAL REPORTS

ROCK SPECIMENS AND SAND SPECIMENS FROM THE SIR JOSEPH BANKS ISLANDS (PT. 1)

Reports MP2008, 2026, 2047, 2063, 2064
2069, 2071, 2096, 2097-63

X-Ray Diffraction by: N. A. Trueman

Investigation and Report by: D. Smale

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES

Adelaide South Australia

ROCK SPECIMENS AND SAND SPECIMENS FROM THE SIR JOSEPH BANKS ISLANDS (PT.1)

Most of these rocks are granitic or gabbroic in composition, and are probably comparable with rocks of the Flinders Group on the mainland (Johns 1961). One of the major problems when describing them is to determine whether they are of igneous or metamorphic origin; some of the gabbroic rocks have subophitic texture which could well be regarded as being of igneous origin; others have a markedly granular texture which appears to be of metamorphic origin. Most of the granitic rocks exhibit a certain amount of foliation or mineral segregation, and many also contain rounded, metamict zircons which appear likely to be of detrital origin. These facts, and the metamorphism undergone by other rocks of comparable age in South Australia, suggest that most of the rocks here described have undergone some degree of metamorphism.

METAMORPHIC HISTORY

One mineral assemblage is fairly typical of nearly all the granitic rocks, namely orthoclase and microcline, microperthite, oligoclase (rarely antiperthitic), quartz, myrmekite and biotite. The basic rocks are a little more variable; common assemblages are: labradorite-hornblende (-hypersthene-clinopyroxene), labradorite-hornblende-hypersthene (-biotite-quartz). Less common assemblages are: labradorite-hypersthene-clinopyroxene-biotite, and orthoclase-oligoclase-quartz-hornblende-biotite-epidote. In general, where pyroxene is present in a rock it appears to be altering to hornblende, and hornblende commonly rims pyroxene crystals. Epidote is a very minor constituent, even at its commonest in P531/63: JJMarum1:TS13136, where it occurs as minute scattered euhedral crystals.

It is difficult to determine which facies of metamorphism is represented by these assemblages, as critical minerals are absent. However, the preponderance of hornblende and plagioclase in the basic rocks, and the fact that pyroxene, when present, is commonly partly altered to hornblende, suggest that the amphibolite facies is not unlikely; the presence of orthoclase as a common mineral in the granitic rocks may be indicative of the fact that most may belong to the uppermost subfacies in the amphibolite facies. The relative scarcity of epidote could support this. However, as no critical minerals are present, it is impossible to say definitely any more than that most of the rocks belong to the amphibolite or granulite facies. It is of considerable interest to note, however, that Barth (1962) has made the following comment on the amphibolite facies: "The facies has a wide distribution in pre-Cambrian gneisses ... In the pre-Cambrian not only supracrustal formations (leptites, crystalline limestones, etc.) but also the synkinematic intrusive-like rocks (hornblende gabbros, diorites, granites) belong to the amphibolite facies." (p.321).

Where rocks of granitic and gabbroic composition are in contact (as in P516/63:LNReevesby5:TS13102, and P536/63: LNPartney6:TS13141) they appear to be in equilibrium, indicating that the two rock types are merely representatives (of different bulk composition) of the same metamorphic facies.

The prevalence of pyroxene altering to hornblende in the basic rocks suggests that these were either gabbros partially readjusted to pressure and temperature conditions where hornblende was stable rather than pyroxene (i.e. amphibolite facies), or metasediments of the granulite facies which underwent retrogressive metamorphism. The acidic rocks are probably metasediments, though it is also possible that they are metamorphosed igneous rocks.

ACIDIC ROCKS

Certain specimens among the granitic gneisses have characteristics which are distinctive. Most of these occur on Spilsby Island, and have been described in previous reports (MP1842-63, MP2008-63), but similar ones are described in this report, namely P556/63:LNSpilsby2: TS13294, P557/63:LNSpilsby7: TS13296, P523/63:JJReevesby10:TS13109, and possibly P529/63: LNMilne3:TS13134. Field occurrences would of course have to be considered before any significance could be suggested. Their most distinctive feature is the high proportion of large, aligned Carlsbad-twinned crystals of microperthitic potash feldspar. These, together with smaller crystals of the same mineral, oligoclase and quartz, form the bulk of the rock. Myrmekitic intergrowths of quartz and plagioclase are fairly common. Biotite is a minor constituent, but in general is the only ferromagnesian mineral present. Hornblende is absent, and this may be a characteristic feature; only one rock (P541/63:JJ Stickney4:TS13243) containing hornblende is at the same time notably similar to the gneisses of the Spilsby Island type, but this specimen lacks the typical prominent alignment of the Carlsbad-twinned feldspar crystals.

A specimen which could be of similar type is P539/63: LNStickney1:TS13240, but as it has undergone some micro-brecciation many of its former features are not clear.

The remainder of the acidic rocks form rather a heterogeneous collection. Many show a certain amount of foliation due to the alignment of biotite flakes (P516/63:LNReevesby 5:TS13102, P525/63:JJBlyth1:TS13111, P527/63:SRDuffield2:TS13132, P528/63:LNMilne2:TS13133, P533/62:JJBoucaut1:TS13138, P535/63: JJKirby1:TS13140, P550/63:LNSibsey1:TS13251, P554/63:JJHareby9B: TS13255); others show both foliation and a minor amount of mineral segregation (P518/63:JJReevesby17A:TS13104, P542/63: SRStickney4:TS13243, P544/63:SRLusby5:TS13245, P549/63:JJDalby6: TS13250, P558/63:LNRoxby1:TS13296). In some of these, however, the specimens are rather small and the thin sections appear rather featureless.

The mineralogy of all the above specimens is fairly constant. Feldspar is usually a little more common than quartz, and potash feldspar (commonly microperthitic) is more common than plagioclase, which varies from andesine to oligoclase. Ferromagnesian minerals are minor, and usually biotite. However, P542 also contains hornblende, sphene and metamict allanite; in P535, and P544 the plagioclase is antiperthitic; in P554 quartz is the dominant mineral instead of feldspar.

Some of the acidic rocks have fairly even grain size, and show no foliation or segregation; they appear to be granites (P519/63:JJReevesby17B:TS13105, P543/63:JJLusby5: TS13244, P553/63:JJHareby9A:TS13254). These rocks are very similar to the gneisses in the minerals present and their relative concentrations. Potash feldspar is dominant, and in P543 and P553 is commonly twinned according to the Carlsbad law; quartz is also common, and plagioclase (oligoclase) a little less so; in P543 it is antiperthitic; myrmekite and biotite are very minor constituents. One specimen (P526/63:JJDuffield1:TS13131) is a porphyritic granite containing phenocrysts of orthoclase up to 3 cms across; P527/63:SRDuffield2:TS13132 is somewhat similar but is foliated, and the phenocrysts are smaller and scarcer.

Others are similar in some respects to the granites, but lack ferromagnesian minerals (P540/63:JJStickney2:TS13241, P548/63:JJDalby2A:TS13249); P540 is probably aplitic. P548 is noteworthy for the prehnite it contains. One (P534/63: JJBoucaut2:TS13139) appears to be pegmatitic, but it has been somewhat altered as a result of weathering, and its pegmatitic appearance may be illusory.

Some granitic rocks (P526/63:JJDuffield1:TS13131, P539/63:LNStickney1:TS13240, P542/63:SRStickney4:TS13243) consist of fairly coarse crystals with finer interstitial material; these appear to have undergone a certain amount of microbrecciation. Their mineralogy is generally similar to most of the other acidic rocks, except that muscovite is a fairly common constituent of P526.

One specimen (P531/63:JJMarum1:TS13136) is rather unusual among the acidic rocks; in it ferromagnesian minerals are fairly common, among which hornblende predominates. The presence of much antiperthitic oligoclase and the absence of perthite are also fairly distinctive features.

Most of the acidic rocks (apart from P531) are granitic in the strict sense of the term, orthoclase or microcline being the dominant feldspars; however, P521/63:JJReevesby17D:TS13107 contains more plagioclase than potash feldspar, and appears to be adamellitic in composition. In other respects (in texture and mineral content) it is similar to the truly granitic specimens.

Though gneisses containing garnet are present on the mainland of Eyre Peninsula (Tilley, 1921), so far none have been seen in the rocks from the Sir Joseph Banks Islands. However, in the heavy mineral suites of the sand samples P494-P498, garnet is not uncommon. It is noteworthy that at least in P495:LNReevesby6 and P497:JJHareby1 what is probably a pyrope-rich garnet (with low refractive index) is present in addition to the more usual pink garnet. The pyrope is present in considerably smaller quantity than the other, and the grains observed have always been well-rounded and colourless, in contrast with the more angular pink grains of the commoner pink garnet.

INTERMEDIATE ROCKS

Two rocks from Dalby Island (P546/63:JJDalby1:TS13247, P547/63:JJDalby2:TS13248) are notably different from both the granitic and the gabbroic rocks; the plagioclase in these two specimens is more sodic than labradorite, yet ferromagnesian minerals are fairly common. Plagioclase is the dominant mineral in both, and both are thus dioritic; in P546 it is antiperthitic oligoclase to sodic andesine, and in P547 calcic andesine. Hornblende is the dominant ferromagnesian mineral. Though clinopyroxene is present in both to a small extent, in P546 it is very rare. The texture of P547 is mostly finely granular, though some coarser veins are present; P546 is coarsely mottled.

BASIC ROCKS

These are amphibolites, consisting mainly of plagioclase and hornblende with some pyroxene. Two have subophitic texture which appears to be of igneous origin, though probably some metamorphism has taken place; these are P513/63: LNReevesby3A:TS13099 and P515/63:LNReevesby4:TS13101. Plagioclase (labradorite-bytownite) is the dominant mineral, and commonly contains numerous oriented rod-like or tabular inclusions. Most of the rest of the rock consists of clinopyroxene, but around most of these crystals there is a rim of green hornblende (see fig. 1). The subophitic texture and the amount of pyroxene present in these specimens suggest that they were gabbros which have been only partially altered by metamorphic conditions in which the pressure and temperature were only a little different from those in which the original gabbroic minerals were stable.

Other basic rocks, though possessing similar mineralogy to P513 and P515, have a markedly granular texture with a fairly constant grain size; these are P512/63:LNReevesby2:TS13098, P520/63:JJReevesby17C:TS13106, P545/63:SRLusby5A:TS13246.

Hornblende and plagioclase (sodic labradorite) are the dominant minerals; hypersthene (with an unusually low optic angle) is a fairly common constituent. The hornblende is green in P512 and P520, but brown in P545.

One (P517/63:LNReevesby8:TS13103) appears to have both granular and subophitic textures, the granular parts having a considerably finer grain size than the subophitic parts. The distribution of the granular texture is very irregular, producing a subtle mottling with a mottle-size of about 2 mm. Though hornblende is present in this specimen it is very rare, the dominant mafic minerals being pyroxene and biotite. The plagioclase is labradorite.

Two specimens (P524/63:JJReevesby8:TS13110, P532/63: JJMarum2:TS13137) have a somewhat irregular granular texture. One of these (P532) has a mineral assemblage similar to those mentioned above. However, in the other (P524) the plagioclase is more sodic (sodic andesine), and apart from a little quartz and clay formed as alteration products, virtually the only constituent is hornblende. The alteration undergone by this specimen has been a little unusual, appearing to have been a solution effect leaving clear outlines in existing grains. (See fig. 2).

One specimen (P514/63:LNReevesby3:TS13100) consists of aggregates of ferromagnesian minerals in coarser-grained plagioclase. Apart from the fact that the plagioclase is calcic andesine, the rock is mineralogically similar to the others, however.

The basic parts of the contact specimens (P516/63: LNReevesby5:TS13102, P536/63:LNPartney6:TS13141) are more similar to P524/63:JJReevesby8:TS13110 than to any of the other basic specimens, as they consist largely of andesine or oligoclase and green hornblende. However, biotite is fairly common, and in P536 traces of pyroxene and epidote occur.

SEDIMENTARY OR SURFACE-FORMED ROCKS

Kunkar, silcrete, and lateritised rock belong in this category.

The kunkar is characteristically fine-grained, (with a grain size of 1-2 microns), with a minor proportion of sand grains consisting mainly of quartz, but with some feldspar; they appear to have been derived from a granitic terrain. Shell fragments abound in two specimens, P522/63:SRReevesby16:TS13108 and the black pebble P530/63:LNPartney1:TS13135. The black colour of P530 could be due to the presence of organic carbon. The remaining two specimens of kunkar are P552/63:JJHareby9: TS13253, and P561/63:LNRoxby5:TS13298.

Both P555/63:LNSpilsby1:TS13293 and P562/63:LNRoxby2: TS13299 could probably be described as protoquartzites; P562 has been lateritised, and it is difficult to see whether it may have been a silcrete or kaolinised granite. However, P555 appears definitely to be a silcrete, possessing such typical features of these rocks as "terrazzo" texture, a comparatively low framework-matrix ratio, and a leucoxene-rich matrix. A considerable amount is likely to be gained from further investigation of this in the light of existing knowledge of similar rocks at such places as Oodnadatta and Warramboo, which may throw further light on their formation and the origin of the high Ti-content. This is discussed in more detail in the appropriate individual description.

NOTES

1. In describing the forms of potash feldspar micro-perthite seen in these thin sections it has been considered warranted to use the terms "string-microperthitic" and "bead-micro-perthitic" as a concise way of stating that the exsolution lamellae (or blebs) of albite are in the form of strings (or beads). The term "replacement perthite" is taken from

Wahlstrom (1955, pg. 109). The nomenclature of strings, stringlets and beads to describe the shape of the albite exsolution bodies is taken from Deer, Howie and Zussman (1963, Vol. 4, pg. 68). Examples are shown in figs. 5, 6, 7 and 8.

2. Note was taken of the results of the analyses of these specimens, and where unusually high values for any elements were obtained the possibility of the presence of appropriate minerals was considered.

3. In the descriptions of sand samples sphericity has been described using the following terms: very low, low, moderate, fairly high, high.

P494-P498/63 (Sand Samples)

The following table summarizes most of the results:

	P494	P495	P496	P497	P498
Quartz	87	76	75	73	61
Feldspar	7	17	19	12	18
Shell fragments	-	-	4	1.2	19
Opaques	4.9	6.8	0.5	13.8	2.6
Hornblende	0.3	0.5	0.1	tr	tr
Hypersthene	0.2	0.3	tr	-	-
Garnet	tr	tr	tr	0.4	tr
Zircon	tr	tr	-	-	-
Clinopyroxene	tr	-	tr	-	-
Rutile	-	-	-	tr	-
Anatase	-	-	-	tr	-
Monazite	-	-	-	?tr	-
Spinel	-	-	-	tr	-
Corundum	-	-	-	?tr	-
Tourmaline	-	-	tr	-	-

Figures are weight percentages

tr = less than 0.1%

Feldspar is mostly potash feldspar.

P494/63:JJReevesby16:PS7921

The grains are mostly subrounded, and have moderate sphericity. Magnetite and ilmenite constitute the opaque grains.

P495/63:LNReevesby6:PS7922

The grains are mostly subrounded and to a lesser extent subangular, with moderate to fairly high sphericity. Magnetite and rather less ilmenite constitute the opaques. The presence of two types of garnet (one common pink one, and a rarer colourless pyrope-rich one of lower refractive index) is noteworthy. The pyrope-rich grains are markedly rounded.

P496/63:LNReevesby7:PS7923

The grains are generally subrounded, and have low to fairly high sphericity. Ilmenite, magnetite and minor goethite constitute the opaque minerals. As in P495, two types of garnet are present; the pyrope-rich grains are much the rarer, and well-rounded.

P498/63:LNPartney2:PS7925

The grains are generally subangular, though some are subrounded, and have low to moderate sphericity. A considerable number of shell fragments are present. Magnetite, ilmenite and a little goethite constitute the opaque minerals.

P502-P509/63

The clay material was washed out of a portion of each of these samples, and the remaining sand identified. In most samples a considerable number of ferruginous grains remained, but as these appeared to be aggregates of fine-grained material they were ignored as probably being pellets of iron-stained clay.

The clay fractions were identified by x-ray diffraction.

P502/63:SRReevesby5

The grains are generally subrounded or subangular. Quartz forms about 80 per cent of the sand fraction, and the remainder is feldspar (mostly potassic).

The dominant clay mineral is illite, with subdominant kaolin.

P503/63:LNPartney3

The grains are generally subrounded, but some are subangular. Quartz forms about 90 per cent of the sand fraction feldspar (mostly potassic) 5 per cent, and opaques 5 per cent.

The dominant clay minerals are illite and kaolin.

P504/63:LNRoxby4

The grains are mostly subrounded. Quartz forms about 85 per cent of the sand fraction, feldspar (mostly potassic) 14 per cent and opaques 1 per cent.

The other material present is calcite; clay minerals are apparently absent.

P505/63:LNRoxby6

The grains are subangular to subrounded. Quartz forms about 80 per cent of the sand fraction, feldspar (mostly potassic) about 7 per cent, and opaques 13 per cent.

The dominant clay mineral is kaolin; illite is subdominant.

P506/63:LNPartney5

The grains are mostly subrounded, but some are rounded Quartz forms about 80 per cent of the sand fraction, feldspar (mainly potassic) 7 per cent, and opaques 13 per cent.

The dominant clay mineral is kaolin, with subdominant illite.

P507/63:LNPartney4

The grains are generally rounded or subrounded. Quartz forms about 80 per cent of the sand fraction, feldspar (mainly potassic) 18 per cent, and opaques 1 per cent; a trace of hornblende is present.

The dominant clay mineral is illite; kaolin is subdominant.

P508/63:SRMilne2B

The grains are subrounded or rounded. Quartz forms about 65 per cent of the sand fraction, feldspar (mainly potassic) 14 per cent and opaques about 20 per cent. A fairly large proportion of the opaque grains appear to be goethite.

The dominant clay mineral is kaolin; illite is accessory.

P509/63:SRMilne2C

This sample contains a surprisingly large amount of feldspar, most of which is rather altered. Though many of the grains are subrounded, most of the feldspar grains are angular. Quartz forms about 33 per cent of the sand fraction, feldspar (mainly potassic) about 35 per cent, and opaques about 31 per cent. Many of the opaque grains are probably goethite.

The dominant clay mineral is kaolin; illite is accessory.

P511/63:LNReevesby1:TS13097:PS7852

This consists largely of opaque material with granitic material scattered around the edges of the specimen in crystals 2-6 mm across. Most of these crystals consist of oligoclase and microcline, but brown biotite and muscovite are also present. Some of the feldspar crystals contain numerous lines of ferruginous material which has probably been deposited along cleavages.

The opaque material consists mainly of magnetite and hematite, the hematite replacing the magnetite and forming martite. Ilmenite has exsolved from the magnetite in sheet-like bodies which appear to have acted as centres for some of the martitisation, and occurs with sporadic lamellar twinning in larger, more irregular bodies in the martite.

P512/63:LNReevesby2:TS13098

This is a medium-grained amphibolite with a grain size of 0.1-1mm. Plagioclase (sodic labradorite) forms a little over half the rock, and green hornblende forms about 40 per cent. Minor hypersthene and rare brown biotite are also present. Although the hornblende and the hypersthene are closely associated, a definite paragenetic relationship between the two minerals is nowhere clearly defined. The hypersthene in this, and in most of the similar rocks from this area, is remarkable in having an unusually low optic angle, which may be lower than the lowest recorded by Deer, Howie and Zussman (1963, vol. 2 p.28), though measurements would need to be made with a universal stage before an accurate determination could be made. As all the other properties are those of hypersthene, the identification nevertheless appears fairly certain. Quartz occurs in very minor quantity in blebs within the hornblende, a feature which in other specimens appears to be associated either with the alteration of pyroxene to hornblende (as in P538), or with the alteration of hornblende to a clay (as in P524).

P513/63:LNReevesby3A:TS13099

This is an amphibolite with a grain size of 0.01 - 2 mm but on the whole fairly coarse-grained. It has sub-ophitic texture, and consists of approximately equal quantities of green hornblende, pyroxene and plagioclase (labradorite-bytownite), which suggest an igneous origin. Most of the plagioclase contains numerous tabular or rod-like inclusions up to nearly 0.05 mm long; they appear to form up to 5 per cent or more of the volume of some crystals (see fig. 1). In many parts of the rock hornblende rims rather corroded pyroxene, generally to a thickness of about 0.05 mm. Minor brown biotite is present, some growing in large flakes through the hornblende. Two pyroxenes are present: hypersthene and a clinopyroxene which is probably augite or diopside.

P514/63:LNReevesby3:TS13100

This is an amphibolite with a grain size of 0.1 - 2 mm. It consists of aggregates of ferromagnesian crystals 0.2 - 1 mm across in a coarser-grained mass of plagioclase (calcic andesine) Brown biotite is common in fairly coarse flakes in the ferro-magnesian aggregates; green hornblende and pyroxene are also common, but they occur in smaller crystals. The latter two minerals are closely associated, but their exact relationship is not clearly shown. Many of the larger pyroxene crystals are somewhat altered, and some have become masses of pyroxene, horn-blende and weathered ferruginous material; the hornblende is cleaner and has sharper outlines, yet small, clean crystals of pyroxene are also present. These appear to be hypersthene, while the other more altered material is clinopyroxene. The latter has irregular extinction comparable with the "birds-eye" extinction of micas, though on a larger scale, and is probably due to incipient alteration.

P515/63:LNReevesby4:TS13101

This is an amphibolite similar to P513, with a grain size of 0.1-1 mm and subophitic texture. Ferromagnesians form about 30 per cent of the rock; the rest consists almost entirely of plagioclase laths. As in P513, the plagioclase is labradorite-bytownite, and has numerous tabular and elongate inclusions. The ferromagnesian crystals appear to have been originally clinopyroxene, but now have rims of green hornblende, which also occurs in smaller crystals associated with the pyroxene. Many ferromagnesian crystals have the appearance of having once been large and subsequently severely corroded, now consisting of separate grains with the same orientation. Some of the clinopyroxene crystals have within them "islands" of differently oriented material, which could be slightly different in composition. Hypersthene and biotite are present only to a minor extent.

P516/63:LNReevesby5:TS13102

This consists of granitic gneiss and amphibolite in contact. Ferromagnesians form about 10 per cent of the gneiss, but about 30 per cent of the amphibolite; hornblende and biotite are co-dominant ferromagnesians in the amphibolite, but biotite is dominant in the gneiss. Quartz and potash feldspar are absent in the amphibolite. In both rocks the plagioclase is andesine. Orthoclase, microcline and quartz are the dominant minerals in the gneiss. The contact has been thoroughly welded, and it is difficult to pin-point it microscopically.

Foliation by alignment of the biotite flakes is present in both the gneiss and the amphibolite, and is parallel in both. The basic and the acidic assemblages appear to be in equilibrium, presumably as a result of the metamorphism

both have undergone. Field relations would have to be examined before a definite statement could be made on whether it was a basic intrusion or a sedimentary band of basic or calcareous composition before metamorphism; the narrow basic bands within the gneiss suggest that the latter may be the case.

P517/63:LNReevesby8:TS13103

This is a rock of gabbroic composition, with a grain size of 0.05-1.5 mm. It consists mainly of plagioclase, pyroxene and some biotite. A distinctive feature of the rock, in contrast with the other basic specimens, is that hornblende is virtually absent; it occurs only in trace amounts, in association with pyroxene. Plagioclase forms about half the rock, and is labradorite. Hypersthene appears to be the dominan pyroxene, but polyaugite (?diopside) is also common. Opaques are minor, but are more apparent than in the preceding specimens. As the pyroxene appears to be in equilibrium in the mineral assemblage, the rock appears to be either a norite or a granulite

---

P518/63:JJReevesby17A:TS13104

This is a granitic gneiss with a grain size of 0.2-2 mm, though this varies in different bands in the specimen; for example, in one band about 1 cm. thick the maximum grain size is 0.6-0.7 mm. Microcline is the dominant mineral, though quartz and to a lesser extent plagioclase (sericitised oligoclase are common. Most of the microcline is string-microperthite and less commonly bead-microperthitic; myrmekite has formed adjacent to it. Biotite and opaques are minor constituents. Zircon is accessory.

P519/63:JJReevesby17B:TS13105

This is a granite, showing no foliation in hand specimen or in thin section. The grain size is between 0.2 and 2 mm, but is generally about 1 mm. Potash feldspars are dominant; orthoclase is present in addition to microcline, and it appears to be this which is perthitic rather than the microcline. Quartz and plagioclase (oligoclase) are also fairly common; myrmekite is present in minor quantity. Biotite is the only ferromagnesian mineral present, and is in very minor quantity; some has been slightly altered, and is now associated with ferruginous material. Traces of green hornblende, also associated with ferruginous material, suggest that hornblende was once present to a greater extent than it is now. Apatite is accessory.

P520/63:JJReevesby17C:TS13106

This is a medium-grained amphibolite with a markedly granular texture. Ferromagnesian minerals form a little less than half the rock, and generally have a slightly smaller grain size (0.1-0.2 mm) than the plagioclase (0.1-0.6 mm) which forms almost all the rest of the rock. The plagioclase is calcic andesine or sodic labradorite, and the fact that much of it is untwinned appears to be a fairly distinctive feature of the rock. Clinopyroxene is the dominant ferromagnesian mineral, and forms about 25 per cent of the rock. Other ferromagnesians form 10-15 per cent, and are green hornblende and brown biotite, with a minor amount of hypersthene and opaques. The biotite is distinctly aligned. All the ferromagnesian minerals are closely associated. The rock is very similar to P517, except that its texture is more granular.

P521/63:JJReevesby17D:TS13107

This is a coarse-grained adamellitic gneiss. Its grain size varies from 0.5 mm to more than 1 cm. Plagioclase (oligoclase, commonly antiperthitic), orthoclase and quartz are the dominant minerals, with fairly common myrmekite and minor microcline. Biotite is the only ferromagnesian mineral; it occurs only in minor quantity. Most of the plagioclase crystals have been sericitised, some fairly severely, but others only to a minor extent; some have also been slightly bent. A little of the orthoclase is string-microperthitic.

P522/63:SRReevesby16:TS13108

This is a fine-grained, fairly poorly cemented, porous, sandy limestone with sand grains forming nearly 30 per cent of the rock; they are generally subrounded, and 0.1-0.7 mm across. Quartz grains predominate, but orthoclase, andesine, minor microcline and minor hornblende grains are also present, suggesting that the area of provenance was an acidic or intermediate terrain. Shell fragments abound, and form about 15 per cent of the rock. The major part of the rock consists of very fine-grained calcite with a fairly uniform grain size of less than 3 microns. Some of the quartz grains appear to have solution cavities.

P523/63:JJReevesby10:TS13109

This is a coarse-grained granitic gneiss with a grain size of 1-10 mm. Microcline microperthite, commonly with Carlsbad twins, is the dominant mineral, but quartz and plagioclase (oligoclase) are also fairly common. The prevalence of Carlsbad-twinned potash feldspar crystals suggests a resemblance between this and many of the granitic gneisses of Spilsby Island, though alignment is not pronounced in this specimen. Myrmekite occurs in minor quantity, but is a little coarser than usual. Biotite is minor, though it is the only ferromagnesian mineral present. Some of it has been partially altered, and is associated with ferruginous material.

P524/63:JJReevesby8:TS13110

This is an amphibolite with a grain size of between 0.3 and 2.5 mm, but in general about 1 mm. Plagioclase (sodic andesine) and hornblende are the dominant constituents, the latter forming 30-40 per cent of the rock, and the former a little more. A small amount of clay (or possibly opal) has formed probably by the alteration of the hornblende in a rather unusual fashion, leaving it with clear outlines and vermicular cavities suggesting that the alteration was a solution effect. Quartz appears to be another alteration product, as it is commonly present in a thin layer between the clay and the hornblende (see fig. 2). Alteration of hornblende to clay would be somewhat unusual, and it is also quite possible that it has formed from the complete alteration of another mineral. (Fracture patterns within the clay are more suggestive of a mineral such as olivine or garnet, though neither of these is likely). Minor opaques are present, and a trace of fibrous epidote.

P525/63:JJBlyth1:TS13111

This is a granitic gneiss with a grain size of 0.5-5 mm. Microcline (some with Carlsbad twins) is the dominant mineral, but quartz, plagioclase (partly-sericitised oligoclase-andesine) and orthoclase are also common. The quartz occurs

interstitially between the grains, and as small blebs in the microcline. A few myrmekitic intergrowths are present. Biotite and minor opaques are the only ferromagnesian minerals present; they form about 2 per cent of the rock. Commonly the biotite flakes are small and apparently broken; some have been altered to clay along cleavage flakes up to 10 microns thick. Apatite is an accessory mineral, generally associated with the opaques.

P526/63:JJDuffield1:TS13131

This is a porphyritic granite which has apparently undergone some microbrecciation. The grain size generally varies from 0.05-5 mm, but the numerous large phenocrysts of orthoclase (which form 15-20 per cent of the rock) may be as much as 30 mm across. Quartz and potash feldspar are the dominant minerals; muscovite is fairly common, but appears to have been broken up into small flakes generally less than 0.1 mm long, and these now occur scattered over numerous areas up to 5 mm across. There is also a considerable amount of fairly fine-grained quartz and feldspar which, like the muscovite, appears to have been brecciated; about 30 per cent of the rock has a grain size of less than 0.1 mm. Much of the coarser quartz is strained. Minor plagioclase is present, which appears to be albite. The phenocrysts generally have Carlsbad twins, and some show microscopic deformation of the twinning plane. The orthoclase of the groundmass is highly distinctive; much of it is string- or bead-microperthitic, but it also appears to be disordered within single crystals, and irregulat patches with crenulate boundaries have different orientations, while being obviously of the same composition (see fig. 3). Carlsbad twins may occur in addition to this. Opaques and biotite are minor constituents. Zircon is accessory.

P527/63:SRDuffield2:TS13132

This is a granitic gneiss. It has a general grain size of 0.2-4 mm, but a few Carlsbad-twinned potash feldspar crystals are up to 20 mm across. Apparent displacement of up to 0.25 mm across the twinning plane of some of these crystals indicates that the rock has undergone some stress. Quartz and orthoclase are the dominant minerals; plagioclase (calcic oligoclase) is also fairly common, and some myrmekitic intergrowths occur. Biotite and minor opaques, the only ferromagnesian minerals, form about 5 per cent of the rock; accessory apatite is commonly associated with them. Some of the orthoclase is string-microperthitic.

P528/63:LNMilne2:TS13133

This is a granitic gneiss with a grain size of 0.3-6 mm. String-microperthitic potash feldspar (generally orthoclase, but some is microcline) and quartz are the dominant minerals. Plagioclase (oligoclase) is minor. A pale brown pleochroic mica is a minor constituent, with apparently secondary, very irregularly-shaped opaques scattered within it: it was probably biotite which has become altered to vermiculite. Zircon is accessory.

P529/63:LNMilne3:TS13134

This is a granitic gneiss with a grain size ranging from 0.25 mm to more than 20 mm. Large Carlsbad-twinned crystals of orthoclase microperthite are very common, and appear to have a preferred orientation. Throughout the rock

as a whole orthoclase is the dominant mineral, with smaller quantities of quartz, plagioclase (oligoclase), microcline and biotite. Some of the biotite has been slightly altered, and epidote is forming along cleavages. A little amphibole present has a somewhat actinolitic appearance, and is probably secondary. Opaques form a very minor part of the rock. Apatite is accessory.

P530/63:LNPartney1:TS13135

The black nodule consists of sandy, carbonaceous limestone. Sand grains form about 10 per cent of the rock; most are between 0.03 and 0.6 mm across, and are subangular to subrounded. Quartz and orthoclase are the dominant minerals among the grains, but plagioclase (probably in the andesine-labradorite range) and microcline are also present. Some of the orthoclase is string-microperthitic. All the sand grains appear to have a rim of calcite about 0.03 mm thick not readily distinguishable from the rest of the rock. The grain size of the calcite, which forms most of the rock, is generally less than 2 microns. Microfossils are common, and about 5 per cent of the rock consists of material recognizable as organic.

The white material adhering to the pebble is also fine-grained carbonate, though rather less sandy than the material of the pebble, and having marked concentric structure around the pebble.

P531/63:JJMarum1:TS13136

This is a medium-grained adamellitic gneiss with a fairly uniform grain size, generally between 0.25 and 1 mm. It differs from the other granitic gneisses in the presence of hornblende, epidote and antiperthite, and is more adamellitic than granitic. Foliation is weakly indicated by the ferromagnesian minerals. The dominant minerals are orthoclase, antiperthitic oligoclase (some untwinned) and quartz. Green hornblende, brown biotite, epidote and opaques together form about 10 per cent of the rock. Biotite is now the commonest of these, but hornblende was probably originally more common; much of it has now been altered to yellowish epidote (pistacite) which commonly occurs in small, euhedral crystals 0.03-0.1 mm across. Myrmekitic intergrowths of quartz and plagioclase are fairly common. A vermicular intergrowth of biotite and quartz (see fig. 4) occurs within an orthoclase crystal in such a way as to suggest that it may have formed by the reaction of hornblende and orthoclase. As this is a rare example in the rock it may be that it has been affected by incipient retrogressive metamorphism. Zircon is an accessory mineral, and commonly associated with the biotite.

P532/63:JJMarum2:TS13137

This is a medium-grained amphibolite. The ferromagnesian minerals have a grain size generally between 0.1 and 0.6 mm, and the feldspars between 0.1 and 1 mm. A little over half the rock consists of plagioclase (labradorite), and the rest consists of ferromagnesian minerals which tend to occur in small aggregates; this tends to make the rock appear coarser grained than it is. The commonest ferromagnesian is green hornblende, but pyroxenes (both hypersthene and clinopyroxene) are fairly common. Biotite is a distinctive constituent, although it is present only to a fairly minor extent.

P533/63:JJBoucaut1:TS13138

This is a granitic gneiss with a grain size generally varying between 0.5 and 2 mm. Orthoclase, generally string-

microperthitic, is the dominant mineral. Microcline, quartz and sericitised plagioclase are fairly common. The plagioclase is difficult to identify on account of its sericitisation, but it is probably oligoclase. Minor myrmekitic intergrowths are present. Biotite is present only in minor quantity, and opaques in very minor quantity; the two are generally associated. Zircon and apatite are accessory.

P534/63:JJBoucaut2:TS13139

This is a weathered granitic rock with a grain size varying from less than 0.1 mm (quartz blebs in orthoclase) to between 1 and 2 mm. Orthoclase and quartz are the dominant minerals; the orthoclase is string-microperthitic, and a few patches of stringlets are present, oriented at a high angle to the strings. Plagioclase (oligoclase) is present to a fairly minor extent. A rather unusual feature of the plagioclase is that it has undergone no sericitisation; yet if biotite was present (and it presumably was) it has been almost entirely altered and removed, leaving only iron-stained cavities and fracture-planes. The ferruginous remains commonly form an irregular intersecting pattern in the orthoclase, but adjacent quartz grains have not been affected. The only biotite remaining is in rare, small inclusions in the orthoclase. Minor myrmekitic intergrowths are present.

P535/63:JJKirby1:TS13140

This is a coarse-grained granitic gneiss with a grain size of 0.2-3 mm. Orthoclase, microcline and quartz are the dominant minerals, but plagioclase (oligoclase) is not uncommon. The orthoclase and microcline are both string-microperthitic, and some of the plagioclase is antiperthitic. Biotite is the only ferromagnesian mineral present; it occurs in minor quantity. Apatite is accessory, and generally occurs in association with the biotite.

P536/63:LNPartney6:TS13141

This consists of granitic gneiss and amphibolite in contact. Though the contact between them appears very sharp in hand specimen it cannot be pin-pointed in thin section, and can be identified only by the presence of hornblende in the basic part and the presence of biotite and quartz in the other; the texture of the rock is continuous over the boundary. Though fairly dark bands occur within the granitic gneiss, the only mafic mineral present within them is biotite; it forms as much as 10 per cent of these bands, and does not occur in the intervening, paler parts of the rock, which consist of orthoclase, quartz, microcline and oligoclase, and contain minor myrmekitic intergrowths.

Quartz, potash feldspar and biotite are not present in the amphibolite, which consists only of green hornblende and partly sericitised oligoclase, with a trace of minute secondary epidote or pyroxene crystals.

This specimen is similar to P516, except that in the latter hornblende and biotite are not mutually exclusive, and, probably as a result of the presence of biotite in the amphibolite, it has observable foliation not present in the basic part of P536.

P538/63:LNWinceby1:TS13239

This is a single untwinned pyroxene crystal, probably augite, containing about 5 per cent of numerous irregular

inclusions of green hornblende up to 2 or 3 mm across. These are apparently an alteration product of the pyroxene; nearly all have the same orientation. The hornblende is associated with quartz, which appears to be a co-product of alteration occurring in rather smaller quantity than the hornblende. Minute alteration patches of goethite are scattered through the crystal. The pleochroic scheme of the hornblende, common in most of these rocks, is:

X = yellow Y = yellow green Z = deep blue-green.

P539/63:LNStickney1:TS13240

This is a coarse-grained granitic rock. It has a grain size of up to more than 10 mm, but some much finer interstitial material is present, suggesting that some micro-brecciation may have occurred. String-microperthitic microcline and quartz are the dominant minerals; some orthoclase may be present. Plagioclase (oligoclase) and myrmekitic intergrowths occur in fairly minor quantity. Biotite, though the only ferro-magnesian mineral present, is in very minor quantity. Most of the larger potash feldspar crystals are twinned according to the Carlsbad law. Stringlets of albite occur as well as strings in the microperthite (see fig. 7). Opaques, associated apatite, and metamict zircon are accessory. The opaques are magnetite (some martitic) and ilmenite.

P540/63:JJStickney2:TS13241

This is a granitic rock, probably an aplite, with a grain size of 0.2-3mm. Alkali feldspar is the dominant mineral; some is a little unusual in that it appears to be replacement perthite (see fig. 5) instead of the exsolution perthite which is more usual in these rocks. However, replacement of potash feldspar by soda feldspar is not uncommon in aplites (Williams, Turner and Gilbert, 1955, p. 147). Some of the potash feldspar is microcline, but orthoclase is also present. Quartz is slightly less common than the feldspars, and usually occurs in smaller grains. Plagioclase (?oligoclase) is a minor constituent. Myrmekitic intergrowths are minor. Muscovite is an accessory mineral. Opaque minerals do not appear to be present.

While this may well be an aplite if its field occurrence suggests it, it gives little microscopic indication of being able an aplite rather than a granite.

P541/63:JJStickney4:TS13242

This is a granitic gneiss. Carlsbad-twinned, slightly perthitic microcline porphyroblasts are common, but unlike other specimens (mostly from Spilsby Island) in which these occur parallel to the gneissosity, in this specimen they bear no relation to the gneissosity, which is indicated by the orientation of biotite flakes. The grain size of the rock is generally between 0.25 and 5 mm, but the porphyroblasts are commonly up to 15 mm across. Quartz, orthoclase, microcline and sericitised plagioclase (oligoclase) are the dominant minerals. Biotite is a prominent constituent, though a fairly minor one. A little green hornblende is associated with the biotite, and may have been more prevalent when the rock was fresher. Opaques are minor; zircon and apatite are accessory; all are associated with the biotite. Altogether ferromagnesian minerals form 10-15 per cent of the rock. The opaque minerals are ilmenite and magnetite, some of which is martitic.

P542/63:SRStickney4:TS13243

This is a coarse granitic gneiss with a grain size varying between 0.8 and 10 mm, but some microbrecciation appears to have taken place, and many of the interstitial grains are as little as 0.05 mm across; they form a mosaic of microcline and quartz. Most of the larger crystals are microcline, commonly microperthitic; some replacement perthite may also be present. Large grains of quartz are present in slightly smaller quantity than the feldspar. Biotite is the commonest ferromagnesian, occurring with a little hornblende, from which some of the biotite may have formed. This rock is unusual in that it contains rare sphene crystals as much as 1 mm across, and a more common blotchy brown material with high relief, which is probably metamict allanite. Rounded zircons are accessory. The ferromagnesian minerals form 15-20 per cent of the rock; they occur in aggregates, the zircon, allanite, apatite opaques and sphene occurring surrounded by biotite and hornblende. The opaques are martitic magnetite and ilmenite.

P543/63:JJLusby5:TS13244

This is a coarse granite with a grain size varying between 0.25 and 6 mm. Orthoclase, microcline (some microperthitic and with Carlsbad twins) and quartz are the dominant minerals. Small quartz blebs, 0.1-0.3 mm across, are common in the potash feldspar. Plagioclase (oligoclase) is fairly common, and is mostly antiperthitic, with typical flame-like exsolution bodies which appear to be microcline. Minor myrmekitic intergrowths are present. Opaques and biotite are present in very minor or accessory quantities; some of the biotite is rather weathered along cleavages. Rare, minute, rounded zircons are present. The opaques are martite and ilmenite.

P544/63:SRLusby5:TS13245

This is a medium-grained granitic gneiss with a grain size of 0.15-1 mm, but with rare crystals up to 3 mm across. Microcline, orthoclase and quartz are the dominant minerals. Plagioclase (oligoclase) is rather less common; some is untwinned and antiperthitic. Minor myrmekitic intergrowths are present. Opaques and biotite are the only ferromagnesian minerals present, and both are in minor quantities. Muscovite and rounded zircons are accessory. The opaques are ilmenite, martite and magnetite.

The rock shows marked gneissosity; this is due only to a minor extent to alignment of the biotite flakes, and is mostly the result of mineral segregation, a little red iron-staining, and possible relict bedding.

P545/63:SRLusby5A:TS13246

This is an amphibolite with a markedly granular texture and a grain size of 0.2-0.8 mm. The dominant minerals are plagioclase (sodic andesine) and brown hornblende, with slightly smaller quantities of biotite and pyroxene (augite or diopside). A little hypersthene is also present. Opaques are accessory. The rare opaque grains are ilmenite. Two features in this rock make it a little different from other amphibolites, namely that the plagioclase is more sodic than usual, and that the hornblende is brown, whereas in almost all the other specimens it is green.

P546/63:JJDalby1:TS13247

This is a coarse-grained rock of dioritic composition; it is probably nevertheless an amphibolite. It has a grain size of 0.25-3 mm. Plagioclase (oligoclase to sodic andesine) is the dominant mineral. Much of it is antiperthitic and some is slightly bent. Some orthoclase is present, but in smaller amount than the plagioclase. Quartz is present to a fairly minor extent; some occurs in blebs 0.1-0.3 mm across in the feldspar. Hornblende is the dominant mafic mineral, and forms 10-20 per cent of the rock. Biotite is absent, but clinopyroxene is present in minor quantity. Opaques (mostly magnetite) are fairly minor, though present to a more than usually considerable extent.

P547/63:JJDalby2:TS13248

This is an amphibolite of similar composition to the preceding specimen, but of much finer grain, the grain size being 0.2-0.7 mm; part which has a vein-like appearance has a grain size of up to 2 mm. The texture is distinctly granular. Plagioclase (calcic andesine) and mafic minerals each form about half the rock. The dominant mafic mineral is green hornblende, but small amounts of pyroxene and biotite are fairly common. Some very corroded clinopyroxene crystals are present which appear to have been 1-2 mm long, but are now represented only by similarly oriented grains. Apatite and opaques are accessory. The material with vein-like appearance consists predominantly of plagioclase(calcic andesine).

P548/63:JJDalby2A:TS13249:PS7853

This is a granodioritic rock with much graphic intergrowth of quartz and feldspar. All the grains have highly irregular boundaries, but in general the grain size is between 0.5 and 5 mm. The feldspar is mostly andesine with a little orthoclase, but much of it has been fairly severely altered, and many of the grains contain a considerable amount of fine-grained prehnite. Secondary calcite and associated prehnite also occur in aggregates and narrow veins. The presence of prehnite in much of the rock, rather than muscovite or sericite, is probably due to the fact that these parts are poor in potassium, and contain a larger amount of calcium. Prehnite is stable in the zeolite and greenschist metamorphic facies; this is lower than the facies suggested by other rocks as being the prevailing one.

The polished section shows sphalerite to occur fairly commonly in large, corroded masses, as well as in smaller grains with clearer outlines. Chalcopyrite occurs in fairly irregular masses, but varying considerably in size; it is also present in small, elongated exsolution bodies in the sphalerite. Marcasite is commonly associated with the chalcopyrite, not uncommonly forming streaky masses within it, which could be exsolution features. However, it is more likely that both marcasite and chalcopyrite were emplaced at the same time. A very small amount of covellite is present, but its paragenetic relation to the other minerals is not shown.

P549/63:JJDalby6:TS13250

This is a coarse granitic gneiss with a grain size of 0.5-4 mm. Foliation is shown by the orientation of the biotite, and there is also mineral segregation into biotite-rich and biotite-poor layers, the biotite-rich layers being somewhat narrower and of finer grain size than the others. Orthoclase microperthite (with bead-or flame-shaped exsolution bodies), microcline and quartz are the dominant minerals.

Plagioclase (oligoclase) and myrmekite are minor, though still fairly common. Mafic minerals form only about 5 per cent of the rock as a whole, though they may form more than 10 per cent of the darker bands. Biotite is the commonest of these, but green hornblende and opaques are also present. The amount of hornblende is rather larger than in most of the other granitic gneisses. Apatite is accessory, and commonly associated with opaques.

P550/63:LNSibsey1:TS13251

This is a granitic gneiss with a grain size of 0.15-1.5 mm. Orthoclase, microcline, and quartz are the dominant minerals. Sericitised plagioclase (oligoclase) is not uncommon, and myrmekitic intergrowths are also present. Biotite is fairly prominent, and produces a fairly marked foliation; it forms about 10 per cent of the rock. Opaques, apatite, sphene, muscovite and rounded zircons are accessory; some of the larger opaque grains have a thin rim of sphene.

P551/63:JJHareby11:TS13252:PS7917

This may have been an altered igneous or metamorphic rock, broken down and recemented; the dominant recognizable crystalline constituent is probably some kind of feldspar, occurring in fragments which are generally elongated; they form 20-30 per cent of the specimen. A rather smaller percentage consists of boxworks, but most consists of yellow and white clay-like material which consists of a mass of minute grains 0.4-1.5 microns across. Much of this is probably tungstite, derived from the decomposition of wolframite, which is the other prominent constituent in the hand specimen. A little scheelite occurs around the edges of the wolframite. The pink mineral occurring in a small pocket in the hand specimen, the identification of which was requested, is jasper, with a little clear quartz.

P552/63:JJHareby9:TS13253

This is a sandy limestone, presumably a kunkar. It has the appearance of being a conglomerate containing 20-30 per cent of rounded "pebbles" 1-10 mm across. The matrix is a good deal more porous than the "pebbles", but otherwise consists of much the same material. Sand grains, 0.05-0.5 mm across, form about 5 per cent of the rock; they consist of quartz, plagioclase (oligoclase), microcline and orthoclase, together with a very small amount of hornblende and rock fragments, and appear to have been derived from a granitic terrain. Most of the rock consists of fine-grained calcite, with a grain size of about 2 microns. The "pebbles" may in fact be genuine detrital fragments, but they give the impression that they are syngenetic, or even non-clastic, on account of the similarity of the material in them to that surrounding them.

P553/63:JJhareby9A:TS13254

This is a fairly coarse granite with a grain size of 0.5-5 mm, and rarely as much as 10 mm. Orthoclase, microcline and quartz are the dominant minerals; plagioclase (oligoclase) is fairly common; minor myrmekitic intergrowths are present. The potash feldspars are microperthitic. Mafic minerals form a minor part of the rock, the commonest being biotite; opaques, weathered hornblende and chlorite are also present. Apatite and rounded metamict zircons are accessory.

P554/63:JJHareby9B:TS13255

This is a fairly coarse granitic gneiss, having a grain size of 0.7-2.5 mm. In one rather subtle feature this rock is distinct from others similar to it: quartz is predominant instead of feldspar. However, orthoclase and microcline microperthite are common. Plagioclase (oligoclase) is slightly less common, and is partly sericitised; myrmekitic intergrowths are present to a minor extent. Biotite and opaques are very minor constituents, though it is the alignment of the biotite that causes the gneissosity. Zircon is an accessory mineral, less metamict than in many of the other specimens.

THREE GRANITIC GNEISSES FROM SPILSBY ISLAND

P490/63 : JJ Spilsby 1 : TS13021

This is a coarse-grained feldspar-quartz-biotite gneiss. Potash feldspars, plagioclase and quartz are present in approximately equal quantities, though scattered unevenly through the rock. The potash feldspars are microperthitic microcline and orthoclase, occurring in large crystals with Carlsbad twins; the plagioclase blebs in the microperthite are all approximately oriented and slightly elongated, 0.02-0.03 mm long. The plagioclase is partly sericitised calcic oligoclase. Antiperthite is present in a few places, the potash feldspar blebs probably being microcline. In one antiperthitic crystal the microcline occupies the whole of one side of the crystal, and occurs in comparatively large, flame-like blebs in the other half. The quartz is commonly in large crystals, though it is also relatively common in small blebs in the feldspar. Myrmekite is a minor constituent. Biotite is the only ferromagnesian mineral present and forms about three per cent of the rock. It occurs in flakes which are about 1 mm long, and considerably smaller than the other grains in the rock. Apatite is accessory, and generally associated with the biotite.

P491/63 : JJ Spilsby 2 : TS13022

This is a feldspar-quartz-biotite gneiss similar to the preceding specimen, though somewhat finer grained; the grain size does not generally exceed 8-10 mm. Microcline and orthoclase are both common, and both microperthitic. Though the oligoclase crystals are also fairly large, they are much less common than the potash feldspar; they are partly sericitised. Quartz is fairly common, but is in notably smaller grains than the feldspars. Myrmekite is a minor constituent. Biotite and minor opaques are the only mafic minerals; the biotite is present in rather smaller quantity than in TS13021, and has been rather altered. Zircon and apatite are accessory minerals.

P492/63 : JJ Spilsby 3 : TS13023

This is a quartz-feldspar-biotite gneiss differing from the two preceding specimens chiefly in the much greater quantity of quartz present. The general grain size is 1-20 mm. Fine material with a grain size of 0.05 - 0.25 mm occurs between some of the larger crystals, as though a result of comminution. This, together with the fact that much of the potash feldspar has been distorted, indicates that the rock has undergone considerable stress, and probably low-temperature recrystallisation. Microcline and orthoclase are present, both to some extent microperthitic. The plagioclase is sericitised oligoclase. The minerals in the fine material are the same as those in the coarser material, but sericitisation of all the feldspars appears more pronounced. Myrmekite is a minor constituent. Biotite is the ferromagnesian mineral, and forms about two per cent of the rock; much of it has been chloritised. Opaques and apatite are accessory, the latter, as usual, tending to be associated with the biotite.

P555/63:LNSpilsby1:TS13293

This is a coarse quartz sandstone, or protoquartzite. It appears to be an incompletely silicified silcrete.

About 30 per cent of the rock consists of subangular fragments of quartz, 0.5-2 mm across, having many re-entrants. About half the matrix consists of fine quartz grains 0.05-0.1 mm across, and the rest of leucoxene and cryptocrystalline silica. The cement is fairly soft and easily scratched, which is probably the result of incomplete silicification. Few grains are present apart from quartz, but rare feldspar occurs; leucoxene-coated sphene, hornblende, zircon and ilmenite are accessory. The leucoxene consists of a mass of minute particles of high relief, about 0.5 microns across.

In hand specimen this rock superficially resembles P460/63:TS12962, also from Spilsby Island, described in AMDL Report MP1842-63, but the matrices of the two rocks are quite different, one consisting of clay, and the other of leucoxene and silica. However, the framework fractions of the two specimens are similar, except that there is a little more matrix in P460.

In several features this specimen bears a marked resemblance to silcretes previously described from Oodnadatta and Warramboo (AMDL Reports 2019-62 and 950-63). These features are:

1. The general shape, size and predominance of the quartz grains.

2. The "terrazzo" texture of the rock.

3. The large amount of leucoxene in the matrix.

4. The high TiO_2 content (connected with the prevalence of leucoxene). Chemical analysis showed this to be 1.32 per cent, comparing well with previous silcrete analyses in which TiO_2 varies from 1.2 to 1.8 per cent. This is considerably higher than other silica-rich rocks; Pettijohn (1963, p.S15) quotes 0.60 per cent as the highest recorded TiO_2 content of the average sandstone. It tends to increase in fine-grained rocks (p. S3).

The differences observed between P555/63 and most of the silcretes described from Oodnadatta are:

1. The lack of complete silica-cementation.

2. The lack of solution cavities in the quartz grains (which is probably directly connected with 1.)

3. The lack of colloform structures formed by the leucoxene. There is precedent for this, however, in many of the Oodnadatta silcretes.

When considering the origin of this rock, it is advisable to bear in mind the following points:

1. The comparative lack of rounding of the grains.

2. The small number of grain contacts among the large grains.

3. The presence of the three components: coarse sand grains, fine sand and silt grains, and exceedingly fine leucoxene.

All these points are explained satisfactorily by a surface origin with little particle transportation.

P556/63:LNSpilsby2:TS13294

This is a coarse granitic gneiss with a grain size of 1-15 mm. Large, aligned crystals of Carlsbad-twinned string-microperthitic orthoclase are prominent, and some replacement perthite is also present. Orthoclase is the dominant mineral, but microperthitic microcline, sericitised plagioclase (oligoclase) and quartz are fairly common. Myrmekitic intergrowths are present. Biotite is a rare constituent.

P557/63:SRSpilsby7:TS13295

This was probably a granitic gneiss with large, aligned Carlsbad-twinned microperthitic orthoclase crystals, but it has been severely ferruginized. The quartz has remained unaltered, but the feldspar has been either partially or almost completely ferruginized. In the partially ferruginized feldspar crystals the alteration has occurred parallel to the exsolution strings of albite. Minor clay is present. The grain size of the unaltered rock was probably similar to that of P556.

P558/63:LNRoxby1:TS13296

This is a granitic gneiss with a grain size of 0.5-4 mm. Bead-microperthitic microcline and orthoclase (with some replacement perthite) are the dominant minerals; quartz and sericitised plagioclase (oligoclase) are also common. Biotite is fairly irregularly distributed throughout the rock, forming about 5 per cent of some parts, but only 1-2 per cent of others. Opaques, apatite and zircon are accessory. Traces of chlorite are probably a result of weathering.

P560/63:LNRoxby3:TS13297

This is a fairly severely kaolinized granitic gneiss, which before alteration was probably similar to those with large, aligned Carlsbad-twinned orthoclase porphyroblasts. Its grain size was probably about 1-15 mm. Relatively little of the rock remains recognizable under the microscope; it has more the appearance of an irregular conglomerate with angular fragments. Quartz is the dominant remaining mineral. String-microperthite (probably microcline microperthite) is virtually the only other original mineral present; it may have become more perthitic as alteration progressed, as the proportion of exsolution bodies is greater than in most other specimens. Plagioclase was probably present, but the only suggestion of it remaining is a higher concentration of sericite in the clay. A few lobes of quartz in the clay indicate the former presence of myrmekitic intergrowths.

P561/63:LNRoxby5:TS13298

This is a limestone similar to P522, P530 and P552, and appears to be a kunkar. Most of the rock consists of very fine calcite with a grain size of about 1 micron. Quartz grains, varying considerably in size between 0.05 and 1 mm, form 5-10 per cent of the rock. Opaques and perthitic potash feldspar are accessory. As appears to be typical of these rocks, this kunkar contains large, rounded pebble-like bodies 2-20 mm across, which consist of the same material as the rest of the rock. The boundaries of these "pebbles" are marked by a narrow band of calcite slightly coarser than that in the rest of the rock, having a grain size of about 2 microns.

P562/63:LNRoxby7:TS13299

This is a ferruginous quartz granule conglomerate, 40-50 per cent of the rock consisting of irregularly-shaped subangular to subrounded grains of quartz 0.5-5 mm across. The matrix consists of fine quartz grains, 0.005-0.15 mm across, which form about 20 per cent of the rock, in a ferruginous cement. The rock is rather porous.

Though somewhat coarser, the quartz grains in this rock bear some resemblance to those in P460 and P555; it is possible that they had a similar origin.

P563/63:LNRoxby8:TS13300

This is an almost completely kaolinised rock. Quartz is virtually the only original mineral present, and occurs in grains 0.1-2 mm across; they are irregular in shape, and form 10-20 per cent of the rock. A few scattered remnants of microperthitic microcline are present, which tend to break into minute elongated fragments. White clay (presumably kaolin) is the dominant mineral. A little ferruginous material occurs, presumably from the alteration of ferromagnesian minerals.

REFERENCES

Barth, T.F.W., 1962; "Theoretical Petrology" 2nd ed. John Wiley & Sons, New York.

Deer, W.A.; Howie, R.A.; Zussman, J., 1962; "Rock-Forming Minerals." Longmans, London.

Johns, R.K., 1961; Geology and Mineral Resources of Southern Eyre Peninsula. Geol. Surv. South Aust. Bull. 37.

Pettijohn, F.J., 1963; Chemical Composition of Sandstones - Excluding Carbonate and Volcanic Sands. Chapter S. "Data of Geochemistry", 6th ed. U.S.G.S. Prof. Paper 440-S.

Tilley, C.E., 1921; The Granite-Gneisses of Southern Eyre Peninsula and their Associated Amphibolites. Quart. journ. Geol. Soc. London 77:75-134.

Wahlstrom, E.E., 1955; "Petrographic Mineralogy". John Wiley & Sons, Inc., New York.

Williams, H., Turner, F.J.; Gilbert, C.M., 1955; "Petrography". W.H. Freeman & Co., San Francisco.

ysc:24

APPENDIX IV

SPECTROGRAPHIC ANALYSES - SIR JOSEPH BANKS GROUP ISLANDS

Island	Field Number	Assay No.	Cu	Pb	Zn	Ag	Co	Ni	V	Cr	Ti	Mn	Ba	Mo	Sn
Spilsby	JJ-Spilsby-1	A3301/63	12	80	20	0.5	7	7	6	800	-	40	400	300	x 2
"	JJ- " -2	A3302/63	15	100	25	0.4	7	7	8	800	-	60	500	70	x 2
"	JJ- " -3	A3303/63	20	150	20	0.3	6	7	7	600	-	50	250	30	x 2
Reevesby	JJ-Reevesby-16	A3309/63	-	-	-	-	8	10	-	500	0.8	-	-	3	8
"	LN- " -6	A3310/63	-	-	-	-	12	15	-	1000	1.5	-	-	5	15
"	LN- " -7	A3311/63	-	-	-	-	3	8	-	1000	0.25	-	-	1	3
Hareby	JJ-Hareby-1	A3312/63	-	-	-	-	10	8	-	1000	xx 3	-	-	20	20
Partney	LN-Partney-2	A3313/63	-	-	-	-	5	8	-	2000	0.5	-	-	5	6
Reevesby	SR-Reevesby-5	A3315/63	10	10	x 20	0.5	5	5	40	10	0.1	x 3	80	1	x 2
Partney	LN-Partney-3	A3316/63	8	10	x 20	0.2	4	5	50	10	0.15	x 3	50	1	x 2
Roxby	LN-Roxby-4	A3317/63	15	20	x 20	1	10	6	15	250	0.15	30	200	3	x 2
"	LN- " -6	A3318/63	15	10	x 20	0.4	5	5	30	80	0.1	3	150	5	2
Partney	LN-Partney-5	A3319/63	12	10	x 20	0.4	5	5	20	50	0.1	3	150	5	2
"	LN- " -4	A3320/63	12	20	x 20	0.4	15	7	20	30	0.1	25	200	1	x 2
Milne	SR-Milne-2B	A3321/63	10	18	x 20	0.3	5	6	30	150	0.1	5	50	3	2
"	SR- " -2C	A3322/63	12	40	20	0.4	1	5	30	800	0.25	10	800	10	2

x indicates less than
xx indicates greater than
Results in ppm except Ti, in %
Tungsten (W) - all samples less than 20 p.p.m.

Island	Field Number	Assay No.	Cu	Pb	Zn	Ag	Co	Ni	V	Cr	Ti	Mn	Ba	Mo	Sn
Reevesby	LN-Reevesby-2	A3323/63	25	50	200	0.3	20	40	150	150	2	-	-	3	6
"	LN- " -3	A3324/63	250	18	150	0.3	30	120	50	80	0.2	-	-	3	5
"	LN- " -3A	A3325/63	150	15	200	0.1	40	500	80	80	0.3	-	-	2	2
"	LN- " -4	A3326/63	25	8	150	0.1	40	300	50	80	0.3	-	-	x 1	2
"	LN- " -8	A3327/63	200	18	250	0.1	30	150	100	150	0.5	-	-	2	2
"	JJ- " -17A	A3331/63	6	60	20	0.3	5	6	-	800	0.2	-	700	3	4
"	JJ- " -17B	A3332/63	18	100	20	0.3	5	6	-	1500	0.15	-	600	4	2
"	JJ- " -17C	A3333/63	250	50	150	0.3	40	250	-	60	0.5	-	200	2	4
"	JJ- " -17D	A3334/63	5	60	20	0.1	4	5	-	1500	0.2	-	700	1	6
"	JJ- " -10	A3335/63	5	100	20	0.2	5	6	-	1200	0.2	-	150	3	2
"	JJ- " -8	A3336/63	12	15	200	0.1	30	40	-	150	0.6	-	80	2	4
Blyth	JJ-Blyth -1	A3337/63	6	80	20	0.2	4	7	-	1200	0.25	-	600	3	2
Duffield	JJ-Duffield -1	A3338/63	8	25	20	0.3	2	7	20	1200	0.25	50	700	2	3
Milne	LN-Milne-3	A3339/63	12	200	30	0.3	4	6	15	700	0.25	100	600	4	1
Marum	JJ-Marum-1	A3340/63	8	25	40	0.5	10	6	15	700	0.5	200	800	4	2
Marum	JJ-Marum-2	A3341/63	30	18	80	0.2	50	250	150	250	0.7	500	500	10	2

Results in ppm except Ti in %
Tungsten (W) - all samples less than 20 ppm.
x = less than

SPECTROGRAPHIC ANALYSES - SIR JOSEPH BANKS GROUP (contd.)

Island	Field Number	Assay No.	Cu	Pb	Zn	Ag	Co	Ni	V	Cr	Ti	Mn	Ba	Mo	Sn	W
Boucaut	JJ-Boucaut-1	A3342/63	15	50	25	0.5	5	5	10	600	0.25%	100	600	5	7	
Boucaut	JJ- " -2	A3343/63	25	25	20	0.1	1	5	20	300	0.2%	30	400	6	8	
Kirkby	JJ-Kirkby-1	A3344/63	8	40	20	0.2	4	5	15	800	0.25%	80	250	2	4	
Winceby	LN-Winceby-1	A3350/63	60	80	800	0.2	30	70	150	150	250ppm	4000	250	5	15	
Stickney	LN-Stickney-1	A3351/63	6	80	20	0.2	4	6	10	1200	2000 "	100	400	1	6	
Stickney	JJ-Stickney-2	A3352/63	5	40	x 20	0.2	1	6	5	1500	100 "	10	250	3	5	
"	JJ- " -4	A3353/63	15	50	40	0.3	8	6	15	800	3000 "	150	600	3	4	
"	SR- " -4	A3354/63	12	50	30	0.2	8	5	30	1200	4000 "	200	400	2	10	
Lusby	JJ-Lusby-5	A3355/63	10	50	20	0.3	2	5	4	1200	250 "	10	300	2	2	
"	SR- " -5	A3356/63	8	50	20	0.3	2	5	4	1200	2000 "	15	500	3	5	
"	JJ- " -5A	A3357/63	30	15	100	0.2	40	60	150	200	4000 "	500	250	2	10	
Dalby	JJ-Dalby-1	A3358/63	8	30	500	0.3	15	20	80	700	2%	1200	100	15	25	x 20
"	JJ- " -2	A3359/63	12	25	100	0.2	25	120	150	150	0.8%	500	200	3	10	x 20
"	JJ- " -2A	A3360/63	4000	60	50	1.5	25	30	40	1000	0.1%	100	150	50	3	700
"	JJ- " -6	A3361/63	20	40	25	0.3	5	5	12	500	4%	200	1000	3	5	x 20
Sibsey	LN-Sibsey-2	A3362/63	20	100	30	0.3	8	6	20	500	3%	200	500	3	6	500
Hareby	JJ-Hareby-11	A3363/63	30	2000	x 20	0.2	3	8	25	1200	0.25%	150	15	50	x 2	(10,000 xx
Hareby	JJ- " -9	A3364/63	5	10	x 20	x 0.1	3	3	2	20	0.05%	10	30	x 1	2	20
"	JJ- " -9A	A3365/63	5	60	20	0.2	2	6	7	1200	0.25%	80	400	4	x 2	600
"	JJ- " -9B	A3366/63	8	150	25	0.3	4	7	7	1000	0.25%	70	500	8	x 2	500

Results in p.p.m.
x indicates less than xx indicates greater than.
Tungsten (W) - all samples less than 20 ppm.
(except where shown)

SPECTROGRAPHIC ANALYSES - SIR JOSEPH BANKS GROUP (contd.)

Island	Field Number	Assay No.	Cu	Pb	Zn	Ag	Co	Ni	V	Cr	Ti	Mn	Ba	Mo	Sn
Spilsby	LN-Spilsby-1	A3367/63	30	10	x 20	0.5	1	8	10	800	-	10	80	12	4
"	LN- " -3	A3368/63	5	150	x 20	0.3	1	5	3	1000	-	20	30	2	2
"	SR- " -7	A3369/63	5	50	20	0.2	1	7	12	300	-	5	5	40	2
Roxby	LN-Roxby-2	A3370/63	4	200	x 20	0.2	1	6	4	1200	-	20	250	5	x 2
"	LN- " -3	A3371/63	4	20	x 20	0.2	x 1	5	x 1	100	-	5	20	5	x 2
"	LN- " -5	A3372/63	8	10	x 20	x 0.1	5	6	3	50	-	10	80	x 1	2
"	LN- " -7	A3373/63	12	15	20	0.1	3	10	180	1200	-	10	20	25	4
"	LN- " -8	A3374/63	7	15	x 20	0.3	1	5	12	700	-	5	40	15	x 2

x indicates less than

xx indicates greater than

Tungsten (W) - all samples less than 20 ppm.

Results in ppm.

CHEMICAL ANALYSES

Island	Field Number	Assay No.	P_2O_5	Fe_2O_3	Al_2O_3
Milne	LN-Milne-2	A1/64	10.35	0.46	0.22
"	LN- " -3	A2/64	0.80	2.32	5.6
Roxby	LN-Roxby-4	A3/64	0.38	1.93	4.8

APPENDIX V

SIEVE ANALYSIS

REPORT ML 2029/63

Reevesby, Hareby, Partney and Roxby Islands.

Mesh BSS	Weight %					
	3304	3305	3306	3307	3308	3314
+ ¼ inch	-	-	-	-	15.2	-
+ 3/16 inch	-	-	-	-	2.9	-
+ 5 mesh	-	-	-	-	1.6	-
+ 7 mesh	-	-	-	-	0.8	-
+ 10 mesh	-	-	-	-	0.6	1.4
+ 14 mesh	-	-	-	-	0.9	0.6
+ 18 mesh	-	-	-	-	2.6	1.6
+ 25 mesh	0.6	Trace	4.6	2.3	16.5	5.3
+ 36 mesh	4.7	1.5	13.0	7.8	29.3	7.8
+ 52 mesh	22.8	16.4	34.5	34.5	19.6	9.5
+ 72 mesh	38.6	44.4	33.6	37.2	8.0	11.9
+ 100 mesh	28.9	31.8	13.3	15.7	1.7	14.8
+ 150 mesh	3.5	4.6	0.9	2.0	0.1	12.3
+ 200 mesh	0.1	0.1	0.1	0.1	0.1	7.6
+ 300 mesh						7.5
- 300 mesh	0.8	1.2	Nil	0.4	0.1	19.7
	100.0	100.0	100.0	100.0	100.0	100.0

Investigation and Report by: A. Stratman

Officer in Charge, Metallurgy Section: P.K. Hosking.
Australian Mineral Development Laboratories.

APPENDIX VI

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Sample No. F 429/63
Ref. D.M. 2070/63

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Flinders
Reevesby Island.

Distance and direction from nearest town or station:
30 miles E. of Pt. Lincoln on Reevesby Island. SR.16.

Details: Collected from bore, outcrop etc. - Outcrop

Depth - Surface

Information required: Fossil identification and age determination.

Submitted by: L.G. Nixon

Address: Mines Department, Rundle St.

Date: 4th December, 1963.

PALAEONTOLOGIST'S REPORT

Limestone with Coxiella, indicating a salt lake or marginal swamp environment. It is probably of Recent or sub-Recent age.

N.H. Ludbrook
.....
SENIOR PALAEONTOLOGIST

Date: 12.12.1963.

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Sample No. F 430/63
Reference DM 2070/6

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality:	County Flinders Hundred Partney Is. Section.	Distance and direction from nearest town or station: Appro 30 miles east of Pt. Lincoln or Partney Island Locality 3 and Roxby Island - Locality 4.

Details: Collected from bore, outcrop etc. - outcrop

Depth --

Information required : Age if possible.

Submitted by : L.G. Nixon - Metallic Minerals Section

Address: : Mines Dept., Rundle St.

Date : 2/12/63.

PALAEONTOLOGIST'S REPORT

Dark red clay with angular quartz grains. It is unfossiliferous, and no indication of age is given.

W. Thackwork
.....
SENIOR PALAEONTOLOGIST

Date: 12/12/63.

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Sample No. F431/63
to F433/63
Reference DM 2070/63

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Flinders
Hundred Roxby Island
Section

Distance and direction from nearest town or station:
Roxby Milne Islands 30 miles east of Pt. Lincoln.

Details: Collected from bore, outcrop etc. - outcrop

Depth: surface.

Information required: Macro and micro fossil types if any, and the environment in which they normally live, i.e. marine or fresh water and their age.

Submitted by: L.G. Nixon

Address: Mines Dept., Rundle St., Adelaide.

Date: 29/11/63

PALAEONTOLOGIST'S REPORT

F431/63 consists of kunkar with quartz grains and some mica. The following organic remains are present:

(1) Austrocochlea torri and tubes of a spirorbid worm, both of which are of marine origin and live on rocks. These have presumably been transported from their natural environment.

(2) fragments of land mollusca belonging to the Pupillacea.
They are all probably of Recent age.

F432/63 is similar to F431/63, and contains both the spirorbid worm and the land mollusc of the Pupillacea, representing a marine and land environment respectively.

F433/63 guano. This consists largely of fish bones with plant material and some quartz grains. It is of recent origin.

W Ludbrook
.....
SENIOR PALAEONTOLOGIST

Date: 12.12.1963.

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Sample No. F 434/63
Reference -

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Flinders — Distance and direction from nearest town or station:
Hundred Hareby Island — Approx. 30 miles E. of Pt. Lincoln
Section

Details: Collected from bore, outcrop etc. - Outcrop.

Depth: Surface

Information required: Identification of fossils if any and age.

Submitted by: L.G. Nixon

Address: Mines Department, Rundle St.

Date: 6/12/63

PALAEONTOLOGIST'S REPORT

Kunkar. No fossils are present.

A.W. Whitehouse
.....
SENIOR PALAEONTOLOGIST

Date: 12.12.1963.

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Sample No. F 435/63
Reference

PALAEONTOLOGICAL EXAMINATION OF MATERIAL

Locality: County Flinders Distance and direction from nearest town or station: 30 miles east of Pt.Lincoln on Roxby Island.

Details: Collected from bore, outcrop etc. - outcrop

Depth: Surface

Information required: Fossil identification if any and their age.

Submitted by: L.G. Nixon, Metallic Minerals Section

Address: Mines Department, Rundle St.

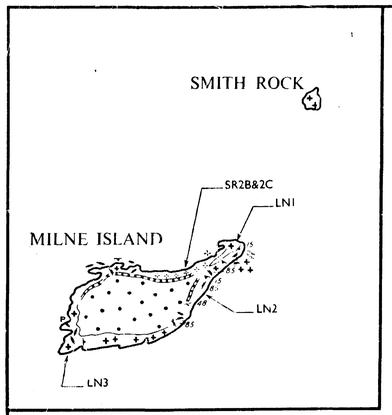
Date: 6.12.1963.

PALAEONTOLOGIST'S REPORT

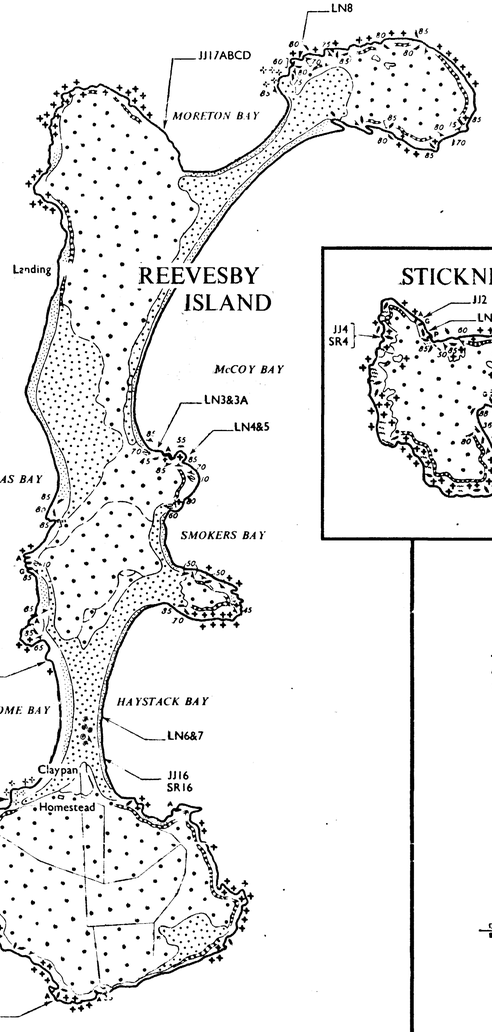
Kunkar. No fossils are present.

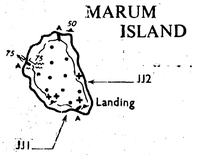
W.Thornbrook
.....
SENIOR PALAEONTOLOGIST

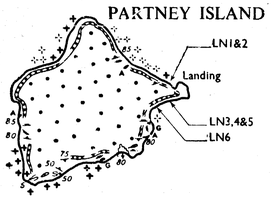
Date: 12.12.1963.

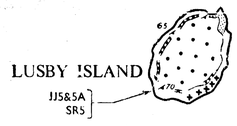


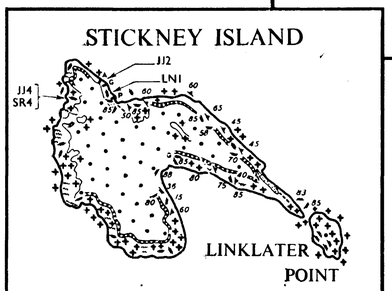
DOUGLAS CHANNEL

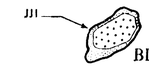


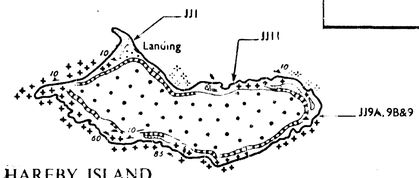


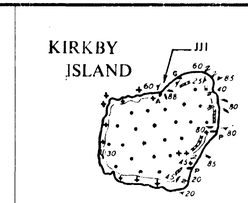


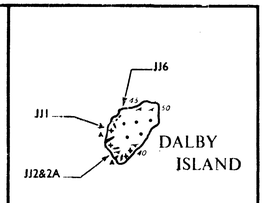




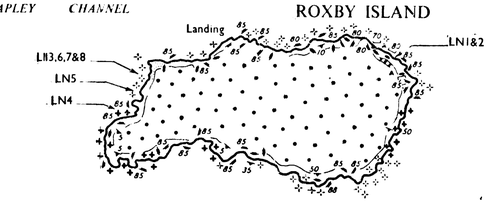


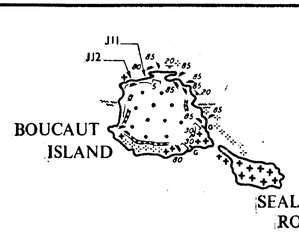


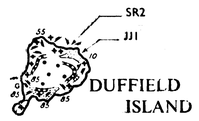


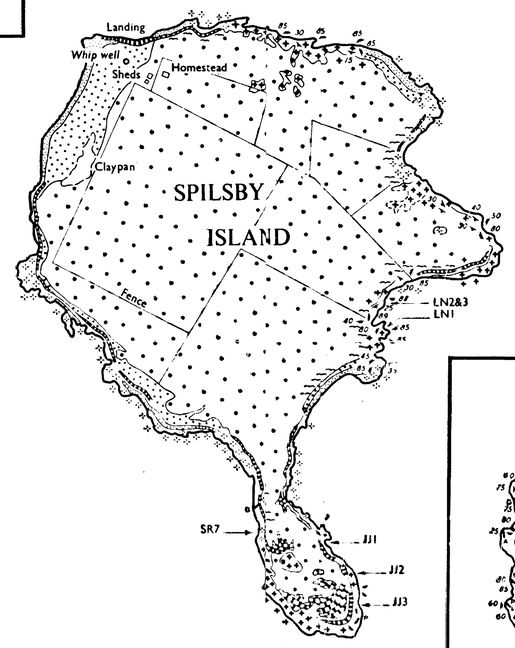


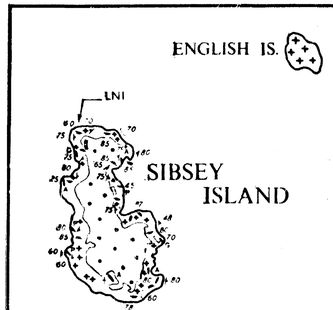
TAPLEY CHANNEL











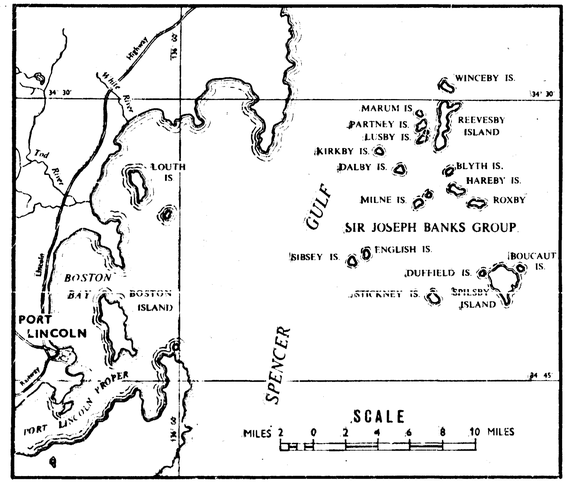
LEGEND

- Basalt
- Dunes
- Sandy to silty loam and wind-blown sand
- Pale reddish sandy clay
- Coxiella limestone
- Kunkar
- Foliation (gneissosity etc.) — VERT / HORIZ
- Flow banding
- Cleavage — VERT / HORIZ
- Joints — VERT / HORIZ
- Felspar orientation
- Quartz vein
- Pegmatite vein
- Micro-Granite vein
- Amphibolite vein
- Granite
- Weathered Granite
- Mylonite zone
- Sample locality and number — LN8

SCALE

FEET 0 1000 2000 3000 4000 5000 6000 FEET

LOCALITY MAP



L64-204

L.G.Nixon, Senior Geologist

S.A. Department of Mines

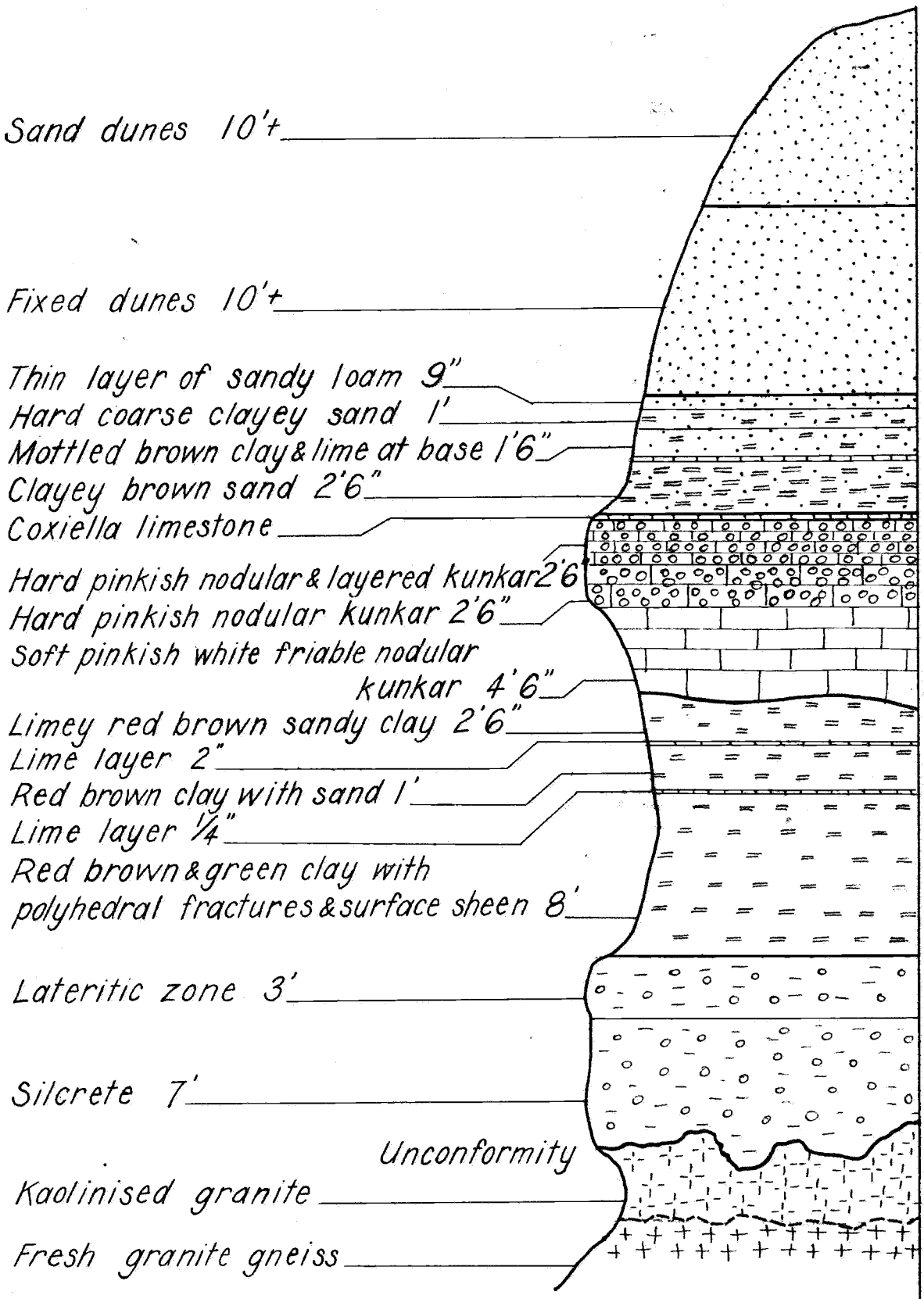


Fig.I

To Accompany Report By L. Nixon.

S.A. DEPARTMENT OF MINES

Approved	Passed	Drn.	SIR JOSEPH BANKS GROUP OF ISLANDS	D.M.	Scale
		Tcd. DE		Req.	S 3960
		Ckd.	Diagrammatic Composite Cross Section through Younger Sediments		Dn
Director		Exd.			Date 19:11:64

400— 6.63 1423

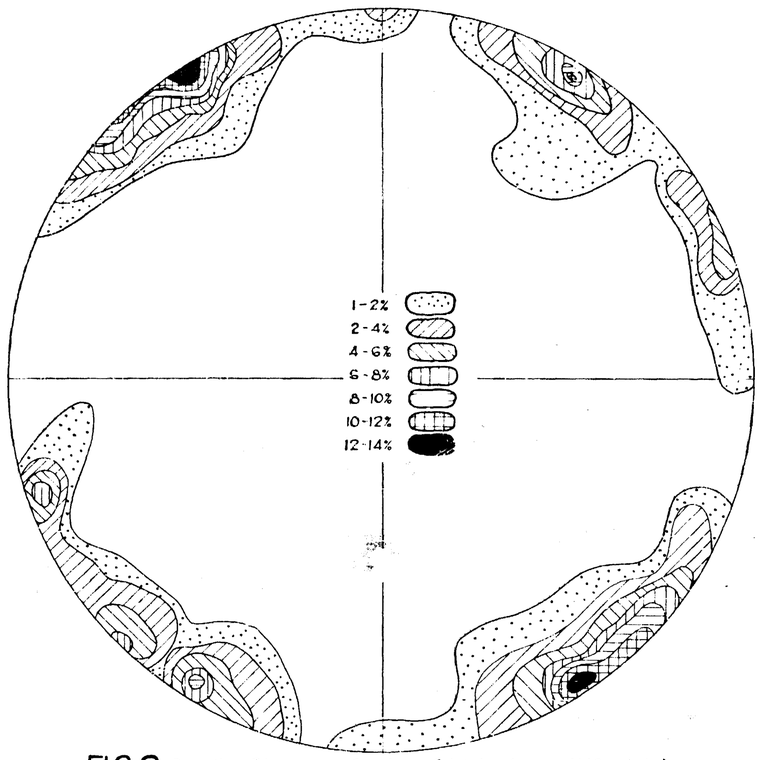


FIG. 2 Density Diagram of poles of joint planes (140 points)
(lower hemisphere)

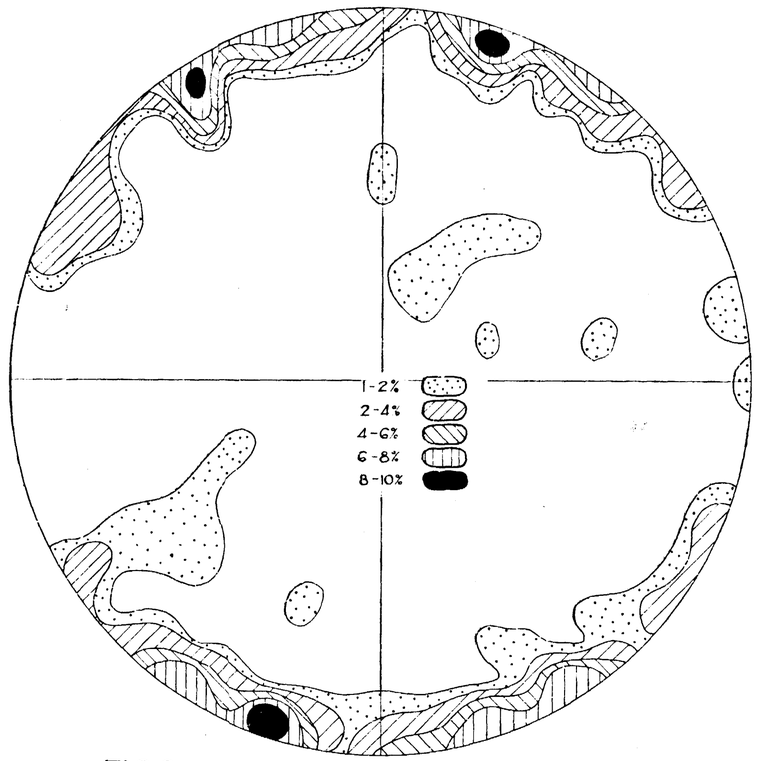


FIG. 3 Density Diagram of poles of microgranite dykes (147 points)
(lower hemisphere)

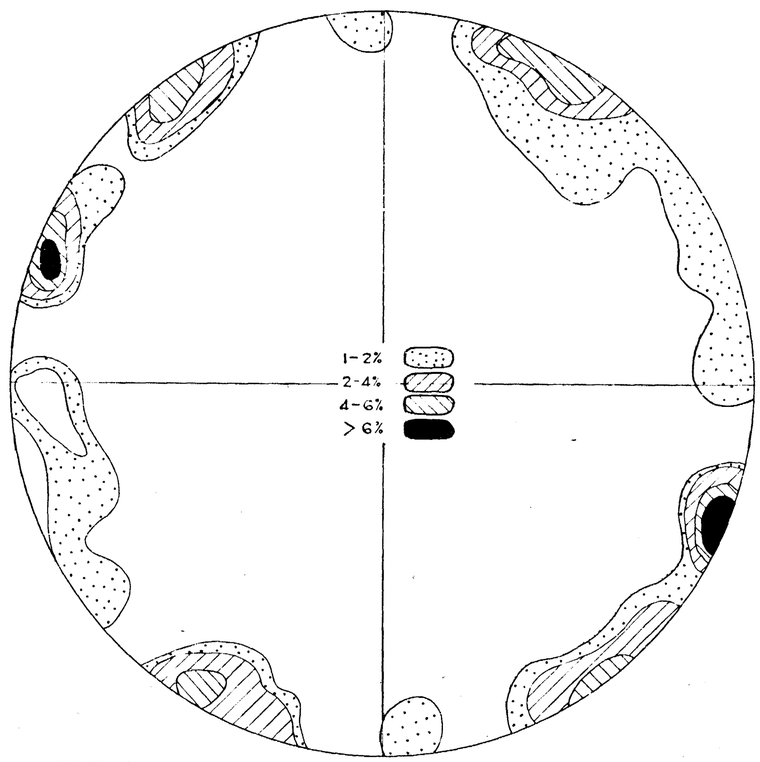


FIG. 4 Density Diagram of poles of amphibolites (62 points)
(lower hemisphere)

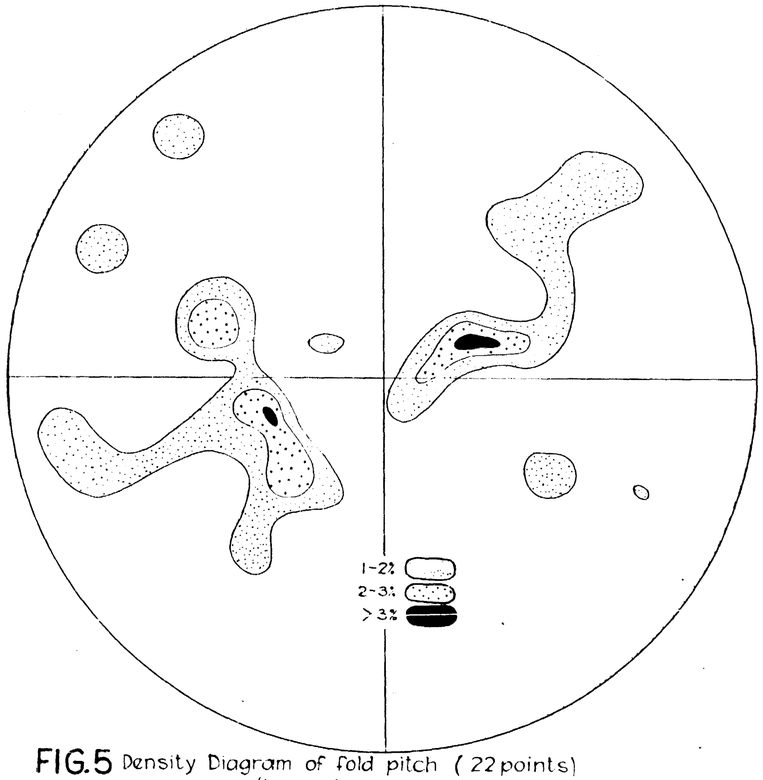


FIG. 5 Density Diagram of fold pitch (22 points)
(lower hemisphere)

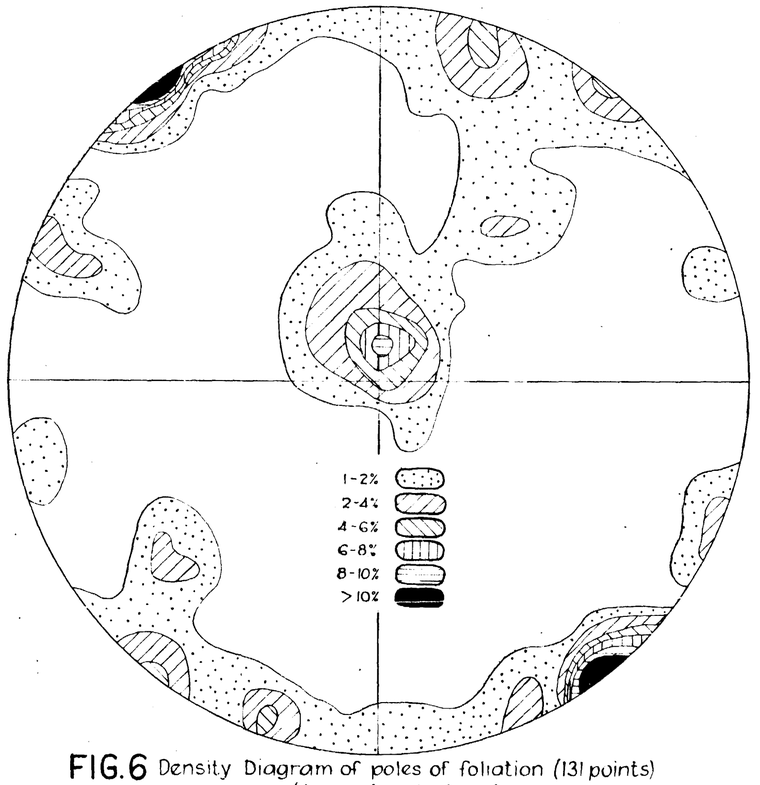


FIG. 6 Density Diagram of poles of foliation (131 points)
(lower hemisphere)

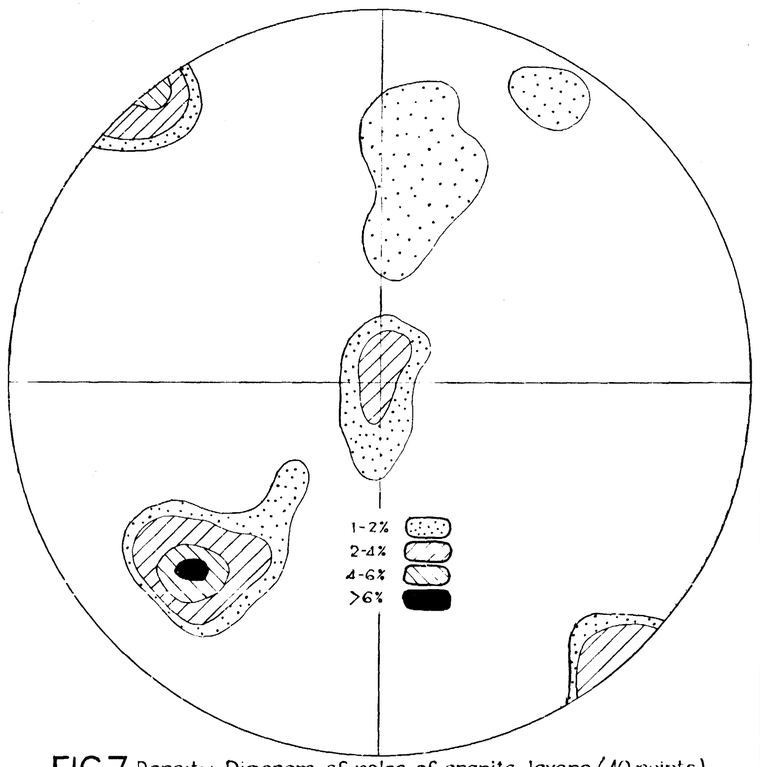


FIG. 7 Density Diagram of poles of granite layers (40 points)
(lower hemisphere)

S.A. DEPT. OF MINES

To accompany report by L.G Nixon

DENSITY DIAGRAMS OF STRUCTURAL FEATURES
SIR JOSEPH BANKS GROUP OF ISLANDS
SPENCER GULF

Associated Drawing	No.	No.	Amendment	Exd.	Date

Req. No
D.M.
Compiled from

Approved	Passed	
		Drn.
		Tcd. PA
Director of Mines		Ckd.
		Exd.

Scale.
64-1027
Dn
Date 16-11-64

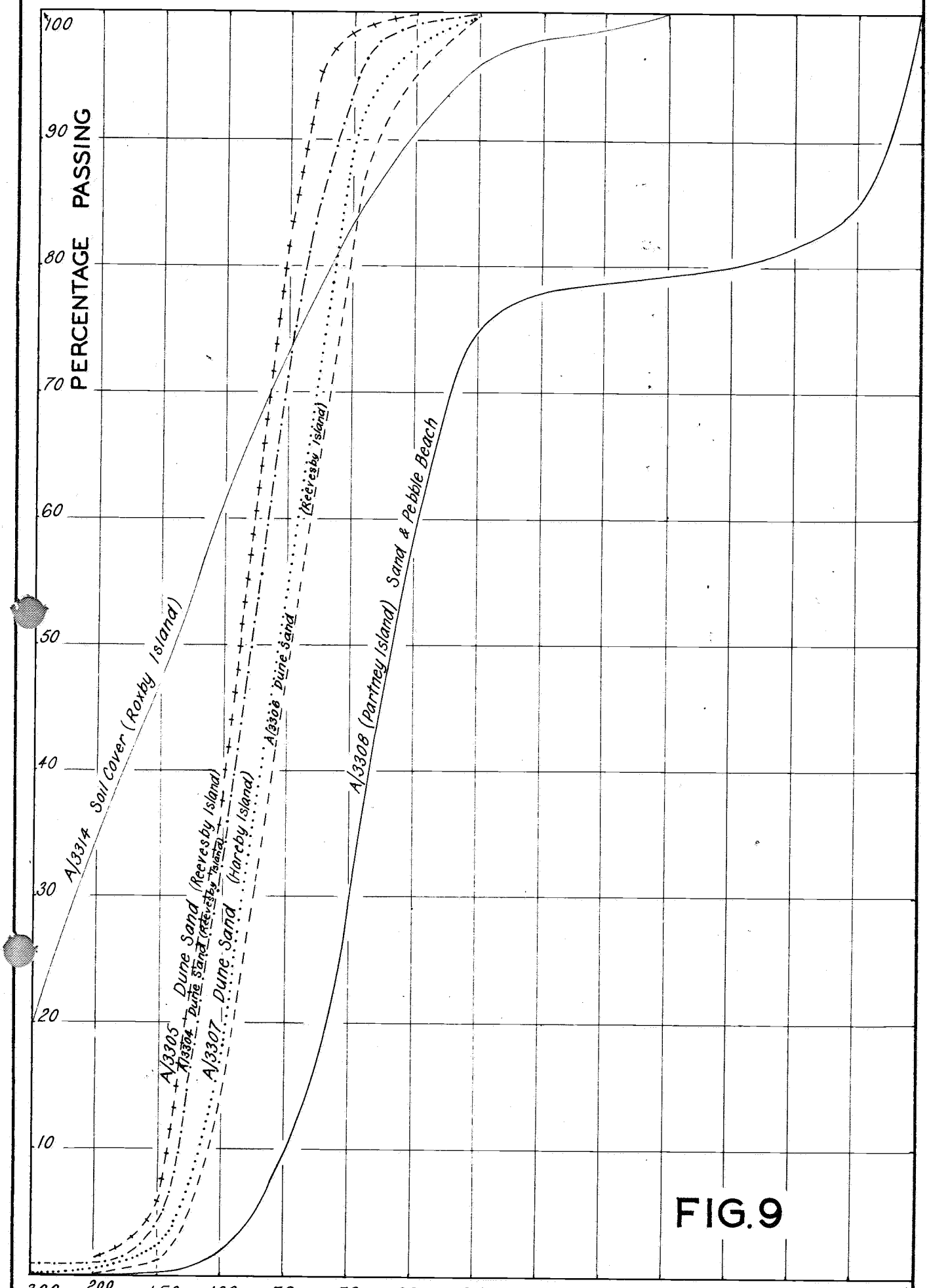


FIG. 9

To accompany report by L. Nixon.

S.A. DEPARTMENT OF MINES

Approved	Passed	Drn.	SIR JOSEPH BANKS GROUP OF ISLANDS SAND DEPOSITS SIEVE ANALYSIS	D.M.	Scale
		Tcd. D. E.		Req.	S 3970 Dn
		Ckd.			
Director		Exd.			Date 20·11·64

400— 6.63 1423